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Keisha LaRaine INGRAM

DOCTORAL DISSERTATION

THE IMPACT OF THE HIGHER EDUCATION POLICY ON THE DEVELOPMENT OF HUMAN-CENTRIC INNOVATION ECOSYSTEMS IN LITHUANIA

SOCIAL SCIENCES,
MANAGEMENT (S 003)
VILNIUS, 2020

MYKOLAS ROMERIS
UNIVERSITY

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MYKOLO ROMERIO UNIVERSITETAS

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I am the sky, the rest is weather (Esu dangus, aplink mane tik oras). Gyvendama Lietuvoje ir rengdama disertaciją, patyriau daugybę metų laikų su skirtingomis oro sąlygomis. Vis dėlto, esu dėkinga tiems, kurie tikėjo manimi ir skatino drąsiai žiūrėti į dangų, nepaisant nuolat besikeičiančio oro.

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ABBREVIATIONS

AU	–	Aalto University
CV	–	Competencies View
DCV	–	Dynamic Capabilities View
DOI	–	Diffusion of Innovation Theory
EC	–	European Commission
EHEA	–	European Higher Education Area
EIS	–	European Innovation Scoreboard
EU	–	European Union
GII	–	Global Innovation Index
GT	–	Grounded Theory
HEIs	–	Higher Education Institutions
ICT	–	Information and Communication Technologies
KBV	–	Knowledge Base View
KA	–	Knowledge Acquisition
KT	–	Knowledge Transfer
KM	–	Knowledge Management
KU	–	Knowledge Utilization
OECD	–	Organisation for Economic Co-operation and Development
NGOs	–	Non-governmental Organizations
NI	–	New Institutional theory
NPG	–	New Public Governance
NPM	–	New Public Management
RBV	–	Resource Base View
RDI	–	Research Development and Innovation
RDT	–	Resource Dependency Theory

GLOSSARY OF MAJOR TERMS DEFINITION

Commercial Economy. Aspects of an economy tied to the exchange of goods, services, and labor activities having a set monetary value (Business Dictionary, 2020).

Human-centered Innovation. An accommodation of the major forces driving innovation in today's global economy: the accelerating business trend to designing innovations to serve human requirements first, and the burgeoning demand for transparency and accountability in pursuit of positive, sustainable economic development (Perelman, 2007).

Human-centric Innovation. Inspired talent is the engine of innovation**.** At its most effective, innovation is an inherently human endeavor. Successful innovation happens when people with skills, experience, and capabilities come together to understand or predict, and then address, other people's challenges. Talent, like capital and technology, is a key success factor for innovation. Inspiring potential talent will drive innovation and growth. (The Global Innovation Index, 2014).

Human-Centric Innovation Ecosystems. These are ecosystems where all agents collaborate cooperatively to develop and nurture the essential attributes of the human capital needed in order to achieve innovation. These attributes include available skilled labor, higher education, digital, technical education and other soft skills necessary for innovation, supporting infrastructure and technology, governmental and other sources of funding, successful talent retention and attraction of highly educated individuals (Baležentis and Ingram, 2017; Ingram, 2018).

Higher Education Policy. The system of directives implemented by the government to higher education institutions that dictates their governance, systems of regulations, funding schemes, methods of operation and organization in society (Gornitzka, 1999; Pfiffner, 2004; Osbourne 2007; Pfeffer and Salancik, 2003; Lipnicka and Verhoeven, 2014).

Higher Education Sector. All universities, colleges of technology and other institutions providing formal tertiary education programs irrespective of their source of finance or legal status. The higher education sector encompass all research institutes, centers, experimental stations and clinics that have their R&D activities under the direct control of, or are administered by, tertiary education institutions (UNESCO, 2020).

Higher Education Systems. Tailored policy-mandated systems of higher education models implemented by the Government according to the purpose of higher education (Gellert, 1993b; Schwartzman 2001; Arthur et al., 2007; Sam and van der Sijde, 2014).

Higher Education Institutions. Institutions arranged according to whether they organise university or non-university provision. Those providing non-university education are further subdivided into centres which offer advanced vocational training cycles and specialized education institutions. (Eurydice, 2020).

Higher Education. Tertiary education, provided by universities and other higher education institutions, is the level of education following secondary schooling. Higher education play an essential role in society, by fostering innovation, increasing economic development and growth, and improving more generally the well-being of citizens (Eurostat, 2020).

Innovation. A linear process consisting of basic research to technology development and on to test/evaluation, demonstration, deployment, commercialization, and ultimately, market penetration (Perelman, 2007).

Innovation Ecosystems. A network of interconnected organizations, organized around a focal firm or a platform, incorporating both production and use side participants, and focused on the development of new value through innovation (Autio and Thomas, 2013).

Knowledge Economy. Greater reliance on instant access to information generating facts and intellectual skills for the productive advancement of economic activities of private and public organizations (OECD, 2005).

New Public Governance. Modernization of the government and public sector and collectively termed post-new public management or digital-era governance (Osbourne, 2007).

New Public Management. The new approach to governance of public service organizations to make public services more 'business-like', using private sector management models. Individuals are treated as "customers" or "clients" (in the private sector sense), rather than as citizens. (Dunleavy et al, 2006; Page, 2007).

New Public Administration. The managerial side of public administration that improves the quality and efficiency of public services (Aderibigbe et al., 2014).

Public Policy. Public policy is a process about selecting strategies and making choices (Raipa, 2002).

Open Coding. Primary coding done according to the source structure and style of the sub-categories extracted (NVivo, 2019)

Vocational Education. Training in skills and teaching of knowledge related to a specific trade, occupation or vocation in which the student or employee wishes to participate, undertaken at an educational institution. Vocational education could be initial training during employment or a combination of formal education and workplace learning (EU Commission Eurostat, 2016).

INTRODUCTION

Thematic relevance of the dissertation. Progressive economies all share a common element to quality innovation: talented, human capital. In countries where innovation occurs at a moderate pace, the assumption is that education does not necessarily render better economic benefits (Jucevičius, 2004). However, collaborative platforms between universities, governments and industries that generate the commercialization of knowledge and skills for innovation (Lowe, and Marriott, 2006), could potentially work better when a strategic, human-centric approach is applied. Therefore the creation of human-centric innovation ecosystems is crucial as human-centric is the core of innovation and when channeled through higher education learning, a curricula developed *with* innovation in mind results in human capital that are problem-solvers (Weisberg, 2006; Sternberg; 2009; Isaksen, Dorval and Treffinger, 2010; Proctor, 2018). A systematic critical literature analysis has highlighted several problems relevant for management sciences:

- The traditional approach to innovation by the higher education sector is inclined to train and educate the human-resources for innovation without understanding role of the problem-solving aspects of innovation entails iteration, empathy and an interdisciplinary approach to the creativity process (Isaksen, Dorval, Treffinger, 2010). These traits, equivalent to human-centered design, when applied to achieve innovation enables total involvement of the end-users of innovation in the problem-solving process (Roser et al, 2009; Smorodinskaya et al., 2017; Luthans, Youssef and Rawski, 2011; Proctor, 2018). As such, the human resources tend to view innovation in an abstract sense where it created for the people and *not with the people* that it should impact on. This leads to higher education being remote and inertial to innovation when it comes to human resources development for problem-solving aspect of it (Buchori and Malik 2004; den Ouden, 2011; Naqshbandi, 2017; von Stamm, 2011; den Ouden, 2011; Choudhary, 2017);
- Problem-solving is the attribute that defines quality innovation and innovation ecosystems (Luthans, Youssef and Rawski, 2011; Proctor, 2018). The university setting could ideally be the starting point for human-centric innovation ecosystems as it consists of the perfect environment to incubate opportunities to establish human resources stakeholder cooperative ecosystems in addition to offering formal education and vocation training directly related to innovation (Jongbloed, Enders and Salerno, 2008; OECD, 2017). Yet as potential conveners and collaborators for quality ecosystems, the higher educator sector greatest impact to nations through innovation is the large quantity of human resources it generates annually which leads to how the policy that support this trend demonstrates that talented human capital from higher education systems does lead to quality innovation outputs (European Commission, 2003; Laredo et al., 2007; Ramirez-Corcoles and Manzaneque-Lizano, 2015; Zaharia et. al., 2016; Pedro et al., 2019; Chang et. al., 2019);

– Opportunities to apply ecosystems theories such as business ecosystems, entrepreneurial ecosystems, innovation ecosystems and knowledge-based ecosystems to expand the scope of the higher education sector's contribution to innovation is significant (Iansiti and Levien, 2004; Moore, 1993:1996; Pralad, 2005; van der Borgh et. al, 2012). However, the advent of the knowledge society have increased the importance of integrating the human-centered design for value capture from innovation considering the number of human-centric activities linked to it (Moore, 1993:1996; Buchori and Malik 2004; den Ouden, 2011; Naqshbandi, 2017; von Stamm, 2011; den Ouden, 2011; Choudhary, 2017). The higher education sector is no exception to this. This dissertation will generate new knowledge on how human-centric innovation ecosystems as a resource in the higher education sector, can strategically capture value for all stakeholders and beneficiaries of the ecosystem.

Level of research of the scientific problem. The dissertation is based on the human-centered approach to innovation in the context of knowledge society era. Quality human capital for innovation is conventionally trained and developed through the formal systems of the higher education sector, promulgated by the supporting internal and external conditions of human-centric innovation ecosystems. Application of human-centric innovation ecosystems is a theme that has been insufficiently explored however is evidenced by the features of the knowledge society. The term "human-centric innovation" is predominantly linked and explored in smart technologies, artificial intelligence and robotics fields, with human-centric in the management field of marketing pertaining to several terms such as "customer-centric, customer-focused, human-centered or people-focused" which are all human centric names due to the object of the product offerings. Human-centric innovation does exists and have emanated from eminent global think-tanks, organizations and companies such as the Global Innovation Index (GII) (Cornell University, INSEAD, and WIPO, 2014), IBM (2020), Fujitsu (2014) and the human-centered design as the strategy for achieving value capture in innovation in the knowledge society. As a strategic resource for human-centric innovation, human-centric innovation ecosystems through the human factor achieves the implementation and developmental aspects of it (Alpkan, et al. 2010; Mahsud, Yukl, and Prussia, 2011; Mariz-Perez, et al. 2012; Prajogo and Oke, 2016; Kianto, Sáenz and Aramburu, 2017). The role and social value of human capital for enterprise or institutions success is acknowledged in research conducted on advanced economies that have benefited and are the pacesetters for innovation (Laužikas and Miliūtė, 2020a). This is crucial for increasing the intellectual capacity of the human resources for regional development of nations (Neverauskienė and Gruževskis, 2009; Laužikas and Miliūtė, 2020a & 2020b; Szara and Ślusarczyk 2020). Research on human capital development have assessed the various the investments possibilities and integration of human capital into the labor market for national development. This revealed that while conditions at the regional level are not created for adults who seek to get occupation or requalification, it is crucial that investments for qualification or re-qualifications is allocated to the improvement of the human resources for innovation (Rodríguez-Pose and Vilalta-Bufí, 2005; Neverauskienė and Gruževskis, 2009; Sverdlova, 2014; Laskowska and Dańska-

Borsiak, 2016; Aleknavičiūtė, Skvarciany and Survilaitė, 2016; Prakapavičiūtė and Korsakienė, 2016; Kottaridi, Louloudi, and Karkalakos, 2019; Laužikas and Miliūtė, 2020a & 2020b; Szara and Ślusarczyk 2020; Capsada-Munsech and Valiente, 2020; Delaney, 2020). Moreover, the concept of human capital is not adequately reflected by the personal qualities (attributes) of individuals, rather through the personal qualities (general competence) in the qualification structure of employees have increased (Heckman and Rubenstein, 2001; Heckman and Carneiro, 2003; Heckman, 2007; Heckman, 2008; Neverauskienė and Gruževskis, 2009; APA, 2018; Holmberg-Wright and Hribar, 2016; Alva, 2019; Laužikas and Miliūtė, 2020a & 2020b; Szara and Ślusarczyk 2020). A number of studies conducted on the higher education policy in innovation have addressed the interface between the higher education sector to the competitiveness and development of economies, not many have analyzed the impact of the policy on the development of human-centric innovation ecosystems. The impact of the higher education policy is very significant and in terms of innovation ecosystems, many researchers have investigated it as concepts of knowledge transfer and knowledge resource (Frankort, 2013; Schofield, 2013; Belitski and Heron, 2017; O'Reilly et. al 2019; Appio et al, 2019), university-industry cooperation (Schaeffer et. al, 2018; Ranga et al, 2017; Markkula and Kune, 2015; Jin-fu, 2010; Mascarenhas et al, 2018) entrepreneurships (Portuguez Castro, et al, 2019; Belitski and Heron, 2017; Bischoff, 2018; Carvalho, et al 2010; Brush, 2014) smart specialization (Romano et al, 2014; Jucevičius et al, 2016; Lopes et al, 2018; Lopes et al, 2020; Santos and Caseiro, 2015; Nieth et al, 2018; Schiuma and Carlucci, 2018), entrepreneurial universities (Guerrero et al, 2016; Schiuma and Carlucci, 2018; Secundo et al 2019; Markkula and Kune, 2015; Romano et al, 2014), open innovations (Carayannis and Campbell, 2011; Schiuma and Carlucci, 2018), social innovations (Romano et al, 2014; Markkula and Kune, 2015; Schaeffer et. al, 2018; Appio et al, 2019) and as a dynamic capabilities resource (Heaton, Siegel and Teece, 2019).

Human-centric innovation ecosystems is a strategic resource that could improve innovation and higher education outcomes, dualistically. The EU higher education sector in itself have consistently undergone many major reforms for the last three decades to address both issues (Nokkala, 2007; Corbett 2011; Hoffman and Holzhuter, 2012; Enders and Westerheijden, 2011; Lipnicka and Verhoeven; 2014; Jongbloed, Enders and Salerno, 2008; OECD, 2017; European Commission, 2018j; European Commission, 2019). Due to the skills mismatch leading to low productivity levels in labor, cyclic fluctuations in the labor market and regional innovation development, this misallocation has consistently led to the reduction of productivity gains from the human capital (Stoll, 2005; Galgóczi and Leschke 2016; McGuinness, Konstantinos and Redmond, 2017; WEF, 2019). At the planning stage of policy, the higher education should expand to include strategies that incentivize the outputs of cooperation activities that collectively address the managerial challenges of skills mismatch and talent development. Currently structural funds address this however through a formal ecosystem framework at the national policy planning stage for the higher education sector, could collectively generate human-centric initiatives to address talent development and skills mismatch challenges issues. Harmonious ecosystem environment is dependent on integrating managerial strategic targets for survival and value generation. The large networks of the higher education sector already have incentives and tools in place to support such environments for increasing the sector's contribution to innovation (Mason, 2009; Holmes and Mayhew, 2015; Delteil, and Kirov, 2016; Houston, et al 2016; Camilleri and Camilleri, 2016; Dewi and Suharti, 2018; Editor, 2018; Capsada-Munsech and Valiente, 2020). However, qualitative tools within an ecosystem framework could enhance the tangible outcomes of the higher education sector contribution to innovation in the knowledge and commercial economies. This would be useful for evaluating the true level of skills mismatch from the sector.

The value framework of the internal and external environmental networks of ecosystems is crucial for success through strong cooperation activities and alliances that strengthens it (Iansiti and Levien, 2004). This is the same for the higher education sector where research supporting this have claimed greater satisfaction levels on the outcomes and value of the outputs generated. Moreover assessing the innovative development of an industrial enterprises entails research on how the perceived risks and threats that affect the innovative activity could impede potential success (Penrose, 1959; Schultz, 1960; Schultz, 1961; Romer, 1986; Lucas, 1988; Barro, 1990; Teece et al., 1997; Heckman and Rubenstein, 2001; Heckman and Carneiro, 2003; Kamath, 2007; Al-Alawi et al., 2007; Heckman, 2007; Heckman, 2008; Ramírez-Córcoles and Gordillo, 2014; Mahoney and Kor, 2015; Pedro et al., 2019; Chukurna et al, 2020). Applying this to human-centric innovation ecosystems in the higher education sector, greater contribution to innovative success comes from strong cooperation, trust and sustainable solutions within an ecosystem framework. Governance and management of human-centric innovation ecosystems entails the New Public Governance (NPG) model research and theory framework incorporated with the modern organizational practices of the innovation-driven private sector. This could generate new knowledge on innovation ecosystems that adopt the human-centered approach and contribute to the fields of New Institutional (NI) and Resources Dependency Theories (RDT) in management sciences.

Scientific problem. What are the theoretical principles for human-centric innovation ecosystems development and how should the impact of the higher education policy be evaluated.

Dissertation research object is evaluate the impact of the higher education policy on human-centric innovation ecosystems.

Dissertation research aim. To empirically evaluate the higher education policy impact on human-centric innovation ecosystems. The proposed suggestions developed from the evaluation would support the management and strategic use of human-centric innovation ecosystems to strengthen the competitiveness of higher education sector.

Dissertation research objectives formulated to achieve the aim of the dissertation are:

1. To critically analyse literature on ecosystems, human capital, higher education systems and develop a conceptual framework of the ecosystem.

2. To conduct an empirical research to assess the relevance of the human-centric innovation ecosystems framework developed using Lithuania as an experimental case;
3. To designate the position of human-centric innovation ecosystems in the higher education sector from the main findings and its application in the management and planning of institutions and resources.
4. The use of human-centric innovation ecosystems as a resource for strategy development in the decision-making and planning processes for the higher education sector from the main insights of the empirical research findings.

Dissertation research methods. Systematic, critical review of scientific literature and articles. Document analysis on national cases of EU Member States policy on higher education and innovation outcomes using the New Public Governance perspectives in addition to New Public Management and New Public Policy theories. Further on in the analysis, it was necessary to evaluate ecosystems, human capital and institutions within the higher education sector according to the New Institutional and Resources Dependency Theories as resources and institutions interconnected according to the objectives set for innovation and ecosystems' development. A conceptual theoretical framework was developed for human-centric innovation ecosystems to identify the stakeholders and beneficiaries and their role, processes of how the ecosystem should work at each level and the value creation captured. In order to test if the developed theoretical framework is correct and valid as a strategic resource for the higher education sector, it was necessary to conduct a qualitative case study and get insights from Experts with scientific and practical knowledge in the field. Prior to the data collection process, unstructured observations were done on the higher education environment. The following steps were then applied for collecting data in the field: (a) formalizing interviews with the experts; (b) case study on the Republic of Lithuania (c) constant comparison process, data saturation, coding and extraction of the themes using Nvivo (2019) to assess the qualitative dimensions for human-centric innovation ecosystems development according to the Expert's responses. The next step was to further evaluate from the findings, the impact of the higher education policy according to the strategic needs of higher education sector. This was done through inductive analysis on the findings from the research.

Scientific novelty of the dissertation. The novelty is determined by the aim and objectives of the scientific research. In the course of developing research, the dissertation will significantly supplement knowledge to the field strategic management and planning of management sciences in the following ways:

1. The concept of human-centric innovation ecosystems is defined according to how the ecosystem is developed using the human-centered attributes of the human factor to achieve innovation skills useful to create quality innovation, through utilization of the formal higher education skills and training attained.
2. After conducting a critical review of scientific literature on ecosystems, human capital, higher education systems, a conceptual framework of human-centric innovation ecosystem was developed. The constructed framework permitted

evaluation of value creation in the ecosystem at all levels for the stakeholders and beneficiaries of the higher education sector.

3. Relevance of human-centric innovation ecosystems is emphasized according to how it used as a strategic resource for the higher education sector. Focus areas for effective utilization of human-centric innovation ecosystems in the higher education sector are assessed according to the insights from the Experts:
   3.1. Strengthening of collaborative networks with stakeholders and beneficiaries to address smart specialization and skills mismatched should be oriented towards new practice and learn or innovate and research degree programs in higher education institutions.
   3.2. Align higher education institutions study programs to the labor market through collectively affiliating the mission, objectives functions of the ecosystem according to each stakeholder and beneficiaries' needs strengthens the performance of higher education sector, structure and functions both in quality and quantity.
   3.3. The evaluation of non-higher educational factors relative to human capital development for contribution to the knowledge and commercial economy, would be monitored by the quality assurance indicators developed for the ecosystem.
   3.4. The significance of the socio-economic, industry, academia and sectorial stakeholder environment in human-centric innovation ecosystems be monitored by the quality assurance indicators to measure how those factors support the ecosystem's survival.
   3.5. Tools and resources developed to measure the performance, outcomes, processes and impacts on the development of the ecosystem should be done as a ratio to the inputs.
   3.6. Provide a comprehensive approach to support management teams in the higher education sector in the process of analysis and decision-making of the ecosystems strategy to increase the competitive advantage of the sector.
4. The position of human-centric innovation ecosystems is conceptually at the strategic planning phase of policy for the higher education sector.
5. Human-centric innovation ecosystems is set as a strategic goal in line with higher education institutions mission and vision to innovation.

Defended statements.

- Applying human-centric innovation ecosystems at the planning stage of policy for the higher education sector effects cooperation networks through the strategies developed to collectively address the challenges and issues of talent development in the sector.
- The problem of generating a harmonious ecosystem environment in the higher education sector is to integrate human-centric innovation ecosystems in each institutions according to the managerial targets set by policy; currently existing incentives in place to support such environments are formalized cluster networks in the biotechnologies, nanotechnologies and fintech sectors that are hardly applicable to the large networks of the higher education sector.

- Using human-centric innovation ecosystems would make visible the sector's input and future performance as a ratio of the outcomes; there is a scarcity of qualitative tools to measure the tangible outcomes of the higher education sector contribution to innovation in the knowledge and commercial economies within an ecosystem framework.
- The value of human-centric innovation ecosystems is identified from the levels of inputs of the ecosystem to the knowledge and commercial economy; the quality assurance indicators set by the higher education sector for monitoring the ecosystem would disclose this.

Main findings of the dissertation research. In the course of the research conducted, the following significant findings have been achieved:

- Human-centric innovation ecosystems are embedded in a network of actors in higher education sector. Its suggested position is at the planning stage of policy development due to the strategic nature of the ecosystems to support the managerial functions, vision and mission of the higher education sector for the development of human capital for innovation.
- The case study of Lithuania revealed that policy related to education and training, lead stakeholders and beneficiaries to proactively choose methods concurrent and supportive of innovation ecosystem development. Therefore, the impact of policy at the planning stage of human-centric innovation ecosystems development is evaluated according to the kind of solutions formulated to strengthen the collaborative networks with stakeholders and beneficiaries of the ecosystem.
- Technically oriented higher education institutions that have stronger and closer cooperation with its stakeholders and beneficiaries in businesses and industry within human-centric innovation ecosystem network have a high smart specialization and entrepreneurship profile. Research-oriented higher education institutions that cooperate closely with partners in HORIZON2020 projects, participate in competitive funding to support scientific and research activities leading to innovation have a high research profile. These instances indicate stronger partnerships and cooperation and strengthens the higher education sector's competitive advantage.
- The attributes of the human capital derived from the internal and external environments for human-centric innovation ecosystems in HEIs, are higher in entrepreneurships, being different innovative and collaborative. Within human-centric innovation ecosystems', quality assurance indicators monitor the qualitative inputs, processes, results, outputs and outcomes on the attributes of the human capital for innovation.
- The significance of the socio-economic, industry, academia and sectorial stakeholder environment in human-centric innovation ecosystems permit the formulation of quality assurance indicators to measure the ecosystem's survival.

The suggested tools and resources for monitoring of the quality assurance are:

1. Quality of human capital produced.
2. Incentives for talent development.

3. Greater cooperation ties among key actors (stakeholders and beneficiaries).
4. Institutions in the higher education sector's strategic goals.
5. Institutions functions (role) in higher education sector to innovation value creation.
   - Most progressive institutions in the higher education sector have stronger cooperation ties, an internal and external environment aligned to its vision and mission, centrality of innovation in its activities, quality human capital and talent. The findings indicate that strategic monitoring of the quality assurance indicators evaluate the ecosystems' competitive advantage status through outcomes and outputs generated. This shows that the features and attributes of ecosystem have taken into account quality rather than quantity as well.
   - Greater cooperation strengthens the higher education sectors' position to the knowledge and commercial economies. Through human-centric innovation ecosystems, the higher education sector contributes to the continuous development of these economies through the quality of the human capital produced and talent developed through its systems. Both knowledge and commercial economies requires human resources, first, to create the technology and digitization platforms for instant access to knowledge, then secondly develop the tools for its commercialization. The quality assurance indicators of human-centric innovation ecosystems evaluate the strategies for integrating more practical learning and research into studies also as a ratio of inputs to processes, outputs and outcomes in the knowledge and commercial economies.
   - Higher education institutions in Lithuania contribute to both knowledge and commercial economies however positioning human-centric innovation ecosystems into the functions would enable systemic quality evaluation of inputs into the commercial and knowledge economies.
   - Higher education sector's systems of learning, practice and research aligned closer to all stakeholders and beneficiaries involved particularly for the expectations on the outcomes of higher education attainment. Human-centric innovation ecosystems ensures that institutions forming its network align teaching methods that are relevant and inclined to the knowledge society, beneficial for stakeholders and actors and ensures that quality and quantity of outputs are measurable. Strategic partners developed through these collaborative structures and relations have greater importance and presence in policy development for the higher education sector. Utilization of human capital and talent as resource tools and strengthened collaborations across institutions results in greater resource optimization in human-centric innovation ecosystems.

Practical value of the dissertation research findings. The comprehensive framework of human-centric innovation ecosystems is significant for the higher education sector due to the following reasons:

- Human-centric innovation ecosystems is a strategic resource in management sciences for monitoring quality ecosystems that create innovation aligned with the objectives, missions and functions of its stakeholders and beneficiaries. The ecosystem was evaluated qualitatively according to how it served the purposes of

the higher education sector as a strategic resource tool for strategy development to capture value in innovation. This new and significant for management science.
- The conceptual theoretical framework developed for human-centric innovation ecosystems is relevant and correct as it is suitable for assessing research on human-centered type innovation through the human capital possessing higher education. This is new knowledge generated on innovation ecosystems features that adopt the human-centered approach to human capital development in the higher education sector.
- The research additionally designated the true position of human-centric innovation ecosystems in the higher education sector. This is new and useful as the practical benefits are the management science approach utilized to develop better strategies for quality collaborative ecosystems leading to new synergies, greater optimization of resources and improvement of the higher education sector's general performance in addressing issues with all its valued stakeholders and beneficiaries of the ecosystem's network.

Implications of the scientific problem. The main implications of the impact of the higher education policy on the development of human-centric innovation ecosystems are:
- Cultural and socio-economic (macro-environment). The socio-economic and cultural environment also determine whether human-centric innovation ecosystems harmoniously develop considering the factors, actors and funding to support it as a strategic resource for the higher education sector.
- Institutional (eso- and meso-environment). The institutional implication originates from possible weak *inter*- and *intra*-cooperation between institutions impede the ecosystem's development. The overall internal and external institutional environment, resources, technology and infrastructure needed to support its functions should be considered as well.
- Skills development (micro-environment). Human-centered features such as trust, communication, organizational and institutional culture to innovation are several barriers to human-centric innovation ecosystems development in the higher education institutions.
- Individual (talent). At the individual level, human-centered features such as skills development, aptitude and an inherent motivation for innovation.

Structure and organization. The dissertation is structured according to the formulated aims and objectives of the dissertation. Part one consists of a critical and overview on literature developed on ecosystems, human capital development, higher education systems and governance which are significant for developing the theoretical framework of human-centric innovation ecosystem for the empirical research. Part two consists of the rationale of the methodology for the research, methods and data collection instruments. Part three consists empirical research and evaluation of the practical applicability of the findings according to the impact analysis of human-centric innovation ecosystems development. Figure 1 provides the structure of the dissertation.

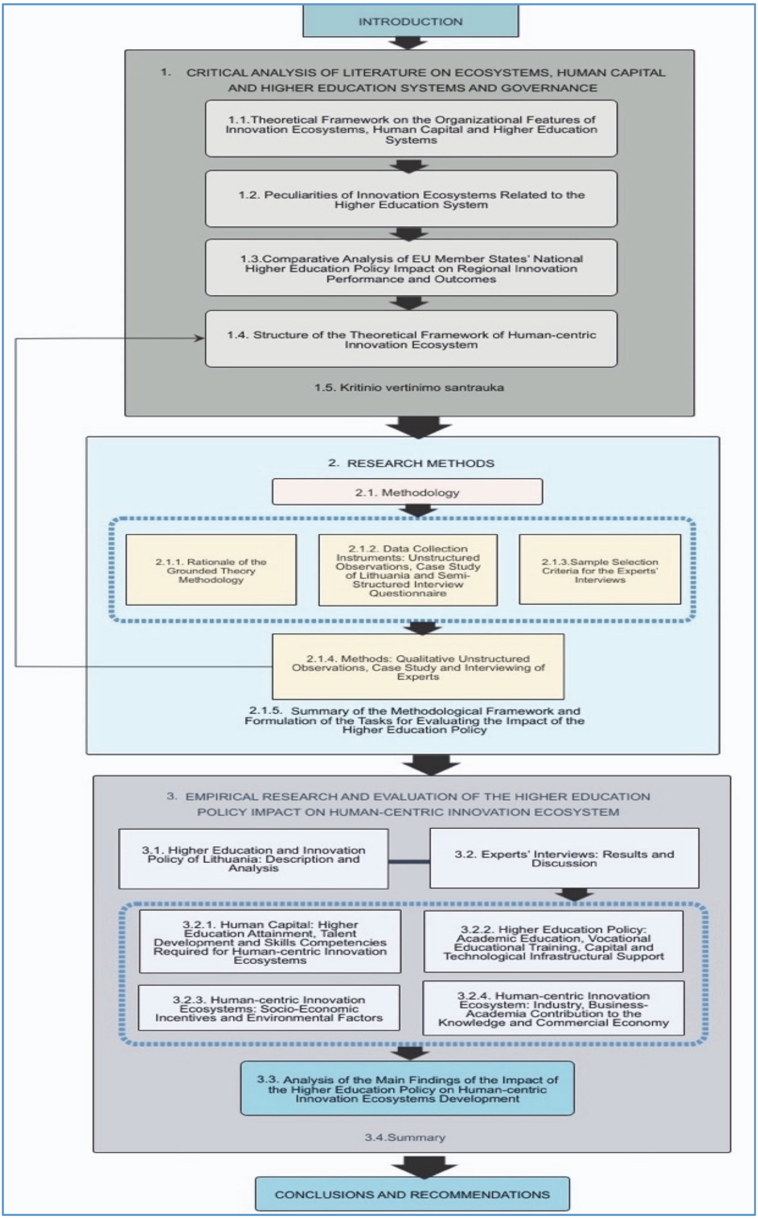

Figure 1. *Structure of the Dissertation*
Source: Developed by the Author

Keywords: Ecosystems, Higher Education, Education Policy, Innovation, Human-centric Innovation.

Dissemination of the research findings. The results of this dissertation research include: (A) Publications in research journals and conference proceedings and (B) Conference presentations.

(A) Publications in research journals and conference proceedings:

- Chukurna, O.; Niekrasova, L.; Dobrianska, N.; Izmaylov, Ya.; Shkrabak, I.; Ingram, K. Formation of methodical foundations for assessing the innovative development potential of an industrial enterprise = Формування методичних засад оцінки потенціалу інноваційного розвитку промислового підприємства = Формирование методических основ оценки потенциала инновационного развития промышленного предприятия // Науковий вісник = Naukovyi visnyk Natsionalnoho Hirnychoho Universytetu : peer-reviewed journal. Dnipropetrovsk: State Higher Educational Institution «National Mining University». ISSN 2071-2227. eISSN 2223-2362. 2020, no. 4 (178), p. 146-151. [Academic Search Complete; VINITI] [CiteScore: 1,50, SNIP: 0,911, SJR: 0,345, kvartilis: Q2 (2019, Scopus Sources)] [M.kr.: S 003].
- Ingram, Keisha LaRaine. Power and culture in human-centric innovation ecosystems // Journal of management and training for industries. Kitakyushu: Institute of Industrial Applications Engineers. ISSN 2188-8728. eISSN 2188-2274. 2019, vol. 6, no. 2, p. 1-16. DOI: 10.12792/JMTI.6.2.1. [ProQuest Central; Business Source Premier; Ingenta Connect; Business Source Complete] [M.kr.: S 003].
- Baležentis, Alvydas; Ingram, Keisha Laraine. Development of human-centric innovation ecosystems theories = Į žmogų orientuotų humanocentrinių inovacijų ekosistemų plėtros teorijos // Socialinių mokslų studijos: mokslo darbai = Societal studies: research papers. Vilnius: Mykolo Romerio universitetas. ISSN 2029-2236. eISSN 2029-2244. 2017, t. 9, Nr. 1, p. 56-64. [SocINDEX with Full Text] [M.kr.: S 003].
- Ingram, Keisha Laraine. Attracting and retaining talented professionals in the Baltic States = Gabių profesionalų pritraukimas ir išlaikymas Baltijos valstybėse // Socialinių mokslų studijos: mokslo darbai = Societal studies: research papers. Vilnius: Mykolo Romerio universitetas. ISSN 2029-2236. eISSN 2029-2244. 2016, t. 8, Nr. 2, p. 224-232. DOI: 10.13165/SMS-16-8-2-05. [ProQuest Central; SocINDEX with Full Text] [M.kr.: S 003].

(B) Conference presentations:

- Sudnickas, Tadas; Ingram, Keisha Laraine. The value framework of sustainable connectivity in business ecosystems // International security in the frame of modern global challenges 2019: collection of research papers / Mykolas Romeris University, Kyiv National Economic University named after Vadym Hetman. Vilnius; Kyiv: Mykolo Romerio universitetas, 2019. ISBN 9789955199625. eISBN 9789955199632. p. 89-92. [M.kr.: S 003].
- Ingram, Keisha LaRaine. Human-centric innovation ecosystems // Social transformations in contemporary society: proceedings of annual international conference for young researchers. Vilnius: Mykolo Romerio universitetas. eISSN 2345-0126. 2018, t. 6, p. 66-77. [DOAJ] [M.kr.: S 003].

– Ingram, Keisha Laraine. Human-centric innovation ecosystems theories // International scientific conference for young researchers „Social transformations in contemporary society 2018“: abstract book, 7-8 June, 2018, Vilnius-Net / Mykolas Romeris University; Doctoral candidates' association. Vilnius: Mykolo Romerio universitetas. eISSN 2424-5631. 2018, 2018, p. 21-22. [M.kr.: S 003].

Other publications. List of scientific publications not related to the dissertation results. (A) Publications in research journals and conference proceedings, (B) Conference presentations and (C) Peer-reviewed articles from conference proceedings that appear in Web of Science and/or Scopus DB:

(A) Publications in research journals and conference proceedings

– Ingram, Keisha Laraine. Intellectual property protection for brand Jamaica's creative industries // Socialinės technologijos: mokslo darbai = Social technologies: research papers. Vilnius: Mykolo Romerio universitetas. ISSN 2029-7564. 2014, [Nr.] 4(1), p. 151-167. DOI: 10.13165/ST-14-4-1-10. [DOAJ; Academic Search Research and Developement (EBSCO)] [M.kr.: S 003]

(B) Conference presentations:

– Ingram, Keisha Laraine. Internet connectivity and the cloud // Social technologies'15: Development of social technologies in the complex world: E-health: conference abstracts, September 24-25, 2015 [Elektroninis išteklius] / Mykolas Romeris University. Vilnius: Mykolas Romeris University, 2015. ISBN 9789955197577. p. 19. [M.kr.: S 003]

– Ingram, Keisha Laraine. Generating online equity for Brand Jamaica through intellectual property administration // SOCIN 2013: Social technologies'13. Development of social technologies in the complex world: special focus on e-health: conference abstracts: 10-11 October 2013 [Elektroninis išteklius] / Mykolas Romeris University. Vilnius: Mykolas Romeris University, 2013. ISBN 9789955195870. P. 29-30. [M.kr.: S 003]

– Ingram, Keisha Laraine. Sustainable Connectivity and One Asia Community // One Asia Convention, Seoul 2019: proceedings. 5-6 August 2019, Lotte Hotel Seoul (Sogongdong) / Konkuk University. Seoul: One Asia Foundation. 2019, p. 120-126. [M.kr.: S 003]

(C) Peer-reviewed articles from conference proceedings that appear in Web of Science and/or Scopus DB:

– Nitsenko, Vitalii; Kotenko, Sergiy; Hanzhurenko, Iryna; Ingram, Keisha Laraine. Determination of Weight Coefficients for Stochastic and Fuzzy Risks for Multimodal Transportation // Journal of physics: conference series: The 2nd Joint International Conference on Emerging Computing Technology and Sports (JICETS) 2019 25-27 November 2019, Bandung, Indonesia. Bristol: Institute of Physics Publishing Ltd. ISSN 1742-6588. eISSN 1742-6596. 2020, vol. 1529, 032007, p. 2-8. DOI: 10.1088/1742-6596/1529/3/032007. [Conference Proceedings Citation Index - Science (Web of Science)] [CiteScore: 0,51, SNIP: 0,454, SJR: 0,221, kvartilis: Q4 (2018, Scopus Sources)] [M.kr.: S 003]

1. CRITICAL ANALYSIS OF LITERATURE ON ECOSYSTEMS, HUMAN CAPITAL AND HIGHER EDUCATION SYSTEMS AND GOVERNANCE

1.1. Theoretical Framework on the Organizational Features of Innovation Ecosystems, Human Capital and Higher Education Systems

1.1.1. The Concept of Ecosystems and Analysis of the Implications of Human-centric Innovation Ecosystems

The role of human factor in the innovation process is consistently acknowledge by scholars, with an emphasis on its particular qualities (Langrish et al, 1972; Utterback, 1975; Rothwell et al, 1974; ven de Ven, 1986; Wolfe, 1994; Martins and Terblanche, 2003). Rubenstein (1976) states that the innovation process is a 'people process' where successful innovations of the past were as a result of the human factor fulfilling a variety of roles, which in most cases are informal. Though innovation management consists of merging it with change management, more interest in the innovation ecosystems created, developed and inhabited within certain networks according to a shared business need have increased (Iansiti and Levien, 2004). Many scholars contributing to its early fundamental development chronologically, perceived innovation ecosystems initially as business ecosystems (Moore, 1993), entrepreneurial ecosystems (Pralad, 2005) innovation ecosystems (Adner, 2006) then as knowledge-based ecosystems (van der Borgh et. al, 2012) where ecosystems are researched contextually according to several different theories. However, further research by other scholars' states that ecosystems can be further categorized according to four types instead of which are termed as knowledge, entrepreneurial, business and innovation ecosystems (Scaringella and Radziwon, 2018; Yu-Shan Su, Y. et al., 2018). These theories, institutional, resource dependency and isomorphism institutionalism (DiMaggio and Powell, 1983; Powell and DiMaggio, 1991; Pfeffer and Salancik, 1978), have been analyzed at the individual (micro-), the enterprise (macro-) and network (meso-) levels (Teece, 2007; Zott and Amitt, 2010; Nambisan and Sawhney, 2011) and linked to the concept of open innovation and co-creation. Mitleton-Kelly (2003), Moore (1993) and Iansiti and Levien (2004) asserts that of all the varieties of ecosystems researched, the complex evolving archetypical nature of business ecosystems enables its distinctness contextually. Furthermore, a new approach proposed by Adner (2006) implies that the innovation strategy should be 'matched' according to the innovation ecosystem. Hence, Adner's (2006) definition from a human-centric perspective defines innovation ecosystems as networks that convert products or services into 'coherent' customer-centric solutions. Thus, as the core-elements of the growth strategies of organizations, these ecosystems rapidly evolve into complexed, networked systems consisting of a wide range of sectors and industries. Through interactions forged, the associative coordination costs involved in these ecosystems are radically reduced due to the human-centric approach used (Adner, 2006; Yu-Shan Su, Y. et al., 2018). As a strategy, innovation ecosystems should shorten the overall goal of achieving gradual benefit for companies (Yu-Shan Su, Y. et al., 2018). The vast array of inter-connected actors and players working cooperatively to progressive and develop the system's symbiotic relationships and connections that exist. Chronologically, the beginnings of innovation ecosystems are analogized initially as relatively chaotic and undefined (Dedehayir et al., 2018; Yu-Shan Su, Y. et al., 2018), consisting of four roles that emerge with each progressing from a business ecosystem into an innovation ecosystem (Adner and Kapoor, 2010; Yu-Shan Su, Y. et al., 2018), according to the Figure below.

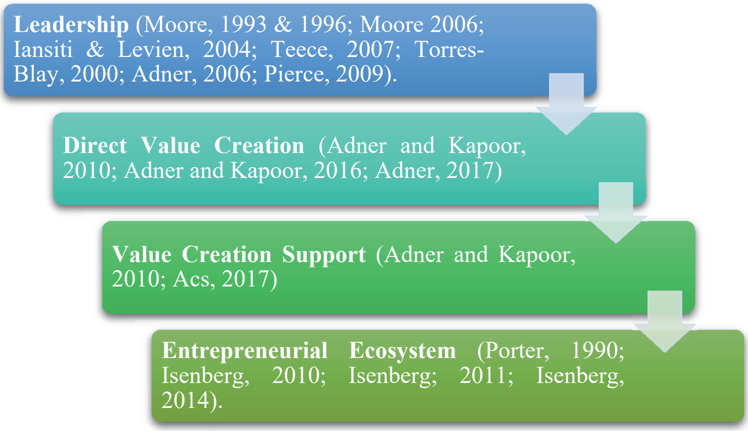

Figure 2. *Origins of Innovation Ecosystems*
Source: Developed by the Author according to Yu-Shan Su, Y. et al., 2018;

Business and innovation ecosystems inherently are not the same networked concepts, as the key distinguishing feature differentiating of each are 'value capture' (business ecosystems) and 'value creation' (innovation ecosystems). The biological analogy applied emphasize this structure as an economic concept between agents grounded on strong relationships and a common foundation (Moore, 1993; Iansiti and Levien, 2004).

Qualitatively, the structural framework of innovation ecosystems derives from terms used in a biological ecosystem (Shaw and Allen, 2018). These terms describe ecosystems' framework as the organism specie of a business model, a community, or a population. The natural structure consists of other pathways of interspersed business models, biomes or 'ecosystems within ecosystems' existing in its internal framework. In contrast, Walrave et al. (2018) in providing a description of the external framework of ecosystems within the context of its innovation-based, socio-technical environment, asserts that each network pathways links to a potential or existing value proposition. Another perspective from the researchers Smorodinskaya and Russell (2018), states that innovation ecosystems frameworks derived from 'complexity science' and encompass defined generic properties. Furthermore, Smorodinskaya and Russell (2018) argues that for innovation linked to these ecosystems framework, should not be ascribe as a term pertaining to technological innovation but rather as an extension to it. This generates the statement of what features of the human factor accounts for innovation and economic growth, in addition to technology and capital. The latter usually does not accrue initial fixed research costs as the former, yet it characteristically contribute to the efficiency of a commodity or service developed, commercialized and termed as "soft" innovation through knowledge transfer (Smorodinskaya and Russell, 2018).

Quantitatively, ecosystems' framework have evolved according to the value chain or the technology used in for its simulation (Yu-Shan Su et al., 2018). Luo (2018) states that ecosystems can either diverge (split) or converge (remain intact) and usually dependent according to the technological composition or the diversity level of the selection capacity applied in the value chain. Nishino et al (2018) modelled the theory of ecosystems as an ever- evolving collaborative networks that comprise mainly of strategic partners who as actors in the systems have indirect reciprocal relationships purely derived on the balance theory. Hence, the cooperative networks existing between them can either develop or collapse. For the former, those ecosystems can still fail even after achieving temporary success. Thus, in order for those ecosystems to thrive, there should exist a wide variety of strategic partners in the system in order to enhance and strengthen the cooperative relations that exist and actors with lower capabilities for enriching the ecosystems to leave with stronger actors dominating and influencing the networked system formed (Yu-Shan Su et al., 2018). In this instance, the human factor is the dominant partner (actor) when categorize as an innovation-led community framework intended for innovation (Smorodinskaya et al., 2017). Community is a human-centric term, which according to its scale or size can function as large global wide networks to a small ad-hoc, networked-based groups.

The quintessential nature of innovation ecosystems in the era of non-linear innovation and digitalization, Smorodinskaya et al., (2017), contends that its true essence developed for the market is irrespective of its geographic locality (World Economic Forum, 2015). Therefore, ecosystems perceived as an environment more conducive for innovation development, promulgate value co-creation through collaborative activities that are human-led. Value co-creation though primarily viewed as a business strategy derives from the interactions between producers and consumers. This has evolved to "active, creative and social processes through collaboration between producers and users" (Roser et al, 2009; Smorodinskaya et al., 2017). On the other hand, collaboration connotes the various form of developed interactive communication modes or methods between networked actors in an innovation system. Based on this implication, in order to 'co-create' innovation, all actors should share a common vision, strategy, distinction, and obligations (Camarinha-Matos and Afsarmanesh 2008; Smorodinskaya et al., 2017). When evaluating innovation ecosystems case analysis in terms of 'value creation' and 'value capture' the very nature of its structure can stimulate the national innovation ecosystem capacity through the rich source of human resources. Though achieved through strategic partnerships fostering innovation capacity through relevant platforms several implications can cause these type of ecosystems to succeed or fail. Therefore, constant evaluation/assessment, directionality at the national policy level(s), technological risks and availability of all resources that prompts innovativeness at the human factor level is imperative. Proper governance of innovation ecosystems are vital in achieving its efficiency and full potential. Therefore, efficiency and attainment of the ecosystem potential depends on the type of environments and interactions between all actors (researchers and institutions such as enterprises, HEIs and research firms). Entrepreneurial ecosystems, as an example demonstrates that through the webbed relationships of diverse actors through collaborations results in new opportunities through entrepreneurial activities. The human-centric aspect is where knowledge transferred aligns with the processes with organizational objectives. As a communicative process, knowledge is a key evolutionary dynamic consisting of assigned meanings (Flores, Pereira and Graça 2017).

Finally, innovation ecosystems are multidisciplinary concepts. Studies from economy literature focuses more on the role and motives of the system (otherwise termed as the outcomes) in generating ideas (Gomes, Facin, Salerno, and Ikenami, 2016; Suominen, Seppänen, and Dedehayir, 2016; Schulte, 2019). For innovative ideas to be efficiently generated, developed, tested and ultimately scaled for developmental impact, they require coordination, collaborative action, resources and ability of multiple interconnected actors such as government, civil society, the private sector, universities individual entrepreneurs and others to work together. The entrepreneurial ecosystem model derives on the foundation of the entrepreneurial universities according to researchers, whilst the human-centric innovation ecosystem derives from the common factor existing in all the actors of this innovation ecosystem, which is the human factor. The human factor consists of human capital that possess the skills, training, motivating and intelligence to initiate innovation and its process. The traits of a human-centric system are learning without barriers, the motivated inspired human capital, training the talented human capital, attracting them through highly ranked universities that offer quality education, and offering highly compensation packages and working conditions that will retain them. Successful innovation as seen through the lense of the human factor occurs only when people with skills, experience and capabilities collaborate to understand, or predict and then address the challenges in society.

1.1.2. Analysis of Human Capital Development Relating to Higher Education Attainment: Knowledge, Competencies and Skills Outcomes

Classic economic theories have often envisaged human capital from an educational perspective (Alva, 2019). These theories implies that investments made in formal education and training prepares the human resources to achieve better working conditions, organizations and firms to achieve efficiency and productivity and countries to achieve economic prosperity (Alva, 2019). Referring to human capital, Bontis (1996) states that in today's knowledge society, this cadre may be the only source for nations to achieve sustainable competitive advantage in the globalized era. Becker (1993), the father of human capital theory, states that human capital as intangible assets, are the outcomes of education, training or investments aimed at increasing the human resources with knowledge, expertise, and skills. Human capital is further termed as the aggregate of abilities, competencies, collectively called intellectual or intangible assets acquired during the course of a human being's life in addition to formal and informal education and training that result in productive utilization for the benefit of individuals, society and nations. Other definitions of human capital addressing the cognitive abilities pertain to the economic and social value of human capital that developed through lifelong learning (Alva, 2019). Moreover, early research indicate that investment in people results in improved work quality and overall economic benefits for organizations, institutions and governments. The economic and social development of societies demonstrates that investments in learning and education resulting in a cadre of qualified human capital leads to positive outcomes both at the individual and societal levels (Becker, 1964; Kaplan and Norton, 2004; Schultz, 1961; Denison, 1962). Early research on human resource development supports this as well. Evidence documenting the processes and outcomes that affect the capacity of human capital to advance high-level, knowledge-based activities that cultivates and generate innovations (Khasawneh, 2010). Becker (1993) elaborates on the necessity of educating the human capital with general and specific training. General training (literacy) is non-transferable rentable skill useful for institutions and organizations in society that utilize human capital as it primary source in the factors of production (Bassi, 2001). The second type specific training, refer to skills or knowledge useful to a single employer or industry (Huselid and Barnes, 2002). One of the more common notion concerning human capital studies is the concept that the evaluation of human capital purely lies on the knowledge and skills gained from formal tertiary level education (Valente et al., 2016). Valente et al. (2016), states that this is fractional compared to abundant cognitive skills actuated through the labor force in the generating and utilization of knowledge.

Human capital development through higher education institutions enable more effective management on talent and skills development and in cooperation with external stakeholders, identify talent gaps and skill priorities in society. This includes recruitment, selection, induction and placement of quality faculty members for teaching and their continuous quality development to train and educate human capital (Khasawneh, 2010). As an individual, human capital, which is an amalgamation of knowledge, skills and other capabilities, created through formal training or education, is a psychological attribute that every human resource possesses (Alva, 2019). In this stance, human capital are complex, intangible elements containing multidimensional constructs both at the individual and institutional levels according to Alva (2019), Khan and Quaddus (2018). Further supported by Huselid and Barnes (2002) at the organizational perspective, the value of human capital concerts to a resource strategic for enabling a firm's competitive advantage. At the individual level, Alva (2019) acknowledge that the theoretical origins of human capital have morphed into novel relevant studies. These studies focuses on the intangible aspects of human capital as an important resource, key to firms' operations, or albeit the heart and soul of production processes. Becker (1993: 1964) and Schultz (1961) reiterates the importance of human capital as the catalyst for achieving a firm's consolidation of several key organizational dynamics. Thus, several theoretical approaches including the Resource Base View (Penrose, 1959), the Knowledge Base View (Al-Alawi et al., 2007), the Dynamic Capabilities View (Teece et al., 1997), the enterprise Competencies View (Mahoney and Kor, 2015) are summarized in Table 1 to define human capital at the organizational and individual theories:

Table 1. *Human Capital Theories based on Knowledge, Skills, Abilities, And Other Skills (KSAOs)*

	Individual Level Theories	Organizational Level Theories
Human Capital Theories	*The Resource Base View (RBV)* are those theories that connects or associates the individual resources of human capital to a sustainable competitive advantage (Penrose, 1959).	*The Dynamic Capabilities View (DCV)* are those theories that demonstrate how human capital, as a 'flexible' resource can be adaptable to external changes (Teece et al., 1997).
	The Knowledge Base View (KBV) are those theories focused on demonstrating how human capital, as the source of knowledge, used as a strategic resource (Al-Alawi et al., 2007).	*The Competencies View (CV)* are those theories relating to those human capital dimensions that generate specific competences for firms (Mahoney and Kor, 2015).

Created by the Author according to Penrose, 1959; Teece et al., 1997; Al-Alawi et al., 2007; Mahoney and Kor, 2015; Alva, 2019.

These theories evaluate human capital according to the principal qualities developed through higher education offered by higher education institutions at the institutional and organizational levels. For the purpose of this research, the individual level theory is examined and taken into consideration purely because it translates one of the most important facets of human capital, the human-centric qualitative dimension (Alva, 2019). While the quantitative dimension of the individual level is more numerically and proportionally applicable to the knowledge, skills and capabilities that the human capital encompass, it examines how human capital generates greater productivity for firms. Schultz (1961) adds that investments allocated to the development of human capital translates to economic benefits for firms at the sectorial level. The cognitive skills and capabilities developed through formal higher education, termed the Big Five personality traits theory, are other factors of the human capital that determines a firm's success (APA, 2018; Holmberg-Wright and Hribar, 2016; Alva, 2019). Collectively, the non-cognitive abilities linked to the idiosyncrasies, motives and personality traits of the human capital required for the labor market are nurtured through socialization, honed through formal education and accrued through lifelong education (Heckman and Rubenstein, 2001; Heckman and Carneiro, 2003; Heckman, 2007; Heckman, 2008). Contextually, the assumption is that the important skills considered categorically habitual outputs of the highly educated human capital with higher education according to the Table below would be:

Table 2. *Skills Required of the Highly Educated Human Capital for Human-Centric Innovation Ecosystems*

Intangible Input Skills (Human Capital at the Individual Level)	**Intangible Output Skills (Human Capital at the Individual Level)**
Knowledge, Skills, Abilities, and Other Skills (KSAOS) according to the Knowledge Base View (Al-Alawi et al., 2007): • Analytical skills • Critical thinking/ Problem solving skills • Strategic thinking skills • Risk taking/ Showing initiative • Quantitative skills • Creativity skills • Entrepreneurship skills • Collaborative skills	• Qualitative Dimensions (Schultz, 1961); • Economic Dimension (Schultz, 1960; Romer, 1986; Lucas, 1988; Barro, 1990); • Cognitive Dimensions (APA, 2018; Holmberg-Wright and Hribar, 2016; Alva, 2019); • Intellectual Capital / Knowledge creation Dimensions (Kamath, 2007; Ramírez-Córcoles and Gordillo, 2014; Pedro et al., 2019);
Knowledge, Skills, Abilities, and Other Skills (KSAOS) according to the Resource Base View (Penrose, 1959): • Collaborative skills • Entrepreneurship skills • Strategic thinking skills • Analytical skills • Critical thinking/ Problem solving skills • Communication skills • Leadership skills • Creativity skills	• Intellectual Capital / Knowledge creation (Kamath, 2007; Ramírez-Córcoles and Gordillo, 2014; Pedro et al., 2019); • Cognitive Dimensions (APA, 2018; Holmberg-Wright and Hribar, 2016; Alva, 2019); • Qualitative Dimensions (Schultz, 1961); • Economic Dimension (Schultz, 1960; Romer, 1986; Lucas, 1988; Barro, 1990);
Knowledge, Skills, Abilities, and Other Skills (KSAOS) according to the Competencies View (Mahoney and Kor, 2015): • Industry-related skills through practical experience • Collaborative skills • Decision-making skills • Leadership skills • Communication skills • Global mind-set • Creativity Skills	• Cognitive Dimensions (APA, 2018; Holmberg-Wright and Hribar, 2016; Alva, 2019); • Qualitative Dimensions (Schultz, 1961); • Economic Dimension (Schultz, 1960; Romer, 1986; Lucas, 1988; Barro, 1990);

Table 2. *Skills Required of the Highly Educated Human Capital for Human-Centric Innovation Ecosystems (continuation of the table)*

Intangible Input Skills (Human Capital at the Individual Level)	Intangible Output Skills (Human Capital at the Individual Level)
Knowledge, Skills, Abilities, and Other Skills (KSAOS) according to the Dynamic Capabilities View (Teece et al., 1997): • Flexible and an adaptable attitude • Motivation/ Drive • Global mind-set • Communication skills • Leadership skills	• Non-cognitive Dimensions (Heckman and Rubenstein, 2001; Heckman, 2007; Heckman, 2008; Heckman and Carneiro, 2003); • Economic Dimension (Schultz, 1960; Romer, 1986; Lucas, 1988; Barro, 1990); • Qualitative Dimensions (Schultz, 1961); • Intellectual Capital / Knowledge creation (Kamath, 2007; Ramírez-Córcoles and Gordillo, 2014; Pedro et al., 2019); • Cognitive Dimensions (APA, 2018; Holmberg-Wright and Hribar, 2016; Alva, 2019);

Created by the Author according to Penrose, 1959; Schultz, 1960; Schultz, 1961; Romer, 1986; Lucas, 1988; Barro, 1990; Teece et al., 1997; Heckman and Rubenstein, 2001; Heckman and Carneiro, 2003; Kamath, 2007; Al-Alawi et al., 2007; Heckman, 2007; Heckman, 2008; Ramírez-Córcoles and Gordillo, 2014; Mahoney and Kor, 2015; Holmberg-Wright and Hribar, 2016; APA, 2018; Alva, 2019; Pedro et al., 2019.

As seen in the Table, the presumption pertaining to the policy of higher education systems is the overlapping of intangible input and output skills required of highly educated human capital for human-centric innovation ecosystems.

Recently a cultural shift in policy has enacted the growing importance of intellectual capital as an important resource for knowledge-driven entities (European Commission, 2003; Laredo et al., 2007; Ramirez-Corcoles and Manzaneque-Lizano, 2015; Pedro et al., 2019). Intangibly, intellectual capital acts as the framework of knowledge resources related to the ideas and capabilities of the human capital. Kamath (2007), Ramírez-Córcoles and Gordillo (2014) and Pedro et al., (2019) have agreed that the intangible inputs and outputs resulting from intellectual capital is knowledge creation. Therefore, extracting from the intellectual capital framework and applying it to the context of higher education systems, human capital then becomes one the most important natural resources that contribute to their governance, mission and type of administration, structure and organization (Leitner, 2004; Pedro et al, 2019) of those systems. Moreover, human capital is the implicit and explicit knowledge possessed by the human resources that related to knowledge gained from teaching activities acquired through formal and non-formal education and training (Ramírez-Córcoles and Manzaneque-Lizano, 2015; Ramírez-Córcoles and Gordillo, 2014; Pedro et al, 2019). When applied to New Public Governance within New Public Management theory, the relational capital of higher education institutions would be applicable to intellectual capital of human capital theory.

Human resources indistinctively refers to the development of skills and knowledge, shaped according to the needs of labor markets. Human resources contrary to human capital are 'indispensable resources' for economic growth and the development of nations. Usually an effective resource for quantifying and formulating the developmental goals to achieve prosperity for these territories. Through Classical Economic theory, the capital accumulation of the human resource is the main determinant of economic growth. On the other hand, Neo-classical Solow Growth Model postulates that labor and capital as '*endogenous*' factors and technology the '*exogenous*' factor contributing to the realization of economic growth for nations (Hassan et. al., 2019). Considering aside the endogenous factor, labor as in human resources development is the catalyst for endogenous technological innovation (Hult, 2009 as cited by Hassan in 2019). To support Schultz's (1960) human capital theory through higher education, Romer (1986), Lucas (1988) and Barro (1990) points out that human capital development endogenously benefits nations economic development (Schultz, 1960; Romer, 1986; Lucas, 1988; Barro, 1990). Nevertheless, many scholars maintains that economic development is externally linked to human capital (Chang et. al., 2019; McConnell and Brue, 1988) and according to their level of education attained and skills demand in the labor market (Chang et. al., 2019).

Early research by Schultz (1961) shows that there is a linear relationship between tertiary level education attainment and economic growth. Significant evidence proves that the education sector does indeed contribute to both individual and societal advancement leading to advanced, thriving economies globally. The higher educational attainment level of the human capital collectively contributes significantly to the GDP growth of nations (Zaharia et. al., 2016; Chang et. al., 2019). Empirical investigations conducted by Gao (1998) supports this with the success of emerging economies such as South Korea, Singapore, Hong Kong and Taiwan. Through continuous improvement to the educational structure and lifelong learning of the talented, skilled human capital, these nations have reaped economic growth through innovation. Furthermore, Chang et al (2019) states that academic training through higher education and vocational educational training significantly reflects a nation's educational progress and advancement as well (Chang et al, 2019). On the other hand, for countries that lag in innovation related economic growth through its stock of human capital system, Barro (1996; 2000) points out using the growth regression theory, that minimum level higher education is enough to achieve this (Barro, 1996; Barro, 2000). Marquez-Ramos and Mourelle (2019) supports this by claiming that the linear relationship between higher education attainment and economic growth does not necessarily leads to greater economic growth. Therefore, countries lagging in innovation linked to the large stock of human capital possessing higher education, usually take advantage of this deficit through a meritocratic higher education system. This system practiced by emerging and some developed countries preserves the value of higher education attained by a small percentage of a country's population. Nonetheless, innovations are implement better with human capital possessing higher education (Acemoglu at al. 2002; Valente et al., 2016; Barro, 1996; Barro, 2000). Schultz (1961) further highlights the linear, positive of this when analyzed from the '*massification*' of education approach utilized by advanced developed, innovative nations. Massification of higher education enables the development of the human resources without merit place on higher education attainment, as it is necessary for the economic growth of nations (Schultz, 1961). Moreover, numerous research supports this, as economies from developed advanced OECD economies (territories) tend to have larger proportions of the population possessing higher education. Though higher education attainment is beneficial economically for innovative nations (OECD, 2014), it is the inertial model to teaching and training that places the correlative relationship between talent development and innovation in a vacuum. For innovation ecosystems, evidence does support that higher education naturally contributes to quality innovation. Yet innovation has evolved to become more human-centric recently and with higher education inertial model of teaching and learning, more incentives should generate to inspire the talented human capital to drive innovation and growth for nations.

1.1.3. Systems of Higher Education Governance and the Prerequisites of the Human-centric Approach to Higher Education

Historically, European universities' origins emanate from three higher education models. The Humboldtian (German), Napoleonic (French) and Anglo-Saxon (British) higher education models emerged consecutively as paradigms reflecting the changing purpose of European higher education (Gellert 1993a and 1993b; Schwartzman 2001; Sam and van der Sijde, 2014). Unilaterally, as each model replicated tailored policy-mandated education systems, the Anglo-Saxon two-fold "liberal education" (universities) and "character formation" (vocation institutions) models first amplified the importance of "personality development and generation" approach through liberal education (Arthur et al., 2007). This granted greater institutional autonomy and freedom for British HEIs to transform the learning curricula competitively to a student-centric approach. The American-based, Anglo-American model is quite similar, with a predominantly multi-disciplinary student-centric research-based cultural approach. This model further radicalize many western-type higher education institutions from traditional 'ivory towers' of knowledge to orchestrators of innovation ecosystems, thus creating an internal value chain system adopted by its European predecessors as well.

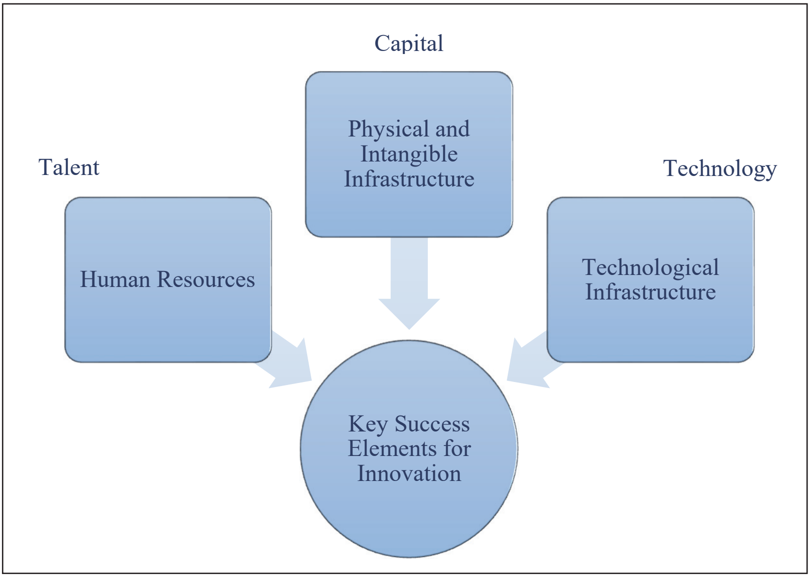

Figure 3. *The Value-Chain System of Human-Centric Innovation Ecosystem in Generating the Key Success Elements for Innovation*
Source: Developed by the Author

For human-centric innovation ecosystem, Figure 3 demonstrates how this internal value chain system of research (German), practical (French) and liberal education (Anglo-Saxon) creates an external value chain system of talent, capital and technology for the continuous development of the human capital for human-centric innovation ecosystems. The Anglo-American model radicalized higher education towards a structured approach to teaching, learning shorter study completion periods through a massified, merit system. This system lessens the inertial effect practiced by European-styled education systems (Buchori and Malik 2004), as it stratifies the merit levels higher education according economic returns in career. Meritocracy guarantees quality innovation ecosystems as 'merited' higher education motivates human capital to pursue innovation leading to knowledge-based economy. Conceptually for EU Member States, modern stratification of innovation according to the historical models of higher education ascribes each State according to the Figure below.

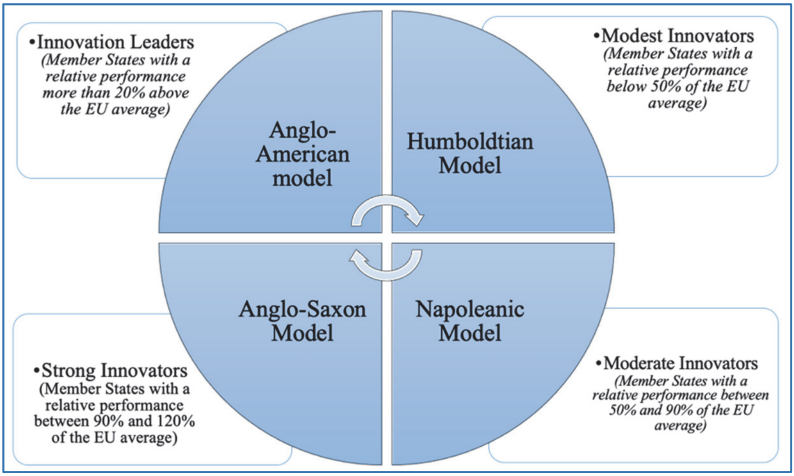

Figure 4. *Understanding National Innovation within the context of Higher Education Models. Source: Created by the Author according to the EU Regional Scoreboard, 2018*

As illustrated, the priorities and policies of the higher education sector depends on the environment on which they derive. Indicators that measure the impacts of these differences predominantly relies qualitatively on the inputs, outputs and outcomes of activities. These contextualize a more meaningful understanding of how higher education systems are organized and governed as well as the relevance of attaining higher education qualification. With the inclusion of a vast diversity of institutions, actors and stakeholders, the higher education sector have evolved into complex systems of relationships and interconnectedness existing at the institutional, national, regional and international levels (OECD, 2017; Jongbloed, Enders and Salerno, 2008). For the last few decades, several factors influenced its structure, qualifications classification schemes, governance and programs that ensure transparency throughout the system. Hence, significant efforts to evaluate and manage the intellectual of the human capital becomes crucial for quality innovation ecosystems upon the completion of each qualification level (bachelor, master or doctoral qualification levels). Applying the New Public Governance theory, modern European HEIs have evolved implicitly into a mix of public service and partly new public administration. As public service defines a function or a combination of functions closely inter-relation to the end-user, HEIs are public service institutions consisting of functions regulated by legislation, socio-economic values, culture and other coercive elements (Pfiffner, 2004; Osbourne 2007). Therefore, the theoretical features of these services and service system in reference to HEIs are applicable to analyze the premise of its governance. Concerning the end-users of HEIs public services, which may be students, the State or even the knowledge economy, the many 'production' processes involved inevitably leads its governance and public service functions regulated by the relevant education ministries. The process itself is purely multifaceted and heavily influences each administrative arm of HEIs through the embedded service-oriented networks existing. Actors within these networks collaborate to produce new knowledge, skills and innovations abstractedly. Henceforth, NPG influenced-HEIs are mostly research and knowledge driven organizations essentially involved in the development, creation, dissemination and preservation of knowledge. These universities normally make vital contributions to the social and economic development of a country and thus enable growth to be achieved (Iqbal et al., 2019). Researchers state that improved processes and services in higher education lead to activities that generate greater knowledge application and utilization that enhance organizational competitiveness. Moreover, it is the practice of knowledge management which is useful for achieving essential successful change implementation and organizational goals (Imran et al., 2017; Al-Kurdi et al., 2018; Iqbal et al., 2019) in organizations have now been applied to the higher education to address the existing gaps that affect the system (Iqbal et al., 2019). Hence, NPG redefines the tasks and responsibilities of HEIs as critical actors in national innovation systems that contribute to the Europe of Knowledge (OEU, 2006; Pedro et al. 2019). From this stance, HEIs contribute to two fundamental differentiated economies the knowledge economy and the commercial economy. The knowledge economy is essentially more reliance on information access that generates facts and intellectual skills for the productive advancement of economic activities of private and public organizations. Equally, the commercial economy are aspects of an economy tied to the exchange of goods, services, and labor activities having a set monetary value. Within this scope, given the significance of these two economies, the dissertation results will contribute to the existing body of research the social and economic value of the framework of human-centric innovation ecosystems to the knowledge and commercial economies.

Taking into context the Lisbon Strategy, EU HEIs tasked with fulfilling the promotion of human capital integral for the betterment of the EU, continuously forge and ensure that economic and social advancement result through cooperation activities (European Commission, 2006; Laredo, 2007; Secundo et al 2017; Pedro et al. 2019). Though neo-institutional theorists have acknowledge that higher education systems, have changed according trends associated with funding, (Berghaeuser and Hoelscher, 2020) universities as organizations have created institutional structures that reflect rules legitimacy through the mission statements created. These formulated mission statements, though limited to the economic impact and technological transfer and less emphasis on the civic engagement embedded locally, incorporate into the regional framework (Berghaeuser and Hoelscher, 2020). Secundo et al., (2017) further iterates the divergent and changing demands of society has made the third mission of HEIs to transform from bureaucratically administrative, to strategically focus. This gradual shift stems from the increased demand of utilizing university graduates' intellectual capital to counter and address the economic and social stagnation persisting in the EU region (Pedro et al, 2019). The very hybrid nature of New Public Management (NPM), which consists of New Public Administration and New Public Policy, is one acknowledging commercialization aspects of innovation, which is a hybrid of the absorptive-capacity model and the intellectual capital model (Secundo et al., 2017; Pedro et al., 2019). Lifelong learning as part of the third mission of the higher education institutions through knowledge dissemination and social engagement (Secundo, et. al, 2017) promulgates EU regional knowledge-based innovation ecosystems through the qualified human capital. In a similar manner, Lithuanian national higher education policy could prospectively influence how human-centric innovation ecosystems are developed. As the government formulates the mandates of the higher education policy and implements them into higher education institutions, mandated policies cannot instantly create innovation in classrooms. Rather it channels the case for the creation of innovation ecosystems that are more human-centric rather than those that technologically and capitally based on innovation activities. From this stance, mandated higher education policy can be the platform for advocating resources that stimulate a climate that permits more innovation rather than compliance to policy. Whilst the third mission of universities is often most reduced at the regional level since it is correlated to economic development activities made commercial through knowledge transfer and related to cooperation and partnership activities within local industries (Markman et al. 2005; Shattock 2005; Berghaeuser and Hoelscher, 2020), bilaterally it is a mutually beneficial system (Bozeman 2000; Koschatzky 2002; Kersting 2013). As an extension, knowledge and technological transfer may involve formal and informal transactional activities where informal knowledge and technology transfer pertains to non-institutionalized base personnel exchange. Usually this entails "problem-solving, conference, personal activities or those that take place with a community be it academic or commercial-based communities" (Bercovitz and Feldman 2006; Abreu and Grinevich 2013; Moore et al. 2009; Glaser et al. 2014; Brown 2016). As further education necessitates lifelong learning, advanced scientific training that knowledge-based scientific work attributes knowledge development, though informal is not entirely limited to a precise timeline after formal education. Hanft and Brinkmann (2013) states that it is more reliant on a networked-based education system. Consequently, the neo-institutional perspective for human-centric innovation ecosystems deriving through the formal higher education systems encompasses of a hybrid network system. This system consists of formal advanced degree study programs, and informal short-term professional certificate courses or educational offers through lifelong learning.

New institutionalism (NI) theory perceives higher education institutions emanating from organizationally, conventional environments, subjugated to policies that govern its criteria and standards (Scott, 1987; Oliver 1997; Gornitzka, 1999; Jongbloed et al, 2013). As certain institutional environments set according to the implemented type of policies inclined by either legislation or legitimization approach, their organizational adaptability is dependent on the adoption of certain norms or principles into their environmental context. This defines whether they are primarily resource resilient or resource dependent, according to the Resource Dependency Theory (RDT) (Jongbloed et al, 2013). Therefore, higher education institutions, *as organizations*, and human-centric innovation ecosystems *as resources* change through the interaction with government policies set as the impetus for the development of these innovation ecosystems. This approach thus centers on the premise that public policy initiatives acts and serves as tools, assuming that a linear relationship exists. This further act as inputs into the organizational change processes for higher education institutions to be the catalyst for the emergence of human-centric innovation ecosystems at the institutional level. Consequently, higher education institutions emanate from a model derived on influence and countervailing power, contends Jongbloed et al (2013). The power and influence of the external stakeholders of higher education systems, as organizations garners that there is greater capacity for institutional choice rather than complying with the external demands of policy or programs.

The environmental context of higher education institutions, are process-enacted. Jongbloed et al (2013) argues that depending on this environment, higher educational institutions usually align according to how its perception become the critical factors delineating it. Moreover, as organizations perceived as the production sites for the highly innovative human capital, higher educational institutions continually face competing, characteristically inconsistent governing policies demands. In order to understand how HEIs react and interact within their environment influenced by these policies, RDT states that understanding its intra-organizational factors is key. This clarifies why HEIs selectively choose or enact environments that favor their position. From these perspectives, the autonomy of HEIs, as emphasized through the RDT and NI theoretical approach would be key in understanding (Jongbloed et al, 2013) which peripheral environmental inclines the development of human-centric innovation ecosystems. Conceptually for Lithuania, whether the prevailing environment of innovation controls or detracts interdependency of resources, institutions, internal leadership processes, power distribution (Jongbloed et al, 2013) to potentially aid human-centric innovation ecosystems development is peripherally dependent.

Therefore, as the government determines this environment conducive to this adaptation, total congruence results (March and Olsen, 1984) where HEIs transforms into institutions (Brunsson and Olsen, 1997; Thoenig, 2011) that develop quality human-centric innovation ecosystems. As higher education institutions should provide a 'prescription for success to the human capital' rather defining the outputs of the skills and competencies attained (Thoenig, 2011) governmental policies inherently influencing its environment should enable fulfilment of its third mission. Though NI prostrates that it is precariously dangerous for governments to reform and control the higher education system through policies to guide their operations and purpose in society, there are trade-offs for resolving the problems and uncertainties that these institutions faced. This theoretically affects the development of the human capital required to drive human-centric innovation ecosystems in the long-term as important dimensions such as organizational decision processes, priorities, and the mobilization of information, support and opportunities take precedence. In addition, though the power issues and tactics from the government influence how policy adoption in HEIs, achieving uniform stability enables a greater chance of innovation ecosystem development. Brunsson and Olsen (1993) further states that higher education institutions as public sector organizations are not '*innovation-adverse*', as there is a tendency for them to replicate and adapt quickly to labor market dynamics or other radical changes that threaten their survival. Moreover, according to NI, policy reforms culturally sensitized to the local context is questionable in terms of their effectiveness and legitimate claims for success (Brunsson and Olsen, 1993; Thoenig, 2011) particularly when applied to innovation ecosystem development.

Finally, the civic or social engagement aspect of these ecosystems from a NI perspective will comprise of a multilateral environment that is beneficial for the State, higher education institutions, students and the greater civil society where all actors positioned as competent partners of society cooperate through strengthened partnerships with other civil organizations in society. In retrospect, for human-centric innovation ecosystems development, the legitimacy of universities further strengthens. Through enhance social visibility and *'social commitment'* forged from educating and research from all actors of the ecosystem, the attractiveness of HEIs increases to students. Greater possibilities to apply academic knowledge, experience and qualifications gained directly to civil society enables their personal development simultaneously (Berghaeuser and Hoelscher, 2020) and justifies theoretically that the framework of the higher education policy is feasible for the development of human-centric innovation ecosystems. However, the empirical research will explore further, how feasibly higher education policy advances human-centric innovation ecosystem development

1.2. Peculiarities of Innovation Ecosystems Related to the Higher Education System

1.2.1. Innovation and Higher Education: Higher Education Institutions as Production Sites for Innovation Ecosystems

The link between the higher education system and innovation are two-fold. Through the production of human capital and being the source of intellectual capital. In focusing on the aspect of the production of human capital for innovation, this perspective assumes that higher education linearly contributes to continuous innovation (Schulte, 2019). According to Schulte (2019), innovative capacity is highly depended on educated human resources (Lundvall, 2008; Schulte, 2019). National innovation ecosystems link to the higher education sector either through the shared use of physical or technological infrastructure, or through the human resources. Research supporting the higher education sector's contribution to the development of innovation educational hubs, knowledge-intensive industries as well as science and technology parks is evident and directly affects the innovation capacities of countries. For Lithuania, empirical linking higher education attainment and innovation-actioned activities (Baležentis and Balkienė, 2011) states that direct contribution is low. Thus, traditional methods of examinations as an evaluation instrument to assess students' innovative potential still inhibits students' problems solving skills and fosters the 'teaching to test' approach learning method (Jucevičius, 2004; Schulte, 2019). As examinations, assessment continue to be the 'acceptable' method of evaluating the right 'kind' of human resources for human-centric innovation ecosystems creativity, non-academic soft skills are just as relevant for these networks. In other countries, for example Japan, Mexico and Finland that exercise comparative evaluation method systems, research suggests a prevalence in that mode of teaching and learning that hinders the development of curiousness prevails in those educations systems. This further hinders the skills of the human resources which impairs ecosystem development. In comparison, other studies on Japanese and Korean HEIs, high interest and curiosity in science subjects often leads to high academic and test performance levels leading to quality ecosystems development. As full engagement and motivation are other skills required for innovation, learning and teaching activities in HEIs should be structured in order to nurture the development of these other skills.

Research scientists have further queried which teaching practices in HEIs could potentially foster competence in scientific knowledge and maintain student's engagement and curiosity to innovate. Here the importance of linking the subjects taught in universities simulated as real-world applications becomes crucial. In addressing this, Kärkkäinen and Vincent-Lancrin (2013) states four different types of scientific pedagogy related students' attitudes and performance to innovation. Investigating, applying, interacting and having hands-on experience which revealed a high positive association, interest and enjoyment of science leading to innovation. Moreover, students' interest in the sciences extend beyond standardized tests and examinations. Rather more correlated to the subject theory taught. Motivation fostered alongside improvement of subject knowledge and the use of on-site technology in the classroom is another approach for enhancing collaboration, engagement and creative skills amongst students as well. Kärkkäinen and Vincent-Lancrin (2013) states that technology-enhanced teaching models such as online laboratories or educational gaming practical learning methods used in STEM education could widen and increase learning prospects available to students. Technology, whether interactive learning tools such as whiteboards, computer tablets or disciplined-based drawing software should be viewed as appropriate learning and teaching aid rather than a substitute to traditional classroom teaching. For mathematical education, researchers state that more priority given to teaching methods that enable students with useful, fruitful long-lasting skills rather than abilities to successfully memorize and pass tests that enables an innovative society (The Global Innovation Index, 2014). In comparison to the common traditionally used approach such as memorization, rote-learning and teaching students' subjects unrelated to the innovative society, a metacognitive teaching model would enable conscious thinking and the foundation to problem solving skills. Experimental studies verifies that metacognitive mathematics teaching can substantially aid towards improving test performance outcomes in mathematics, in addition to fostering reasoning and motivation skills that contributes to innovation.

In ensuring that there are ample number of skilled graduates trained in certain key disciplines, some HEIs have undertaken the responsibility of addressing the growing concern of increased labor market shortages in the STEM and IT areas. Reichert

(2019), states that several universities in Poland, Amsterdam, Czech Republic, Finland, Portugal, the United Kingdom, have tackled the problem through the increasing and allocating of more resources to attract from the regional talent pool more students into STEM- and IT-related subjects. The University of Warsaw (Poland), have introduced the "Humanities in New Technologies" six-month program, that offers additional courses to humanities study curricula for students that desire further training in programming, productivity tools science and new technologies. This program ensures skills directly relevant to the humanities field are further honed and developed in students through the ready-to-deployed solutions they have generated from the actual problem exercises and projects students undertake during the program. The Physics department at that same university have introduced more practically based experiments at kindergartens, research, rural and community workshops as way of contributing or giving back to society. In the Czech Republic, through the Masaryk University's industry-relevant STEM subjects, talented motivated graduates successfully recruit into the regional IT sector easily. For that particular university, while the shift has been on decreasing the gender gap in technical related fields such as the IT sector, it is one of the net importers of talent for all study cycles including the PhD level (Reichert, 2019). These examples from Czech Republic and Poland are the conceptual framework of human-centric innovation ecosystems practically applied through the close-knit university-industry-societal cooperative network.

Taking in consideration the depth of competencies used in innovation, other approach for fostering innovative skills should extend beyond the scope of mathematics and science. Exploring the creativity competency within the arts education program at HEIs and its link to innovation, researchers agree that students more likely to contribute to service or product innovation in this field. Winner et al. (2013) have outlined that arts education study program at universities foster innovation skills. Visual-spatial and verbal skills are key skills for innovation. Enhanced verbal competences through arts education, fields similarly like mathematics or science-based activities are essential as well. Intelligence Quotient (IQ) through individualized music lessons according to Winner et al. (2013) contributes to geometrical reasoning. Visual-spatial and observational skills linked to other performing arts-based education potentially develops emotional regulation, perception and empathy, key skills necessary innovation. Collectively, these form the key important aspects of effective communication for innovation. Evidence that supports soft skills developed are crucial for innovation directly links arts program education to creativity. Moreover, other ethnographic studies uncovered a correlation between technical artistic skills, creativity, critical thinking and persistence to visual arts teaching. As these teaching methods are usually individualized, project-based approach to learning, they potentially nurture the skills requisite for innovation. At the organizational level, innovation management tools such as for example 'idea management', 'brainstorming' or 'portfolio management' contributes as well. As actors of innovation ecosystems organizations benefit from these tools that assist in triggering the creativity of employees for continuous development through education. Viewed as the evolutionary integration of technology at the organizational context, these innovation processes operate on a push and pull basis (Tidd and Bessant 2009). When combined these factors result in a measurable process that fosters greater knowledge exchange and absorption in organizations cooperating directly with universities (Prajogo and Ahmed, 2006). This validates the importance of technical-oriented learning at universities as it also aids in visualization process during the problem-solving stage in innovation ecosystems.

Technical-oriented learning synergistically improves the teaching curriculum of universities while training students how to develop the traits necessary for innovation in real case settings. When operated in an environment that present opportunities to develop experience and training as the prerequisites for innovation, students will appreciate the value of higher education more. Students will then view higher education as requisite for developing the skills and mind-set to excel as innovators. Enabled through the connections formed through academia (university), industry (business) and social (environmental) this forges and develop innovation ecosystems that are purely human-centric. These innovation ecosystems like other traditional ecosystems thrive organically from the co-creation process through dual interaction between industry, technology and education. Applied research results generates solutions that creates, and tests prototypes developed while utilizing the expertise and knowledge offered through the higher education system. Through this, students will directly develop several important traits necessary for human centric innovation ecosystems:

- Social responsibility;
- Leadership skills ;
- Motivation;
- Empowerment;
- Willingness and initiative;
- An innovative psychological mind-set;
- Proactively create innovation.

These ecosystems could essentially garner greater importance for advancing and countering economic stagnation. They also stand to promote continuous betterment of societies through the readily transferable skills potentially attained by talent through the higher education sector. National policy reforms to the delivery of teaching are one of the solution for unlocking innovation through universities. The main view is aligning the learning curriculum towards a student-centric approach. As evidenced by Reichert (2019), several EU-based universities have substantiated that reforms to the higher education system systematically links realistically the university's role in innovation. While some reforms introduced a system of added entrepreneurial programs to the existing curriculum through project-based initiatives, the main objective is fostering the entrepreneurial mind-set in students for solving industry future problems. The University of Warsaw have already successfully stimulated the needed awareness in students of the economic demand for innovation as well as the critical-thinking skills through their very own "Humanities in New Technologies". National policy reforms has also effected higher education institutions such as Eindhoven University of

Technology (TU/e) in Amsterdam to adopt a comprehensive approach in developing the engineer of the future. The University in acknowledging the paradigmatic shift to the cultural perceptions of values in students and academia have embraced that future engineers should be trained differently using newer, more relevant methods than those utilized before. This contemporary approach is the human-centered, student-centric approach to higher education training. At the initial start of higher education studies, students are eager to make a great impact on society and contribute to its economic development through the higher education attained. Hence, laboratories for conducting research, testing activities and challenge projects that incorporate all the stakeholders in higher education and innovation should be embedded into the curricula studies. At TU/e it was observed after implementing the approach of the 'active learner', successful students-based projects with industry stakeholders were linked to recent reforms made to the higher education sector. This teaching methodology ensures actual problem-based learning connected to the current engineering industry, assessment of students' competence, relevance of the study curricula to industry and the development of innovation-related skills through industry exposure was beneficial for all the stakeholders involved. Moreover, continuous student mentorship through training could potentially ensure that a close interaction with external knowledge creation generated through industry links, prevent skills stagnation and disconnect for students in the higher education system. Additionally, learning across study disciplines aids students to optimize their skills developed in connecting with actual, problematic scenarios within a multidisciplinary context, a caricature of real society. However these requisite changes in current incentive systems, necessitates the re-orientation of higher education models and their governance.

As innovation is important for driving economic growth in Lithuania it is necessary to outline the parameters that influence innovation behavior in a country. Institutions, academia, the industrial sector and the government all affect and impact innovation, however factors such as funding, incubation of innovative ideas, infrastructure, mentoring and support for innovation, financing, markets and organizations is necessary for the development of innovation ecosystems, the human factor remains central to innovation. While qualifications-based innovation ecosystems viewed as the solution for countering economic stagnation and fostering sustainable growth in highly competitive markets many scholars, attempt to understand the underlying factors influencing it. Key actors including governments, commercial industries, and academia as well as other factors such as financing, technological support and infrastructure, research and market demand are important to drive any innovation ecosystem. However, the human factor that remain the essential creator and purpose for innovation. It therefore means that in order to foster human-centric innovation ecosystems there should be greater utilization of the human factor in Lithuania. When the human factor is educated and trained well through a higher education policy that is more cognizant and aligned towards the needs and requisites of the industrial and manufacturing sector, then innovation will follow. Lithuania's modest population of approximately 2.7 million posits it to many unparalleled possibilities to drive effectively innovations that generate realistically to the knowledge economy (OECD, 2019; Eurostat, 2019). However, at the EU regional level, there is evidence from other highly Member States' socio-economic, industry, academia and sectorial environmental factors potentially permit student-centric type higher education necessary for human-centric innovation ecosystems development. As evidence through the reforms that lead to a revised curriculum for academic and vocational education, these higher education institutions fundamentally contributed to talent development aligned to qualifications-based innovation ecosystems developed through student-centered higher education. Using Lithuania, the research seeks to identify the infrastructure already in place in the higher education system that enhances the knowledge of population in various technological and non-technological fields of study. It is also fundamental to identify the basic, advanced teaching, as well research and development facilities that helps form the talented human capital. The general perception referenced from the previous examples is that Lithuanian higher education institutions could engage the local and foreign talented human capital to form human-centric innovation ecosystem to pursue innovation through the same standard commonly used incentives. In addition, with the unlimited evidence supporting higher education attainment as the remedy for generating greater economic activities and wealth, the extent to which Lithuania's large stock of qualified highly educated human capital directly link to quality innovation uncovers the correlation depth of human-centric innovation ecosystems.

1.2.2. Socio-Economic, Industrial Sectorial Environmental Features of Start-ups, Scale-ups and Entrepreneurships related to Qualification-based Human-centric Innovation Ecosystems

For the last several years, the entrepreneurial higher education approach was set as an alternative model for continuous development of regional entrepreneurial ecosystems through the national economies of the EU. Through education, enterprise and entrepreneurship related activities (Bikse, Lusena-Ezera and Rivza, 2016), higher education institutions that adopt the entrepreneurial model could readily ingrain the entrepreneurship mindset by the nature and aspects of operations, structure, mission and organizational style. The omnipresence of this entrepreneurship culture formidably demonstrating the entrepreneurship mind-set, entrepreneurial ecosystems would result as catalysts stimulating venture creation. As entrepreneurial education directly relates to the entrepreneurship related skills aiding students to create and identify entrepreneurial opportunities through education, the human capital from entrepreneurial universities would hypothetically flourish in favorable socio-economic environments, having harmonious relations between industry, academia and sector. Though the EU continuously advocates entrepreneurship education, as the remedy for fostering continuous innovation through start-ups, scale-ups, and entrepreneurial enterprises, uncertainty surrounding its links to the qualified human capital willingness to start these entities is evident. Entrepreneurship by definition relates to the creation of enterprises aimed at making a profit through risking-taking ventures, and the entrepreneur is the human factor that creates entrepreneurship initiative and enjoys most of the profits created. Entrepreneurial ecosystems would then encompass entrepreneurs (actors), resources such as capital, technology and networks that promulgate and generate funding for survival of the ecosystem. Though these ecosystems ideally could counter economic stagnation for many economies through job creation, entrepreneurship should not be treated as the 'side effects' of good higher education qualifications of the innovative human capital. Rather, having a higher education model that is human-centric would likely lead to human-centric innovation ecosystems appropriate for innovation, as innovation is human-centric by nature. The conventional approach to ecosystems formation is that these networks appear formally or informally and according to nomenclature ascribed and operates as such. Human-centric innovation ecosystems in comparison to entrepreneurial ecosystems and other ecosystems are not 'description-based' rather its novelty derives on the 'nurtured' approach to the human factor through a formal qualifications systems offered through higher education institutions. Higher education predominantly exists as the final phase of lifelong education and thus contributes conclusively the innovative attributes of the human factor perceived ideal for quality innovation. Hence, higher education coupled with the surrounding environment secondarily permits these ecosystems to evolve according to the identified economic need as they are not 'restricted' in a nomenclature sense, like other traditional ecosystems. Human-centric innovation ecosystems can evolve even further into business, innovation, entrepreneurial, and knowledge-based ecosystems as all these ecosystems will share one similar feature: the human factor trained for innovation. Human-centric innovation ecosystems through its very nature potentially eliminates the gaps existing in skills mismatch, promotes higher education relevance in society, increase its attractiveness, enables a realistic approach to innovation in addition making it commonplace in society through the competencies instilled to the human capital. Comparatively, business, entrepreneurial, and innovation ecosystems similarly share the economic feature purpose and usually do not require the human factor in these ecosystems to be formally, trained qualified human capital. Knowledge-based and innovation ecosystems similarly share the intellectual capital attribute of the human capital intangibly and through a linear relationship contribute to quality innovation useful for the commercial and knowledge economies. Referring to the desired competencies of the human capital, as proposed by Alva (2019) at the organizational level these ecosystems encompass one or more attributes of the RBV, KBV, DCV and the CV (Mahoney and Kor, 2015; Teece et al., 1997; Penrose, 1959; Al-Alawi et al., 2007) however human-centric innovation ecosystems encompass all attributes and effectively links multilaterally them to academia, industry and economy.

Higher education institutions should instill these competencies and according to Reichert (2019) are fundamental for the development of EU regional innovation ecosystems. The Table below summarizes the aptitudes and proficiencies necessary for the these ecosystems:

***Table 3.** Recommended Competences for Optimizing Innovation Potential*

<table>
<tr><th colspan="2">Aptitudes and Proficiencies</th><th>Institutional Conditions</th><th>Framework Conditions</th></tr>
<tr><td rowspan="6">Qualitative</td><td>Prepare for disruptive innovation</td><td rowspan="10"><u>Teaching reforms:</u>
• Extend interdisciplinary, project-based learning
• Support student self-organization
• Improve teaching innovation services
• Extend mentoring, including by external stakeholders
• Provide entrepreneurial modules, as extra offer or integrated into curriculum.
• Develop digital skills modules
• Encourage and support start-up
<u>Outreach:</u>
• Working with schools to promote STEM (for instance targeting girls), entrepreneurial mind-set, and digital skills
• Working with schools to update and develop teaching skills
• Extending continuing professional development offer and acting as contact points for easy access of businesses to universities</td><td rowspan="10"><u>Regulatory:</u>
Sufficient academic autonomy of universities for introducing new study programs and design their content
Sufficient academic autonomy of universities for the selection of students to study programs
<u>Financial:</u>
Sustainable funding for low student/ staff-ratios to allow for project-based learning, orientation in diverse learning paths, and mentoring
<u>Regulatory:</u>
Sufficient financial autonomy of universities to fund continuing professional development through alternative funding streams, including fees
<u>Financial:</u>
Provide enough resources for staff time to invest in support for schools
Provide financial incentives for continuing professional development in areas of high innovation need</td></tr>
<tr><td>Promote systemic understanding and competences</td></tr>
<tr><td>Extend students research-related competences</td></tr>
<tr><td>Foster entrepreneurial mind-set and skills</td></tr>
<tr><td>Promote digital skills</td></tr>
<tr><td>Create game-changers</td></tr>
<tr><td rowspan="4">Quantitative</td><td>Extend the skills base for the region or country</td></tr>
<tr><td>Re-skill and up-skill in response to innovation needs</td></tr>
<tr><td>Increase engagement in the STEM area, particularly regarding digital know-how</td></tr>
<tr><td>Develop continuing professional development for employers, helping their adaptability</td></tr>
</table>

Source: Created by the Author according to Reichert, 2019

Through quality education the main conditions, as stated by Reichert (2019), the development of the competencies necessary to drive the innovation potential in young adults and graduates must take into context whether current and future societal needs can be solved with the skillset, aptitude and training potentially offered through the higher education system. Many academic leaders and innovators agree that an integrative, multidisciplinary approach or "specialization" or "project-based learning can be the way forward to link methodically based, technological subject fields, practically (Reichert, 2019). Evidence of the success of this approach as applied by other EU tertiary institutions, are demonstrated by the Technical University in Munich (TUM), Germany, where the combined approach of 'mixing' social-sciences and humanities-based subjects into deeply dense technically- or technologically-based curricula is foreseen potentially to attract brilliant and motivated students. The University of Sorbonne (Paris) and Masaryk University (Czech Republic) have attested that this method has garnered more enrolment of the best prospective students (Reichert, 2019).

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As evidenced by the European Commission's innovation strategy in 2006 and its flagship initiative in 2010, innovation performance is essential for boosting productivity growth, competitiveness, and addressing societal challenges within the EU. The existing divergence in innovation outputs between each Member State country and their respective national economies affects the European innovation ecosystem as a whole, regionally. As a result, a number of EU countries have adopted and implemented reforms to make their teaching activities relevant to the changing labor market demand. On example is Finland, which have implemented new national guidelines for the provision of entrepreneurship education. Aalto University (AU) is a university that have taken the leadership role its local innovation ecosystem, with a bottom up approach to entrepreneurial activities adopted by its faculty and students while maintaining strategic links with the other actors of AU's innovation ecosystem. Aalto university as an example of an entrepreneurial university have attributed its success factors for the development of it place-based Espoo innovation ecosystem to the high concentration of the highly skilled human capital, research infrastructure, vision to innovate, regional collaborative cultural ties established between the Helsinki-Uusimaa Regional Council and Espoo City through consistent commitment. Moreover, the fact that AU has emerged as such a strong coordinating actor in that innovation ecosystem has stimulated a great synergy with the other actors through the shared strategic vision, leadership, university management inter-disciplinary intellectual as well as a strong focus on the people potential capabilities to influence changes in policies and programs. This ecosystem receives strong financial support from the central government, the innovation agency and private enterprises, as well as serial entrepreneurs that collaborate and aid in sustaining the synergy through providing mentorship and funding to further start-up activities.

The desire to innovate is an attribute shared by all actors in an innovation ecosystem. While some are active innovators due to the very nature of their role and responsibilities, an innovative attitude instilled to students at the beginning of studies diminishes it as a novelty but rather essential for professional success. At leading universities such as the Eindhoven University of Technology (Netherlands), Aalto University (Finland) and Munich University of Technology (Germany), the importance of this attribute enabled a stronger applied research and knowledge-transfer base. The traditional credentialing system of higher education affords it recipients as more qualified than other individuals. Yet many employers have outlined, particularly in today's digital technological age a set of 'desired' behavioral attributes and competencies that the talented human capital should possess in the workplace environment. Hence, a diversified higher education system directly linked to a credentialed-based human-centered type of learning training will be central to the proposed human-centric innovation ecosystem model. Some include online learning platforms, self-teaching, MOOCS and the empowered learner method forming the new paradigm in tertiary level education and training ecosystem that differs from qualifications credentials traditionally awarded by higher education institutions (Rainie and Anderson, 2017; World Economic Forum, 2016; OECD, 2017). Moreover, future job functions that are human-centered performed in conjunction to a blended networked system of education and training applicable to industrial sector needs. This approach ensures the importance lifelong learning in the digital era to all ecosystem stakeholders instilled through all aspects of their career. More importantly, social and emotional intelligence will take credence along with creativity and critical thinking skills and mentoring through all the stages of education processes by all stakeholders involved in the ecosystem.

1.2.3. Human-Centric Innovation Ecosystems and Smart Specialization

Numerous research supports that the future of work rests on the highly educated human capital possessing novel skills for smart specialization. Smart specialization, as a feature of human-centric innovation ecosystems, supports policy and market-based resolutions predicted for the future of work and employment of the human resources. While non-qualifications-based innovation linked to the entrepreneurial, business and innovation ecosystems is poised as the alternative to the lifelong learning model, smart specialization preserves higher education relevance to quality innovation ecosystems, when the human-centric approach is utilized. Institutionally, HEIs contribute abundantly to smart specialization through human capital and talent developed, then secondly through research and technology. For innovation, HEIs also contribute to ecosystems formed from smart specialization hubs through three key ways: innovation activities, research and education. Though smart specialization through formal higher education and training is presumably linear to entrepreneurship leading to innovation, within the scope of the EU, HEIs still account for more than seventy percent of innovations directly developed in H2020 projects. As such, many leading EU higher education institutions in stressing the importance of smart specialization have adopted a diversified approach for equipping the human resources with the desired skills set. While the plethora of online learning platforms, self-teaching and empowered learning methods could imminently reorient how smart specialization is imparted to the human resources, human-centric innovation ecosystems ensures that the higher education niche to smart specialization is preserved. Therefore, stakeholders of the higher education sector would be more inclined to provide the specialized skills for human resources relevant to their career as well. As the evolutionary nature of ecosystems is purely cyclic and determined by it performance four factors Birth, Expansion, Leadership and Self-Renewal measuring it performance according to strategic coordination as enablers of innovation through smart specialization.

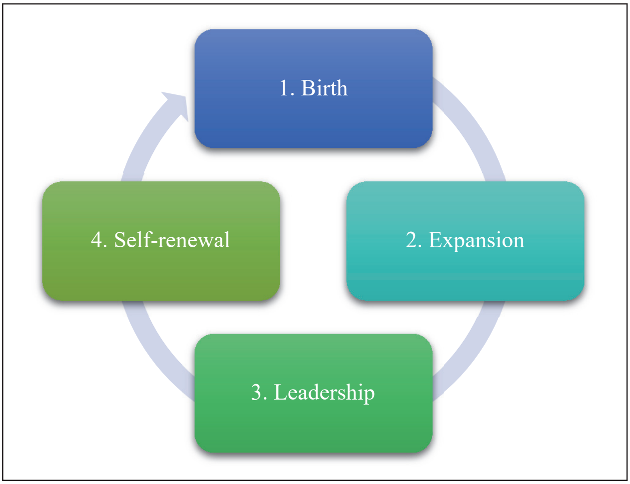


Figure 5. *Evolutionary Cycle of Innovation Ecosystems*

Source: Created by the Author according to Moore, 1993; Mitleton-Kelly, 2003; Iansiti and Levien, 2004; Adner, 2006; Yu-Shan Su, Y. et al., 2018.

In exploring smart specialization linked to human-centric innovation ecosystems, more understanding on how knowledge transfer (KT) from higher education institutions creates greater opportunities for the knowledge economy and commercialization to occur (Miller et al., 2016). In this respect KT, Miller et al. (2016) propose the absorptive capacity-based concept model since it portrays a multidimensional process existing between universities and its integral stakeholders. The human centric factors, being primarily identified for facilitating stakeholder engagement in KT is emphasized in the effectiveness through acquisition, adaptation, conversion and utilization of knowledge. Recent studies focused on the changing role of the university to include 'internalizing knowledge' through the addition of a fourth helix to the Triple Helix ecosystem. The Quadruple Helix ecosystem which is linked to smart specialization knowledge transference is affected by the rate it is developed and fostered through higher education institutions (inertial learning). Moreover, research supporting utilization of the Quadruple Helix ecosystem by HEIs for smart specialization emphasize the relevance of knowledge transference to connect the linear stages between acquisition, assimilation, transformation and exploitation as highly interactive processes (Miller et al., 2016).

Within the context of innovation, knowledge transfer using the absorptive capacity model does not entirely achieve it commercialization stage as it is a 'continuous learning process' where prior knowledge developed is utilized for future innovation activities (Miller et al., 2016). This loop is a cyclic activity in the second stage of the knowledge transfer process. As a common feature in smart specialization hubs, knowledge validation a latent factor characteristically human-centric, is embedded in the network, power relationships and entities. In depicting the networking capabilities of stakeholders which influence knowledge transference (Miller et al., 2016), a fluid mix of competencies and experiences forms the new knowledge assessment framework shaping how knowledge is process into innovation (Flores, Pereira and Graça 2017). In this context when the theory of complex responsive processes is applied, knowledge as a communicative process is perceived as a crucial asset for organizations oriented on smart specialization. Furthermore, a knowledge-based culture in HEIs is important for introducing a merit and recognition system linked to smart specialization.

Knowledge acquisition (KA) as a process or activity required for the generation of new ideas, knowledge and skills is termed 'accumulated knowledge' and is measured in the extent to which organizations create, attain, disseminate and utilize this knowledge (Choo, 2003; Holsapple and Singh, 2001; Tiwana, 1999; Iqbal et al., 2019). On the other hand, knowledge sharing is crucial for smart specialization of the human capital as it involves exchange or diffusion of learning, knowledge, skills and experience according to the context (Gharakhani and Mousakhani, 2012). Knowledge sharing (KS) as a mechanism that facilitates dissemination of knowledge between institutions (Yang et al., 2005) serves greater importance in HEIs in promoting research collaboration among the stakeholders of smart specialization (Tan and Md Noor, 2013). Knowledge utilization (KU) is also useful for smart specialization and although termed storage, retrieval, application and donation of knowledge (Gold et al., 2001) it is gainfully exploited for a competitive advantage commercially (Lee et al., 2011). Hence a higher education policy tailored towards human-centric innovation ecosystems has relevance in the smart specialization of the human capital through knowledge transference (teaching), acquisition (learning), utilization (application) and sharing (dissemination). With respect to each, the enormity of developing the human capital as specialists is novel through ecosystems relevant to all stakeholders involved, hence the importance of generating human-centric innovation ecosystems.

As a strategic resource, developing human capital entails linking it all the elements that contributes skills and knowledge generation. In management sciences, a strategy usually results from detailed strategic planning processes and tend to be the general direction set for organizations to follow. Applying it to quality ecosystems through higher education systems, the human capital as a managerial resource should be trained and developed as a functional strategic resource beneficial to all stakeholders of the ecosystem. Thus, the strategic management of these resources will entail understanding of the unique position that talented human capital has in generating a competitive advantage and successful development of the ecosystem's goals (Cox et al 2012). When equipped with other important intangible skills and capabilities as an organizational resource, it enables easier implementation of strategic plans of the ecosystem network crucial for its survival. Thus, the novel of human-centric innovation ecosystems is utilization of the human-centered design model and resources to achieve value creation in the ecosystem framework. Major stakeholders of these networked ecosystems such as the higher education sector and the human factor within, tend to be affected by policy regulations yet through certain human-centered attributes have capability to influence the priorities and objectives through quality ecosystem management. Through strategic planning and management, a flexible process result. This process, which is built on trust and common interest to cooperate to form mutually beneficial partnerships, enables sustained competitive advantage. From the human-centered model, human-capital possessing these attributes are the preferred managerial resources developed from the higher education sector for institutions and organizations. Therefore, strategic planning and management in ecosystems for innovation thus leads to competitive advantage, collaboration, communication and trust leading to significant functional results and longevity of the ecosystem network.

1.3. Comparative Analysis of EU Member States' National Higher Education Policy Impact on Regional Innovation Performance and Outcomes

Higher education purposes, from a human-centric perspective, entails knowledge generation, service to society, promoting inclusiveness, development of skills and intellectual capabilities. Strategic planning and management through policy regulation enables the higher education sector to accomplish this and retain its competitive focus, capitalize on resources, provide accountability and assessments on its administration, operations and external engagement through internal management systems. The scope of policy making in higher education sector involves the planning and management of HEIs at the institutional level as well as internally. Concerning the planning aspect, this reflects the structure of the higher education sector within national systems encompassing the level of direct Government control. For the EU, each Member State will have varying arrangements that take into context, the political influences, historical background as well as the practical realities concerning higher education and its place in society. Nonetheless, the true outcomes reflect the direct relationship between the State and the institutions, particularly in terms of the level of control and autonomy. In addition, granted the significance of higher education in the development of a skilled workforce as well as the impact that higher education institutions' make in advancing societies and economies, there is a responsibility of Governments to regulate the higher education sector, accordingly. At the national level, though the governance systems of higher education of the EU have transitioned from a state controlled to a market-base model, the position of individual Member States have varied over time particularly when scaled to innovation. With advanced, progressive Member States leading in innovation outputs, other Moderate and Modest States are benchmarked at the same evaluation levels to produce the same outcomes, irrespective of the timeline of transitioning into the market economy. As such the market-based approach of massive restructuring of recently acceded Member States have significantly limited the scope of HEIs to plan and manage internally to match external innovation outputs. Restructuring higher education systems in transition, as an extension of strategic planning and management, does not provide a generalize transparent approach to the interpretations of policy leading to regional innovation performance outputs due to the immense diversity of higher education systems across the EU. On the other hand, restructuring has enabled a strategic approach in the planning and management of EU higher education systems during challenges compounded on the higher education sector as it transitions towards the knowledge society that is attributed to the human-centered design. This is therefore, the background and rationale which strategic planning and management in higher education must operate within Government control (policy). An assessment of how the higher education policies of each strategically matches correlation between policy-making and institutional strategic development processes is crucial for the novelty of human-centric innovation ecosystems.

EU Member States national higher education policies affect HEIs. More, particularly with respect to the associative challenges in achieving the objectives of the EU wide Bologna Process through traditional national higher education learning processes. Taking in consideration each Member State's social, cultural, historical backgrounds and national inherent policies, the new institutional (NI) and resource dependency theories (RDT) approach to the Bologna Process have been instrumental in coordinating change in national higher education systems. Through strategically aligning the relevance of the higher education sector to economic growth, this enabled the human-centered design correlated to innovation be legitimized in the teaching curriculum of HEIs to foster the sector's impact on economic growth. Nokkala (2007), Hoffman and Holzhuter (2012) points out that the Lisbon Strategy aim of reforming the EU's higher education system, by directly investing more on developing the human-centric attributes of the human resources through lifelong learning and training. Since then, EU HEIs have adopted more open, effective strategic systems to internal management style and structures inclined to the external human-centric approach to higher education. These factors evaluates HEIs relevance by the quality of the intellectual capabilities of the human factor instilled for human-centric innovation ecosystems. Henceforth, the concept of the '*Europe of knowledge*' where universities are oriented as essential instruments for propelling economic competitiveness to regional innovation ecosystems development. The knowledge economy has fostered a closer inclination to the economistic approach towards higher education, where university–industry led cooperation hypothetically progresses the paradigm of learning and an output based curricula centered on the attributes of the human factor evaluated to its innovation potential (Jucevičius, 2004; Hoffman and Holzhuter, 2012). Within that stream, the higher education sector becomes inclusive and functionally contributes to quality human-centric innovation ecosystems that consists of human resources with desired skills and intellect which normal to higher education. The systematic inductive methods for conducting a theory-building research, such as the grounded theory entails an in-depth inquiry on the position of the education policy of each EU Member State in relation to other factors and contextual challenges that lead to the current and previous innovation rankings. Solution-based educational, training programs and other social initiatives are developed in order to address the socio-economic, political and educational human-centered needs of the region. Therefore, the interpretive analytical approach will go beyond process development of policy and then bridge it to the human resources and institutions involved using the NI and RDT perspectives. Policy analysis entailing the knowledge building framework is requisite in order to interpret each Member State's position or strategy, then strengthened by conducting an empirical case study on one of Member State. This would take the research further from the analysis of policy-building purposes to the strategic planning and management purposes. Human capital is a managerial resource developed by organizational internal and external factors, therefore the approach for the analysis of policy is appropriate. The steps involved for the policy analysis is outlined in the Figure below:

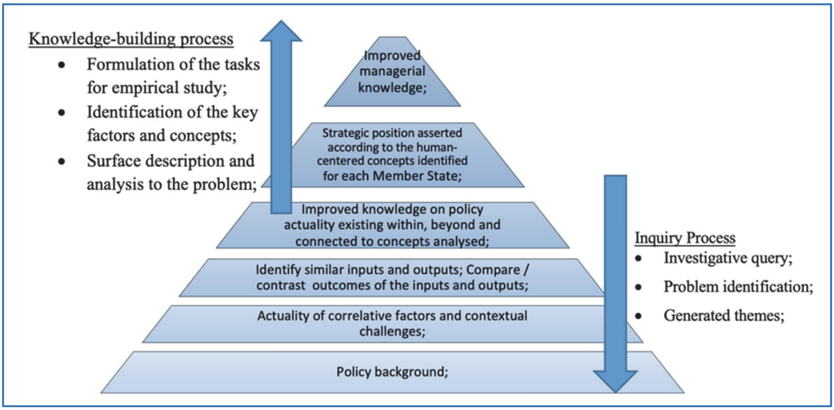


Figure 6. *Structure of knowledge building from analysis of policy documents to strategic development tools.*
Created by the Author according to Richards (2011)

As tertiary level qualifications remains an important requirement for many entry-level occupations and professions, the higher education sector inclusively have expanded to online methods teaching. Though reconfiguration have resulted in addressing these human resources' need the aims, goals, processes and other new approaches to formal education training needs reorientation to counter the skills mismatch (Hoffman and Holzhuter, 2012). The absence of a merit system linked to academic qualification in some EU Member States due to the abundant quantity of qualified human capital have led to re-examination of how the higher education policy fosters knowledge commercialization within the existing parameters of higher education. Without the human-centric approach higher education ecosystems become redundant in providing quality 'specialized highly talented human resources' for innovation.

The European Innovation Scoreboard ranks EU Member States according to national innovation outputs. Table 4 thus assesses, using the NI and RDT perspectives, how each Member States national higher education policy strategizes innovation linked to the attributes of human-centric innovation ecosystems.

Table 4. *Summary of the Theoretical Perspectives on the Institutional and Resource Context of the Innovation Environment of EU Member States*

European Innovation Scoreboard (EIS) Ranking of Member states		**National Higher Education Policy Impact on EU Regional Innovation**	
		Resource Dependency Theory (cultural and structural pillars)	Neo-Institutionalism Theory (environmental pillar)
1) Innovation Leaders	The Netherlands, Sweden, Finland, United Kingdom, Luxembourg	*Key characteristics:* • Policy formation and implementation oriented; • Deeply interconnected and well-concentrated; • Munificence; • Very adherently-led and strongly conventional; • Structured and well-coherent networks; • Highly compliant;	*Key characteristics:* • Action oriented; • Legally sanctioned; • Proactive and responsive; • Supportive relationship among social actors; • Highly interdependent; • Legitimate and continuous survival; • High social obligation; • Low power and influence;
2) Strong Innovators	Austria, Belgium, Ireland, Italy, France, Germany Slovenia	*Key characteristics:* • Policy formation and implementation oriented; • Moderately interconnected and concentrative; • Compliant; • Ambivalence; • Well-established networks; • Non-habitual and strongly conventional;	*Key characteristics:* • Negligibly proactive; • Legally sanctioned; • Compliant; • Moderately interdependent; • Social obligation determined as per the regulatory environment; • Good relations amongst social actors;
3) Moderate Innovators	Croatia, Poland, Cyprus, Portugal, Czech Republic Slovakia, Estonia, Hungary, Spain, Greece, Latvia, Lithuania, Malta	*Key characteristics:* • Policy formation oriented; • Moderately implemented; • Interconnected and well-concentrated; • Partially concentrative; • Partially compliant; • Semi-habitual and conventional;	*Key characteristics:* • Legally sanctioned; • Reactive oriented; • Policy formative; • Moderately implemented; • Relatively social obligated; • Moderate power and influence; • Moderately good relations with low level of fragmentation amongst social actors;

European Innovation Scoreboard (EIS) Ranking of Member states		National Higher Education Policy Impact on EU Regional Innovation	
		Resource Dependency Theory (cultural and structural pillars)	Neo-Institutionalism Theory (environmental pillar)
4) Modest Innovators	Bulgaria, Romania	*Key characteristics:* • Policy formation oriented; • Ambivalent to policy; implementation process • Constrained by external pressures; • Non-compliant and highly absorptive; • Habitual and un-conventional; • Low social compliance;	*Key characteristics:* • Policy formative; • Slow implementation process; • Legally sanctioned; • Low reactance; • Low stability and predictability; • High power and influence; • Low social obligation;

Source: Created by the Author according to DiMaggio and Powell, 1983; Gornitzka, 1999; Kyvik, 2009; Pfeffer and Salancik, 2003; Lipnicka and Verhoeven, 2014.

Therefore, national education policies of the Bologna process do impact the performance, measurement and overall framework of EU Member States as regional innovation ecosystems, designation and scoreboard rankings. Understanding the correlative effects of the impact, using the of NI and RDT perspectives, fundamentally assess the strategic insights of the conceptual framework of human-centric innovation ecosystems. Through policy-making systems the qualitative indicators of human-centered attributes and their associative implications for strategic management and planning should derive.

The EU higher education sector, as institutions endowed with developing the human resources for the furtherance of the local and regional environment improvement of the European Union, have undergone many significant changes. Borne as the 'by-product' of the Lisbon Strategy the Bologna Process (Lipnicka and Verhoeven, 2014), was commissioned for improving the higher education system (Nokkala, 2007; Hoffman and Holzhuter, 2012). The New Institutional theory and Resource Dependency Theory emphasize that management of the knowledge society and attaining the wider EU objectives leads to economic growth for the region.

Innovation leading Member States such as **The Netherlands, Sweden, Denmark, Finland** the **United Kingdom** and **Luxembourg** are those that are prudently focus on fully utilizing its national resources to create advanced, leading research and development sectors, renowned education sector and science parks that known as strategic '*havens*' for boosting innovation and growth capacity through academic related research at higher education institutions and R&D facilities (Gornitzka, 1999). For the Netherlands, many investments made into stabilizing the country's public and private research and development intensity have been done in order to achieve its Europe

2020 targets. While this has minimized unemployment rates through the introduction of the temporary contract system and self-employment, the untapped labor potential still remains due more women taking up part-time work and lack of integrating migrants and those of migrant backgrounds into the labor market (at 20.6 percent) according to Eurydice (2019). This demonstrates that more resources are needed at the governmental policy level to actively earmark the resources and institutions needed in an ecosystem, comprising of a resource dependent-type of framework for achieving in the medium to long-term objective of increasing public and private research activities to charter more innovation development. This could very well be achieved through the introduction of more fiscal and structural policies at the national level (Brunsson and Olsen, 1993; Thoenig, 2011).

On the other hand, Sweden's advanced economy is in great need of more highly qualified workers, and while the skills gap is predominant in the health, science, construction, engineering, communication and information technologies and education sectors, according to Lundvall (2008), Schulte (2019) argues that this challenge, similar like the Netherlands, is caused by the absence of proper mechanisms to successfully integrate female persons with migrant backgrounds into the labor force. Moreover, higher education institutions, due to the shortage of highly qualified teaching personnel, still are plagued with the growing divide of educational performances of students from diverse socioeconomic background differences, which has resulted in direct interdependence of resources necessary for achieving the Europe of knowledge for innovation (Lipnicka and Verhoeven, 2014). Denmark have attempted to counter and prevent these challenges that plague the Netherlands and Sweden by implementing reforms to increase the participation and completion rates of persons pursuing vocational education training, which ensure that a continuous labor supply exists in certain key sectors for sustainable growth. Lundvall (2008) and Schulte (2019) points out that Denmark introduced national policies to ensure that all human resources, including marginalized and disadvantaged persons, have access to resources for increasing their digital skills to equally compete in the labor market (Eurydice, 2019). In last few years Finland have witnessed an increase in entrepreneurship activities and start-ups due to taking advantage of the environmental changes that fosters and supports measures that ensure access to capital, infrastructure and technology for entrepreneurs as well combining training and coaching for the human capital involved so innovation results (Lundvall, 2008; Schulte, 2019). Brunsson and Olsen (1993) as well as Lipnicka and Verhoeven (2014), points outs that as entrepreneurs and self-employed business person although boosting economic activities for Finland, have little social protection and do run the risk of getting into poverty as when compared to employees, leads to another disadvantage of the importance of innovation through entrepreneurships. The United Kingdom, likewise in the last few years have performed comparatively poor due to inefficient business enterprise processes, skills shortages and investment. Though labor market metrics continue to remain in the positive ratios, employment quality still remains questionable particularly concerning skills development and labor market participation. Lipnicka and Verhoeven (2014), states that the policies earmarked for addressing these issues should be more coherent in order to ensure that reforms to technical education, increasing of apprenticeship programs are implemented purely to raise the quality of the higher education system for continuous sustainable growth. On the policy side, the UK's system of European Framework for Quality and Effective Apprenticeships developed as a national initiative to monitor and track the career progress of tertiary graduates, is one method that promotes and fosters lifelong learning locally, in an analogous manner to the Bologna Process (Lipnicka and Verhoeven 2014). Moreover, the post-Brexit era will command greater sustainable fiscal and socioeconomic policy geared towards addressing the skills and progression needs through targets set in apprenticeships programs. This initiative could promulgate the improvement of the skills, particularly for those persons gaining entry into the labor force through apprenticeship programs, and thereby assess the quality and the relevance of these programs in achieving innovation for economic growth (Eurydice, 2019). The high standards of living have significantly deterred Luxembourg from successfully attracting and retaining a skilled labor force, particularly from the human resources that are of a migrant background. Several strategies such as increasing the retirement age of older persons is perceived as the prominent solution purely due to the fact that the continuous, long-term sustainable economic advantage of Luxembourg is derived from an efficient and thriving resource dependent-based governance system and institutions that coordinate and interact well at the national level (Pfeffer and Salancik, 2003; Lipnicka and Verhoeven, 2014).

Member States such as **Austria**, have demonstrated that despite challenges affecting social groups such as women and migrants, the learning outcomes for disadvantaged students has not improved. Though attributed to the broad performance gaps resulting from the absence of the required educational attainment from the Programme for International Student Assessment (PISA) that measures the attributes of students that leads to innovation (Avvisati, Jacotin and Vincent-Lancrin, 2013) implies a negative correlation existing in national-level student test scores outcomes. This is coupled with the fact that low cooperative networks exists with external organizations, institutions and actors at the national, regional and local level further impacts the socio-economic and cultural factors of the surrounding environment for migrants and low achievers of the higher education system. Moreover, the resource dependency theory views local entrepreneurship and network building at the national level for Austria as the outcomes of HEIs closely harmonized with higher education policies that fully incorporates the precedence of the historical, socio-economic and cultural dimensions as well as inherent structural features (Pfeffer and Salancik, 2003; Gornitzka, 1999; Lipnicka and Verhoeven, 2014). In regard to the structural descriptions of the Austrian higher education (HE) system, Kyvik (2009) and Haukland (2018) suggests that an in-depth look on the impact of the level of innovation-led activities to the socio-economic changes generated by the national education system for increasing the proportion of low achievers in mathematics, reading and science should be examined. Though, most often native pupils outperform the first generation migrants at an equivalent rate of almost three years of schooling improvements, an innovation-friendly environment that encompass addressing the labor market outcomes of women propitiously improves the basic skills of disadvantaged young persons as well as migrants, thus ensuring Austria to retain its position as the symbol of modernization and a strong contributor to the global economy through education and innovation (Eurydice, 2019).

Rooted with the diverging and changing demands of society, the third mission of higher education institutions has become more evident in entailing that these institutions remain strategically focused (Secundo et al., 2017; Pedro et al., 2019). The fact that **Belgium's** economy has been job-rich with strong employment growth since 2017, has demonstrated the strategic shift at national level of more utilization of the talented human resources. This is further evidenced in the increased use of university graduates' intellectual capacity for building economic growth despite the outward stagnation persisting the EU region for other Member States (Pedro et al, 2019). Though the unemployment rate is still steadily approaching pre-crisis levels and impacts the demographic groups aged 20 to 64 (68.5 % in 2017), the knowledge economy, according to Secundo et al (2017) and Pedro et al (2019) can only result through the adoption of hybrid system encompassing the absorptive-capacity model and the intellectual capital model for putting Belgium on track to achieve its Europe 2020 target of 73.2 %. The job vacancy rates are one of the highest within the Union due to major skills mismatches related to low participation in lifelong learning. Though the proportion of tertiary education graduates is high with inequalities in access to quality education still persist as well as significant skills shortages and regional gaps in skills mismatch. The proportion of graduates in science, technology and mathematics is one of the lowest in the European Union, and shortages in these fields could become a major barrier to growth and innovation. Though the Dynamic Capabilities View (DCV) states that the flexible nature of human capital as a resource that is adaptable to external changes (Teece et al., 1997), the Flemish and the French-speaking Communities of Belgium sought to implement major reforms of the education systems with decades-planned implementation phases to address the challenge of skills mismatch prevailing the higher education sector. This proactive stance by Belgium is ensuring that while there is a delayed response to the enforcement of key measures of these reforms for a year, its measured impact is crucially dependent on effective implementation and monitoring. With Flanders abolishing the Establishment Act for a selected number of craft professions, regulation still remains high for some professional services with low entry amount of new companies coming into the market which impacts the level of entrepreneurship activities and business dynamism. The recorded low rate of these activities is due to the environmental surroundings and independence between the resources required to foster local entrepreneurship and network building, and according to Pfeffer and Salancik (2003) promulgates more rigidity. As the Resource Dependency and New Public Governance theory have emphasized, outdated public sector systems that contribute to the prevalence of businesses being consistently burdened with heavy administrative procedures combined with uncertain regulatory incentives are the ingredients inhibiting entrepreneurship in Belgium (Gornitzka, 1999; Pfeffer and Salancik, 2003; Kyvik, 2009; Lipnicka and Verhoeven, 2014; Eurydice, 2019).

Variances in the levels of low, medium and highly skilled workers, have contributed to high employment rates in **Ireland** since 2016 and resulted in more pronounced skills mismatches and skills shortages. Within lifelong learning, the level of low-skilled employed persons remains low although when compared to the increased vulnerability to the changes in labor demand particularly with the high rate of science, technology, engineering and mathematics graduates, Ireland is one of the Member States that have one of the highest levels of digital skills in the Union. Regarding research and development activities, the diffusion of new technologies in SMEs will flourish in 2020 and beyond and this demonstrates that when potentially fostered through public-sector incentives (Eurydice, 2019) there will be an increased availability of skilled workers as indicated by the Irish National Competitiveness Council which can potentially be utilized as resource inputs to achieve greater economic development (Pfeffer and Salancik, 2003; Gornitzka, 1999).

It is quite evident that the intangible and intellectual assets as key input resources for **Italy** can lead to national economic growth and productivity despite persistent innovation-led activities and training of human resources being well-below the EU average. Kyvik (2009) argues that given the emphasis placed on achieving the regional ideologies placed on higher education systems entreats whether these institution respond better to these ideologies rather than the socio-economic, historical and cultural ideologies, nationally. The increased prevalence of micro-firms, lack of specialization in knowledge-intensive and creative industries, limited digitalization and digital skills in the human resources, reduced public spending in research and development as well as low investments made in research and development, new policy incentives for the establishment of innovation enterprises and improved quality of education system demonstrates that the entrepreneurship culture implanted through an entrepreneurial-based type of education could revamp and permit favorable conditions for the business environment according to Oosterbeek et al. (2010). Thus, a competitive business environment that is characterized with more efficiency in the use of resources (Brunsson and Olsen, 1993; Thoenig, 2011) strategies and measures to potentially increase human capital skills which are more matching to meet the future labor market needs of Italy is dire. Neo-institutionalist have countered that although improvements in the quality of Italy's higher education system, could minimize the differences in the number of students performing well above the EU average (for foreign-born students, the figure is 30.1 percent in contrast to EU average of 19.4 percent), the reforms for vocational education training are requisite as the high drop-out rates and prolonged study periods contributes to low educational attainment levels (Powell and DiMaggio, 1991). In terms of adult education programs, the learning environment of Italy has struggled in connecting with the global environmental needs as though upskilling and reskilling is adamantly fostered to employers in providing more learning opportunities for the human resources as stated by Haukland (2018), the country still has one of the lowest rates in the EU (Eurydice, 2019). This has led to a consistent decline in investments in Italy, which has impeded its recovery from the 2007 economic crisis. Compounded with other restrictive structural factors and financial constraints that underdeveloped the business markets, unfavorable business environments and the absence of abundant skilled human resources have contributed to the low level of private investments as well (Eurydice, 2019).

Through New Public Governance and New Institutional theories, the current vocational education training system of the **France**'s higher education sector is perceived to have chartered great improvement through adequately proportioning the human capital competencies according to the needs of the labor market of the country (Gornitzka, 1999; Pfeffer and Salancik, 2003; Kyvik, 2009). Though limited employment prospects have historically impeded vocational graduates, when compared to those that have attained higher education qualifications through the general education system, the Government have implemented more strategies for increasing their entry into the labor market, as skills acquired from apprenticeships programs and internships often leads to innovation. When considering the situational context of France, in particular the environment in which meritocracy is purely absent for technically-based subject areas, and at the same time attempts to improve access for continuous lifelong training in accordance to the objectives of the Bologna Process (Lipnicka and Verhoeven, 2014), the 2018 National Reform €14 billion investment plan may herald the way for a complementary reform of the school-based initial vocational education training (Eurydice, 2019). Regarding innovation, the European Innovation Scoreboard shows that France's innovation performance still remains below average when compared to High Innovators of the European Union in spite of the overwhelming public support. It is perceived that implementing tax credit for research and development would result in greater innovation output. Currently, knowledge transfer between business industry and public research remains a challenge and limits the commercial prospects of innovation. However, there is potential to strengthen and improve knowledge transfer between academia and industry which can be achieved through simplification of research collaboration and provision of incentives for researchers' mobility (Eurydice, 2019).

Though **Germany** is on track towards achieving its Europe 2020 research and development targets through increased investments made in business research and development in addition to the strong cooperation networks forged to foster more entrepreneurial activities, Miller et al (2016) states that greater involvement of actors from the higher education sector should take precedence as this charters more opportunities for knowledge transference of academic research to the commercial sector. The fact that the venture capital (VC) market is less developed when compared to other international innovation leaders, Germany can gain a significant advantage in this sector though actively focusing on improving the situational environment of the human capital integration into the labor market by taking an egalitarian approach to all business entities, as VCs are more innovation-led when compared to other traditional businesses. Moreover as pointed out by Schulte (2019), focusing on certain specific traits of the human capital required for innovation, education and economic growth is linearly linked as a nation's innovative capacity is dependent on the educated human resources (Lundvall, 2008; Schulte, 2019). Hence, the purpose of linking national innovation ecosystems to the higher education section for efficient usage of resources particularly for an economy such as Germany, is useful when taking into account the significant skilled labor shortages within certain labor market groups. Due to the lack of resource utilization, it is quite evident that an environmental tension exists (Pfeffer and Salancik, 2003), particularly between entrepreneurship and network building within the business sector as socio-economic background is still a challenge for students with migrant backgrounds seeking to integrate and develop entrepreneurship activities that lead to innovation. When compared with native-born students, migrant students tend to be early leavers or 'drop-outs' of tertiary level education which leads to the under-utilization of their skills potential in the labor market. This further exacerbates negatively the labor market opportunity potential for low-skilled adult groups amounting to 7.5 million persons (Eurydice, 2019). Similarly in **Slovenia,** the social trends for economic growth continued and improvements in the labor market is one of the lowest and well below the EU average due the lack of coordination and exclusions of certain social groups in that society (Eurydice, 2019). The fact that strategies to increase adult education, greater enrolment of females, while chartering the requisite skills to counter these large gaps in vocational occupations is evident of the inadequate utilization of resources at the national level. Hence greater resource allocation and reducing the tension between all actors, resources and institutions could lead to lifelong learning programs that impart more employable skills for older and low skilled workers (Gornitzka, 1999), enabling Slovenia in the long-term to be well-above the EU average.

Moderate Innovators Member States are the largest group consisting of **Croatia, Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Portugal, Slovakia, Spain,** and **Greece,** all sharing the common feature of innovating at an incremental pace (Eurydice, 2019). Though few Member States namely Greece, Spain and Portugal gained EU membership during eighties, the remaining majority all except for Cyprus which gained ascension in 2013, was granted Member status in 2004. Many scholars, in consideration of the timeline when these nations were ascended into the EU, have argued that the criteria and benchmarks used to measure innovation as a by-product or end-result of the tertiary education system research and academic knowledge should be diverse in a similar manner as the policy, socio-economic, cultural, environmental and historical factors that defined them, though united by the Lisbon strategy of the EC (Corbett 2011; Enders and Westerheijden, 2011; Lipnicka and Verhoeven; 2014; European Commission, 2018j; European Commission, 2019).

The modernization process as a response to the plaguing unemployment problems, poor higher educational achievement outcomes in terms of the quality of graduates' skills attainment and labor market needs, have resulted in positive developments such as revision of the higher education curricula, a new appointment system for teachers, and the consolidation of the higher education institution in order to ensure greater use of physical and technological infrastructure in addition to converting the human resources into the talented human capital. Contextually, the neo-institutional and resource dependency theories according to Haukland (2020) in regards to the changes that have occurred both at the national and local levels, features the improved environmental surroundings and interconnections results from a mature and well-developed entrepreneurship system and network building (Pfeffer and Salancik, 2003). Aesthetically, this deepens and creates a richer picture of 'modernized system' of higher education (Gornitzka, 1999) for these Member States. While several have undergone significant reforms to the higher education sector with Cyprus implementing drastic changes as a commitment to foster lifelong education and training; the merging and consolidation of state universities in Lithuania; curriculum reform in Latvia's vocational education system; quality inclusive education and training prioritized in the Czech Republic and alignment of skills towards the science and technology, the general perception is that these measures may result in an improved study curricula for the higher education sector of Moderate Innovator Member States. The fact that the EU as a welfare inclined region is derived on the framework of structural-functionalism, the impact of these reforms to improve the higher education sector will be effective through increasing the birth rate numbers particularly within the middle class as this would increase the amount of students pursuing higher education further aggregating new professions (Kyvik, 2009).

The fragmentation of institutions in the higher education sector, has led to a paradigm of horizontal integration where the shift of a dysfunctional system towards a more 'functional' approach in organizing educational system is seen as one of the solution to the labor market needs (Kyvik, 2009). At the global level, the main theoretical perception is that as higher education institutions are constantly changing due the global 'ideals' that are placed on the system, these changes could be as a result to the institutional and socio-cultural historical influencers. Kyvik (2009) argues that though historically organizations tend to copy each other with HEIs no exception to these tendencies, the institutional and socio-cultural historical influencers are not the yields of these decisions that lead to more new work-based learning approach for Member States such as the Czech Republic and Lithuania which involves more collaboration with social partners and companies (Haukland, 2018). Rather as seen in the case of Lithuania, numerous reforms made into the higher education sector for the period 2018 and 2019 were the right step in the direction of effectively improving the outcomes of its education and training system (Powell and DiMaggio 1991; Eurydice, 2019). In addition, with the financing and accreditation rules implemented in Lithuania's higher education systems to increase the number of persons with tertiary education qualifications demonstrates that Lithuanian higher education institutions are dependent on three key resources *financial:* state support and tuition payments; *students*: for enrolment purposes; and *staff:* administrative and academia (Haukland (2018).

In addition, with the improved financing and accreditation rules implemented in Lithuania's higher education sector to aid the increasing number of persons with higher education qualifications, concerns regarding its relevance to labor market needs, fragmentation (too many higher education institutions in the country) and quality have added to the challenges facing the sector. With the ongoing consolidation of the universities in Lithuania, the relative challenges accompanying this process could be addressed complementary with changes to the accreditation system and financing rules (Eurydice, 2019). Pertaining to the socio-cultural changes, clarifications on why certain values such as quality and equality in education, competency of the system in addressing the societal challenges, opportunities and social benefits through higher education is still outstanding. In order to address this, Kyvik (2009) points out that for the labor market needs and relevance of vocational education training in respect to the identification of skills needs, more correct appropriation of skills through national assessments and evaluation of learning programs should be one the policy 'norms' through government (Powell and DiMaggio 1991; Haukland, 2018). Similarly for Latvia, owing to the adverse demographic changes and emigration, the labor market has tightened with employment growth becoming constrained due to falling labor supply. This has result in varying employment opportunities between regions and skill levels. Curriculum reform has been implemented in vocational education training to align education with the requisite contemporary skills requirements, however, further efforts are needed to ensure full implementation is achieved in order to increase participation in initial and lifelong vocational education training (DiMaggio and Powell, 1983; Powell and DiMaggio 1991; Haukland, 2018). Correspondingly like its Baltic counterpart Lithuania, the onset of new work-based learning approach which involves collaboration with social partners and companies have ensued. Additionally as upskilling initiatives that encompass instilling more digital skills through higher to students could substantially improve greater access to labor market for countries such as the Czech Republic (Eurydice, 2019). For Hungary this is the contrary as basic skills outcomes through tertiary-level education are significantly well below the EU average due to the early streaming and stratification of students at the primary school age into different types of higher education institutions thus resulting in extensive gaps in education outcomes and specialist employment paths (Lipnicka and Verhoeven 2014). Increasing social partners' capacity could potentially increase their engagement in collaboration activities involving vacation education and training (Haukland, 2018). In Spain several programs have been earmarked to address this problem, particularly the *'Qualifica and the national digital competences initiative Incode 2030'* their effectiveness in elevating the human resources' basic digital, numeracy and literacy and skills, and eventually the productivity levels of the country. Moreover, the quality outcome of these skills are dependent on monitoring the quality of the training offered and skills recognition (Eurydice, 2019). In Portugal a similar approach also been undertaken and have resulted in positive developments in terms of quantity and quality of the human resources through the creation of a research-driven culture through the forging of stronger academia-business cooperation, greater commercialization of research outputs, and more opportunities focused on the development of 'entrepreneurial research' and industry-research collaboration activities (Eurydice, 2019). On the other hand for Slovakia, at the EU regional level, the quality of educational outcomes and the level of basic skills remain weak. As it is crucial to assess whether according to the NI and RDT, the regulative, normative and cultural pillars remain significant factors that influence institutional changes at the local, national and EU regional level (Lipnicka and Verhoeven, 2014). This is attributed to the ineffective approach in addressing the *cultural* pillar of the higher education sector with the insufficient resources for the training of academics on intercultural issues (Lipnicka and Verhoeven, 2014). For the Spain this is exacerbated in the *normative* pillar where under-qualification and over-qualification in higher educational outcomes are addressed by special policy programs aimed but with little effect due to ongoing negotiations, or according Lipnicka and Verhoeven (2014), internal complex network ties. As a consequence, higher education graduates face great difficulties in finding adequate, suitable jobs in the labor market. In Lithuania, though the labor market situation has narrowed considerably due to the strengthening of the economy, rapid demographic developments and high emigration that have led to skills shortages during the last decade, a dissimilar scenario exists when compared to other Member States such as Malta, Portugal, Slovakia. For those countries increased employment opportunities coupled with decreasing tertiary education attainment age rates (between age 30-34 years), increased economic growth and legislative reforms that fully supports anti-discriminatory practices against female employment as well as lifelong skills development of the workforce are instances within the institutional context where important resources at the State level are utilized to develop the human resources (Lipnicka and Verhoeven, 2014). Though adult education rates are low in Lithuania, the country's economy have not benefitted from these skills upgrading initiatives or innovation. With the curricula and content of vocational education training predominantly outdated despite numerous investments to upgrade the supporting infrastructure and facilities, the main priority has always been aligning the skills attainment to the current needs of the local and regional labor markets. On the other hand when students from challenging socio-economic backgrounds are deliberately stratified into the vocational secondary schools that tend to have higher dropout rates, it results in graduates with poor basic skills and training as well as the likelihood of lower wage earnings, undermining the development of quality and inclusive education as seen in the case of what occurred in the Hungarian higher education (European Commission, 2019). Latvia also experienced a similar case but have countered that problem by minimizing the rate of students enrolled in those higher educational schemes similar to Hungary. This was done by increasing the rate of adult participation in learning which has led to decreasing unemployment figures particularly when compared to other Moderate Innovator Member States (Eurydice, 2019).

For innovation-led activities borne through the higher education sector, scientific research states that there is a negative correlation between student test scores in science and the level of interest in science (Avvisati, Jacotin and Vincent-Lancrin, 2013). Therefore the Czech Republic, Estonia, Croatia, Poland, Portugal, Greece, Lithuania, Slovakia and Spain's gradual transition to more knowledge activities through a fragmented innovation and higher education system, a series of comparative outcomes will only result, ranging from low performances in national level tests and high interest in science and technology, and high scores and low interest in science and technology. In Estonia, although policy measures have been adopted to establish links between academia and business, less than 0.5% of Estonian companies have undertook research activities, with research and development penetration rates at a meagre 0.7 % of the GDP which is barely half of the EU average of 1.3%; Croatia have implemented a smart specialization strategy aimed at reforming the national science and innovation system; and lastly Lithuania's' public expenditure aimed at strengthening research and development cooperation between businesses and science is still low (Eurydice, 2019). For Slovakia, while further subsidization from European Structural and Investment (ESI) funds increased public investments in research and innovation during the period 2009-2015, this has not enable Slovakia to achieve its innovative potential capacity due to inefficiencies uncovered in its research environment (Eurydice, 2019). The fact that Avvisati et al (2013), in their research on Asian higher education students' national tests outcomes and the interest in science and innovation, have proved that full engagement and an attitude to more science-led research activities are the necessary skills required innovation is supported by Miller et al (2016), as well as the resource dependency theorists Powell and DiMaggio (1991). Complementarily as the fourth helix model, in defining the true purpose of higher education systems in society, is relevant for achieving the objectives set in the regional innovation policy of the EU28, Miller et al (2016) further stresses that the learning and teaching activities in HEIs should be structured accordingly to ensure that continuous improvement of the human factor and that proficiency of science tests do not inhibit the development of other important soft skills either.

In terms of the labor market, though its performance in Poland and Portugal have strengthened in recent years despite low participation of some groups with low-skills set for the innovative capacity of the economy of those Member States to evolve positively, proposed policies to further train the human resources with the adequate skills-set and competences needed, Miller et al (2016) argues that challenges may arise between stakeholders in the direct knowledge transference (KT) into the wider national ecosystem. The Portuguese labor market should attempt to continuously improve and strengthened economy policies to address labor market segmentation despite low figures for innovation potential and competitiveness of the overall skillset of the adult population (Eurydice, 2019). For Slovakia, a country where large number of multinational companies (MNCs) are interested to conduct research and development activities, Miller et al (2016) states that knowledge ecosystems at the regional level encompassing the quadruple Helix model can evolved particularly where the higher education sector takes a leading role in adopting an entrepreneurial approach in order to ensure deeper cooperation ties with businesses. This would be the recommended method for Slovakia especially where a small number of small and medium-sized enterprises (SMEs) still continue to carry out in-house innovation, approximately more than 13.9 % since 2016 (Eurydice, 2019). Low employability, weaknesses in literacy, numeracy and digital skills have led to proposed changes in the organization of tertiary and vocational education training studies in Poland. It is predicted that the changes could potentially yield the 'preferred' skill levels for innovation, although more research is needed to prove this. From the resource dependency perspective, though there is a desire to increase the Polish economic capacity to innovate in order to elevate the country's position in global value chain and potentially improve living standards, requisite policy action on all frontiers of the economy needs gradual implementation within the next several years according to DiMaggio and Powell (1983) and Powell and DiMaggio (1991). Kyvik (2009) on the other hand have emphasized that a structural-functionalism could result where a fragmented, weak governance framework, along with the poor coordination and a wide bureaucratic system could significantly impede the advancement and stimulation of knowledge transfer in Poland on top of further minimizing low cooperation between businesses and academia if extra reforms are introduced to regulate the system. Accordingly the Eurydice policy report (2019) have stated that the key relevant policy measures identified for boosting innovation activities through the tertiary education in Poland would include strengthening the science base by actively reforming the higher education system to increase the level of KT which results in a more favorable environment for innovation resulting in closer cooperation ties between education, enterprises and research institutions. Researchers of the resource dependency and isomorphism position unilaterally agree that these improvements to the environmental contexts ensures that more favorable conditions would result for the development and commercialization of research activities, especially when supported by public funding (DiMaggio and Powell, 1983; Powell and DiMaggio 1991; Gornitzka, 1999; Lipnicka and Verhoeven; 2014).

The macroeconomic imbalances, private sector debt, high unemployment and high degree of labor market segmentation plaguing the Spanish economy can only be eradicated through policy measures geared at increasing its economic resilience and productivity growth levels (Eurydice, 2019). Unless these are introduced, Spanish business and enterprise innovation activities that contribute to productivity growth levels will continue to be impacted. Greece in a similar manner have experience significant weakening in the finance and support for innovation which has led to the country being ascribed Moderate Innovator status since 2010. Though increased cooperation between education and business could potentially increase labor market access for tertiary graduates, the higher education policy should be structured where business appreciate the benefits of the higher education sector that consistently equip graduates with the matched skillsets for business innovation ecosystems (Moore, 1993). Although a proposal to implement a new national digital strategy to improve the digital skills of graduates, it is acknowledged that the low number of specialists in the field of information and communication technologies is directly related to the lack of promotion by the education of these highly requisite skills. Thus, in terms of innovation, the notion of retraining or training workers with digital skills should allow Spanish companies to remain relevant and competitive in the digital economy since the education sector do not regularly carry out this function (Eurydice, 2019).

The higher education policy of Modest Innovator Member States such as **Bulgaria** and **Romania** are undergoing reforms similar like their 'Moderate Innovator' counterparts. The 2018 National Reform Programme in Bulgaria emanated as a direct remedy to alleviate the challenges identified in the European Commission (2018) Country Report that plagued the higher education sector (Eurydice, 2019). Hence a massive structural transformation that include effective governance, stable level of public research and innovation resources was required in order to raise productivity and growth levels of the labor sector. In addition, more support of the economic transitions towards higher, value-added activities in line with the development of regional innovation ecosystems were done similarly for Strong Innovator Member States (Eurydice, 2019).

When imbalances between the labor market policies and the education sector occur, the resulting *'ripple'* effect impacts the rate of innovation and the development of the knowledge society (Lundvall, 2008; Lipnicka and Verhoeven, 2014; Schulte, 2019). As such these effects, as highlighted in Eurydice (2018) for Bulgaria, are low employment figures reaching at pre-crisis levels and well-below the EU average, unmet developments to the labor market needs resulting negative impacts to the entire working-age population which cause longer term unemployment and an inactive youth. In comparison, innovation resulting from the higher education sector's research and knowledge transference activities have declined since 2010 for Romania which is why the country has consistently remained as a Modest Innovator (European Innovation Scoreboard, 2018). Innovation dimensions such as human resources, attractive research systems, innovation-friendly environment, finance and support, firm investments, linkages, innovators, intellectual assets, employment impacts and sales as analyzed through the *environmental* pillar (Lipnicka and Verhoeven, 2014). This has further revealed contrasting results for the impact of the national higher education policies for both Romania and Bulgaria, which are: an *innovation*-friendly environment, with a resilient commercial sectors and limited amount of *innovators* and *investments.* With respect to innovation dimensions analyzed through the social pillar, Romania and Bulgaria share the similar problem of skills shortages and limited employment opportunities and marginalization of certain groups in society. Though a reinforced approach aimed at increasing access to more upskilling and training of certain groups to correctly match the labor market needs, in terms of employability prospects for graduates (Lipnicka and Verhoeven (2014) states that higher education institutions as organizations that have undergone transitional changes aligned to the Bologna Process will face structural shortcomings including high fragmentation in research and development through government, low public spending and investments linked to innovation as a direct impact from the sluggish reforms that hinder the move towards an innovation-oriented system. This in turn affects the quality of scientific outputs from higher education institutions and weakens the commercialization of research and knowledge transference from these institutions.

Subsequently from the review of the EU Member States, innovation performance derived from training and learning from HEIs in the EU has increased in eighteen

(18) Member States and decreased in ten (10) since 2010, where for the Scandinavia region, Sweden is dominating, followed by Denmark then Finland. For the rest of region, the Netherlands, followed by the United Kingdom and Luxembourg are the top innovating member states. Notably, Lithuania, the Netherlands, Malta, the UK, Latvia, and France are characterized as the fastest growing innovators accordingly (European Innovation Scoreboard, 2018)

1. 4. Structure of the Theoretical Framework of Human-centric Innovation Ecosystems

The analysis conducted on the correlation of how the higher education policy impacts human-centric innovation ecosystems is not entirely comprehensive and thus leads requires an inductive research. At the regional level, analysis of the types of ecosystems that is linked to the human-centered attributes of the problem-solving process from higher education systems to innovation ecosystems was achieved through the comparative assessment of EU Member States. This was done according to each categories of innovation performance outputs will be used as the initial sample. The evaluation will be further broken down from the macro-, eso-, meso-, micro- to the level of the human factor in order to distinguish the novelty of human-centric innovation ecosystems networks as managerial resources in strategic management systems.

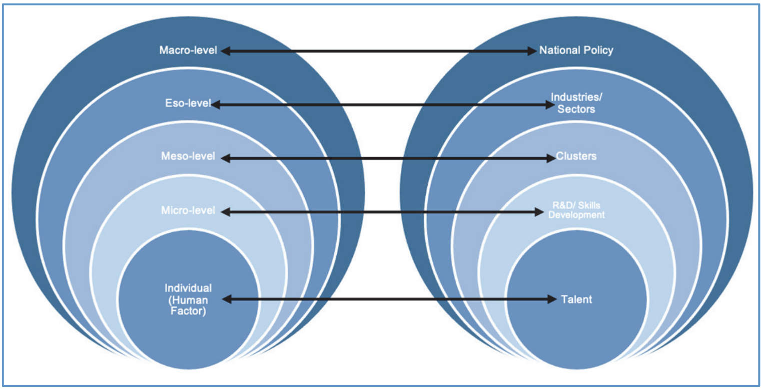


Figure 7. *The Value of Innovation Modelled as Human-Centric Innovation Ecosystems at each Level*

Source: Created by the Author according to DiMaggio and Pfeffer and Salancik, 1978; Powell, 1983; Powell and DiMaggio, 1991; Moore, 1993; Teece, 2007; Zott and Amitt, 2010; Nambisan and Sawhney, 2011; Mitleton-Kelly; 2003; Moore 1993; Iansiti and Levien, 2004

As seen in Figure 7 the interaction and matching the value of innovation at each level translates to the fundamental conceptual framework for the human-centric innovation ecosystems. The theoretical conceptual framework developed describes most important features of the human capital, the internal and external environments of HEIs impacts, all actors including stakeholders and beneficiaries as well as non-higher educational social and economic factors which strategically enhances its contribution to the knowledge and commercial economy. The strategic value created from this ecosystem through the collaborative activities, investments into the development of the human resources through higher education, skills development as well as training to enhance human-centered attributes necessary for innovation. According to the critical analysis of literature, the conceptual framework should operate on two-fold basis where skills and knowledge transference occurs simultaneously.

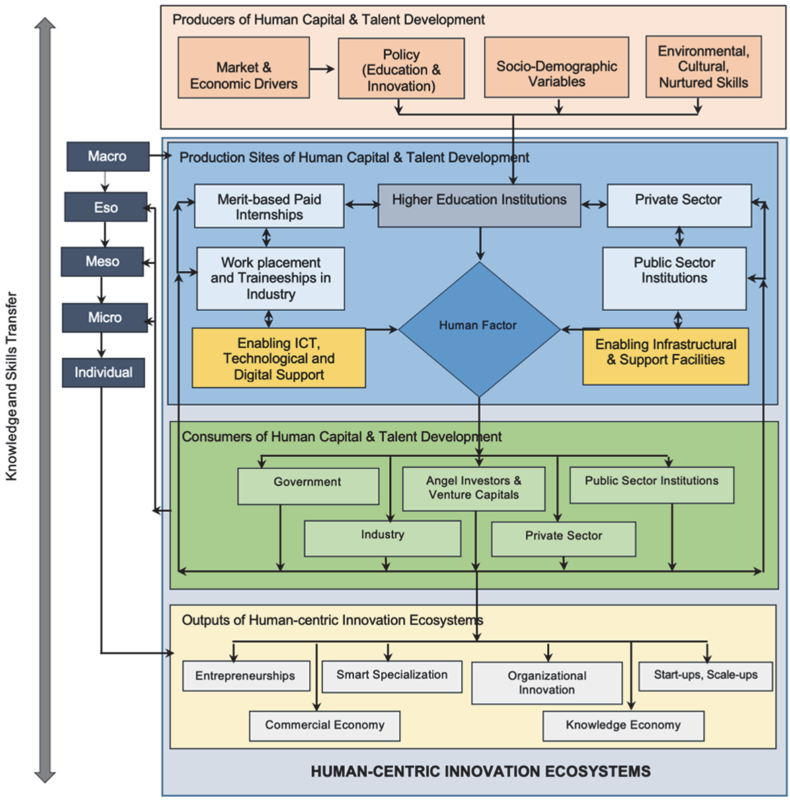


Figure 8. *Theoretical Framework of Human-centric Innovation Ecosystems*

Source: Created by the Author according to Penrose, 1959; DiMaggio and Pfeffer and Salancik, 1978; Powell, 1983; Powell and DiMaggio, 1991; Moore, 1993; Teece et al., 1997; Mitleton-Kelly; 2003; Iansiti and Levien, 2004; Al-Alawi et al., 2007; Teece, 2007; Zott and Amitt, 2010; Nambisan and Sawhney, 2011; Mahoney and Kor, 2015; Alva, 2019;

The theoretical conceptual framework of Figure 8 is described according to its features: *Levels, Actors, Processes, Role of each Actor* and *the Value Creation at each Level.* This is outlined in Table 4 below.

Table 5. *Features and Description of the Framework of Human-centric Innovation Ecosystem*

Features of the Framework	**Description**
Levels	Macro, Eso, Meso, Micro, Individual
Stakeholders and Beneficiaries	Government, Industry, Angel Investors and Venture Capitals, Public Sector Institutions, Private Sector, Human Factor, Higher Education Sector;
Processes	a) Enabling ICT, Technological and Digital Support Infrastructure; b) Enabling Infrastructural Support; c) Policy (Education and Innovation); d) Market and Economic Drivers; e) Socio-Demographic Variables; f) Environmental, Cultural, Nurtured Skills;
Role of each Actor	1) *Producers of Human Capital Development:* Policy (Education and Innovation); 2) *Production Sites of Human Capital and Talent Development:* Higher Education Institutions in cooperation with the Private Sector, Public Sector Institutions, Merit-based Paid Internships, Work Placements and Traineeships in the Industry, through the support of Enabling ICT, Technological and Digital support Infrastructure and other Enabling Infrastructural and Support Facilities; 3) *Consumers of Human Capital and Talent Development:* Government, Angel Investors and Venture Capitals, Public Sector Institutions, Industry, Private Sector; 4) *Outputs of Human-centric Innovation Ecosystems*: Entrepreneurships, Smart Specialization; Organizational Innovation, Start-ups, Scale-ups, Knowledge Economy, Commercial Economy;

Features of the Framework	Description
Value Creation at each Level	*Macro:* Social, Economic, Improved quality of life and society; Greater commercialization of research results, Knowledge economy; Human-centered solutions, Attraction and retention of quality human capital; Focused innovation-led activities, Smart specialization, Start-up and scale-up economy, Entrepreneurship; *Eso:* Improved industry and sectorial collaborative activities, Strategized industry-led innovation networks; *Meso:* Diverse, human-centered innovation ecosystems, Easier transfer of knowledge and skills for greater coordination, Greater collaboration; *Micro:* Trustful, Openness Collaboration, Increased diversity of innovation activities, Greater use of actualized skillset, Training and knowledge skills developed according to market and economic drivers, Inclusivity, Greater satisfaction in the quality of the human capital, Increased competitiveness of the Higher Education sector; Quality ecosystems *Individual:* Inspired and creative human resources, Improved social and economic quality of life, Quality higher education qualification, Skills- and knowledge-oriented, Problem-solver, Citizenship, Trusting, Open, Entrepreneurial-minded, Motivated, Leader, Shows initiative, Flexible and an adaptable attitude (Psychological), Industry-related skills through practical experience; Global mind-set; Willing to take decision and responsibility; Strategic thinker; Good communicator; Collaborator; Analytic, Quantitative thinker; Risk-oriented

Source: Developed by the Author according to Penrose, 1959; DiMaggio and Pfeffer and Salancik, 1978; Powell, 1983; Powell and DiMaggio, 1991; Moore, 1993; Teece et al., 1997; Mitleton-Kelly; 2003; Al-Alawi et al., 2007; Teece, 2007; Zott and Amitt, 2010; Nambisan and Sawhney, 2011; Mahoney and Kor, 2015; Iansiti and Levien, 2004; Alva, 2019;

The value creation of human-centric innovation ecosystems theoretical framework is initially outlined at the *Individual* level are structured according to how the human factor is developed to drive and be the creator of innovation. At the individual level, the value creation of the framework is illustrated according to the benefits attained through pursuing higher education studies or training and the associative incentives from human-centric innovation ecosystems. At the *Micro* level the value creation of the conceptual framework is illustrated according to the benefits construed for all the actors of the framework. At the *Meso*, level the value creation of the conceptual framework is illustrated according to the benefits developed through active cooperation, greater and appropriate use of the knowledge, skillsets developed and training through the higher education system that match the actualities and demands of the market's needs. In addition, greater satisfaction in the outputs of human capital, and the diversity of strategies and solutions developed by each actor for the continuous lifelong improvement of skills and knowledge of the human factor in an inclusive, trustful environment. At the *Eso* level the value creation of the conceptual framework is illustrated according to the benefits construed for the actors within that level, that is the Government, Ministry policy makers, stakeholders and beneficiaries of the ecosystem. The *Macro* level relates to the outputs of the conceptual framework of human-centric innovation ecosystems as well as the benefits for all actors of the ecosystem.

1.5. Summary of the Critical Assessment

From the critical analysis, innovation ecosystems, human capital and the peculiarities of human-centered *type* higher education institutions are disruptive terminologies that enhance the social and economic value of the novelty of human-centric innovation ecosystems. The analysis indicates that innovation ecosystems in scientific literature have evolved from business to entrepreneurial innovation ecosystem model. These types of innovation ecosystems are not the same as human-centric innovation ecosystems though they share a common actor, the human factor. Human-centric innovation anthropocentrically is a term that describes innovation that improves the quality of life for humans and human-centric innovation ecosystems are the networks that permits the creativity process with humans involved. Innovation ecosystems from business to knowledge-based types are complex evolving systems linked to the concept of open innovation and co-creation. Analogizing these ecosystems through New Institutional theory, Resource Dependency Theory and Isomorphism Institutionalism uncovers the key features for the human factor necessary for human-centric innovation ecosystems. In addition to systemically examining the bearing effect of the higher education policy on the development of the talented human capital, the value promulgation of such a platform increases exponentially. The role of human factor in human-centric innovation ecosystems thus requires an education policy that fosters the nurtured and educated skills capacities of individuals.

The cognitive abilities of the human capital such as individual personality traits, a global mind-set, creativity, critical thinking, problem-solving, analytical and decision-making skills, as well optimism, empathy and motivation highlights the economic and social value of human capital development attained through lifelong learning education. Linking these human-centered attributes, human capital, is indeed related to quality innovation ecosystems. In addition to the aggregate of abilities garnered as well as the basic competencies acquired from the *natural* surrounding environment of a human being's life proves the aggregation of this invaluable 'capital'. Contextually within strategic management, human capital as a managerial resource in organizations can be *resource-base* (Penrose, 1959), *knowledge-base* (Al-Alawi et al., 2007), *a dynamic capability(ies)* (Teece et al., 1997), or as *competencies base* (Mahoney and Kor, 2015).

The analysis further indicated the need to consider the models of higher education system as generated through the national education policy during the empirical research. This is requisite in order to understand the development and management of human-centric innovation ecosystems, the ecosystem's limitations and benefits, the traits of the human capital linked to quality innovation outputs, the external and internal network environment of the higher education sector as well as the ecosystem's position relative to these models of higher education systems. Moreover, the assertion that though higher education policies could influence the prospective development of human-centric innovation ecosystems, higher education institutions would benefit from the evaluation on the managerial issues of such ecosystems holistically. This leads to greater strategic perceptiveness on how the human-centered aspect of innovation progresses in ecosystems and the depth of cooperation with the other stakeholders that are specific to enable HEIs ecosystems to contribute to quality innovation through the talented human capital. The comparative analysis revealed key important limitations of the critical analysis conducted. Using the theoretical rationale developed, the significance of reviewing actual cases of higher education policy systems that impact human-centric innovation ecosystems development, the position of policy to the interdisciplinary framework of management of the innovation and innovation ecosystems is identified.

The analysis focused on the challenges at the macro, eso, meso, micro and individual levels of the EU relating to policy-making systems governance strategic approach to innovation to the higher education sector. Although the main essence of the analysis was focused primarily on the policy then secondarily on the internal and external environment, all stakeholders of an ecosystem network and the outcomes of policy impact, a further qualitative analysis using a single national case is needed. The knowledge-building feature applied focused on the dilemmas and challenges of each Member State as well as interpretation of the outputs of the policy ecology reflects the targets for innovation. The is due to the diversity of each national case which should be considered in the added analysis. From the comparative analysis, the higher education sector of each national case was assessed according to the authentic contexts and associative interdisciplinary collaborative activities of each stakeholder or institutions responsible for contributing to developing quality innovation ecosystems leading to innovation. The analysis additionally provided knowledge building on the associative meanings behind the implications of policy that results from gradual development of human resources through the higher education sector's internal and external environments. This could serve as a suggested approach to gain insights on the strategic background of regional innovation linked to the higher education sector. The comprehensive analysis provided more effective and evidence based strategic planning and management of education and innovation-based ecosystems. Thus, more effective ecosystem management would have a positive impact on the competitiveness of human-centric innovation ecosystems for higher education institutions.

The observations identified in each national case was useful to improve the conceptual framework developed which can only be validated further through an empirical qualitative research on one of the EU Member States. In order to assess the higher education policy impact on human-centric innovation ecosystems, the Republic of Lithuania will be used as the experimental variable for the research as its policy of higher education is sufficiently similar to other EU Member States mandated by the European Commission. Contextually as an EU Member State, Lithuania geographically forms part of the European Higher Education Area (EHEA) and shares similar European historical, political, social and cultural origins in higher education. The empirical analysis focus is on the extent to which knowledge, skills development and training disseminated to the human resources leads to human-centric innovation ecosystems. Thus, more effective ecosystem management would have a positive impact on the competitiveness of human-centric innovation ecosystems for higher education institutions. The empirical research should support the management and strategic use of the conceptual framework of human-centric innovation ecosystems in order to strengthen the competitiveness of the higher education sector. The empirical research should validated if the conceptual framework developed for human-centric innovation ecosystems is correct, as well as any further practical and theoretical significance identified from the evaluation on the findings. The empirical research should also assess the performance of higher education sector and structure referring to the qualitative and quantitative data collected on higher education institutions, its stakeholders, beneficiaries and networks. The instruments for testing will be qualitative experts semi-structured interviews and case study on Lithuania. The findings would stand as a provision for the development of managerial solutions to the challenges and issues faced by the higher education sector, which amplifies the relevance and usefulness of the evaluated conceptual framework of human-centric innovation ecosystem.

2. RESEARCH METHODS

2.1. Methodology

2.1.1. Rationale of the Grounded Theory Methodology

The aim of empirical research is to assess the impact of the higher education policy on human-centric innovation ecosystems development. The research design centers primarily on the main research question and the methodology chosen. This section reviews the applied methodology, within a wider context, according to the research study on the impact of the higher education policy on human-centric innovation ecosystems. The aim of this analysis is to outline the background of the research and justification for choosing the grounded theory (GT) in order to develop a deeper understanding of the phenomena. This section also provides the open, axial and selective coding processes as well as the epistemological, ontological, axiological and philosophical orientation used, while referencing the essence of the study design of the research. While methodology is a way of thinking when studying a particular social phenomenon, it is *the methods* that determines the methodology and methods applied to conduct the investigation of the research study. Qualitative research permits a greater understanding to a particular phenomenon and the development empirical knowledge is the method applied for connecting the object under study at the human level. As mentioned earlier, grounded theory is a specific methodology developed by Glaser and Strauss (1967) for the sole purpose of building theory from data. The epistemology behind the grounded theory methodology is Chicago interactionism (symbolic interactionism), Dewey, and Mead's Pragmatist Philosophy of Knowledge- *pragmatism* (Corbin and Strauss, 2008; Strauss 1991). Demonstrating both in simpler terms, Blumer (1969), states that symbolic interactionism is form of interaction occurring between persons where the distinctiveness lies in the interpretations of these interaction according to the actions rather than the reactions of the persons involved. Mead (1965) states that pragmatism and its origins lies out of the interest and relationship to the act or actions between persons (Corbin and Strauss, 2008). Dewey and Mead counters that knowledge results from actions and interactions. Knowledge is developed or created through the acting and interacting with the self-reflective being. Dewey (1929) have stated that ideas are not statements of what is or should be, but rather acts that should be performed. Moreover, pragmatism advocates that the single individual rather than a team or organization that discovers or create some new understanding of reality, through being already socialized with these inherent perspectives (Corbin and Strauss, 2008). Human-centric innovation ecosystems create and drive innovation rather than organizations *(institutions)* due to the natural skills inherent within and the undeveloped skills that are instilled through formal education systems. The research methodology is primarily built on the researcher's views and postulations (Cutcliffe and Harder, 2012; Birks and Mills, 2015), which forms part of the overall research design, according to Figure 9.

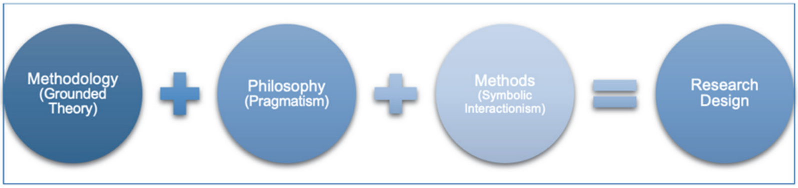


Figure 9. *Research Design*
Source: Developed by the Author

Accordingly, incorporating the methodological, philosophical and methods used to form the design of the research, the author initially identified which parts of paradigms relating to innovation and ecosystems development will be evaluated in order to answer the research question. The interpretive paradigm is appropriate for generating an understanding of social phenomena and is the paradigm integrated into the study. Overall, for innovation ecosystems and applying the epistemological (the scientific paradigm), the sociological (the interpretive paradigm), and exemplars (the critical paradigm), the author demonstrates the essence of incorporating both interactionism and pragmatism into the research design for generation of the themes relative to the human-centered attributes for the strategic process. The interpretive paradigm from a subjective stance, assumes that several paradigms exists and that individuals construct their own social realities. Hence, the new findings or knowledge generated through symbolic interactionism between the researcher and the research group during the investigative stage co-constructed between the two said groups is achieved (Corbin and Strauss, 2008).

By applying the interpretive paradigm to the research, the language used throughout the research should align to the paradigm stance. Thus while the positivism in general will term the research group as 'subjects' that do not participate or have any role during the research process, in interpretivism the research group on the other hand are referred to 'participants' that contribute and have a shared role during the research process. Bearing this in mind, the author purposefully during all stages of the research process ensured that a consistent balance prevailed between personal preconceived notions and perspectives held on innovation and ecosystems. Thus, the applicable methodology and methods and the actuality of the situation existing in the participatory research area, where Lithuania as a Member State of the European Union would be the experimental variable for the empirical research. The main assumption is that the cognitive, behavioral and developed skills as it relates to the human factor as strategic managerial resource in human-centric innovation ecosystems is shaped by formal higher education systems. From a wider context of the EU, national higher education policies, formed through the directive of the European Commission acts as the setting for the controlled laboratory research.

Referring to the epistemological, ontological and axiological approach applied, epistemology uncovers the relationship between the social actor and the new knowledge (*that is*- what can be known), ontology the social reality or what reality actually is (actuality), and value and beliefs of the researcher, axiology (Strauss and Corbin, 1998; Sexton, 2003; Weber, 2004; Strauss and Corbin, 2008). Once these positions were established by the author, it was imperative that the consistency and methodological awareness was emphasized throughout the entire course of the research as well as the inherent biases of author and the assumptions eliminated. While there was no evidence of the latter, the author already understood that the system of higher education of Lithuania is developed according to the regional targets, vision and mission and overall agenda and policy of the European Commission. Furthermore, the system is a product of constructs that are irrespective of socio-economic actualities, demographics and social dynamics, culture and historical background of each Member State. Further on, it is then implemented at the national level through the Government. Hence, it was crucial to ensure the chosen research methodology and design addressed the initial assumptions raised by the author. This essentially demonstrates the research novelty. Finally, achieving methodological congruence is essential as it demonstrates the uniformity and consistency of the research particularly in consideration of the assumptions related to the epistemological and ontological approach used. The importance of methodological positioning has been pointed out by (Strauss and Corbin, 1998) as it is acts as the core essence of the research study. Methodological positioning deflects the possibility of potential biases arising during the analysis of the findings and the final conclusions derived (Strauss and Corbin, 2008).

To understand how the higher education policy impacts the development of human-centric innovation eco-systems, the qualitative approach permits going further below the surface to the human-centered meanings and purpose connoting to innovation and ecosystems and appropriate methods to apply to the empirical research. Qualitative research, as a methodology, contains general assumptions that should be integrated, along with the role of the author into the research design. The Figure below outlines how this was incorporated into the research design and the main assumptions of qualitative methodology outlined, in selecting the approach to the research study:

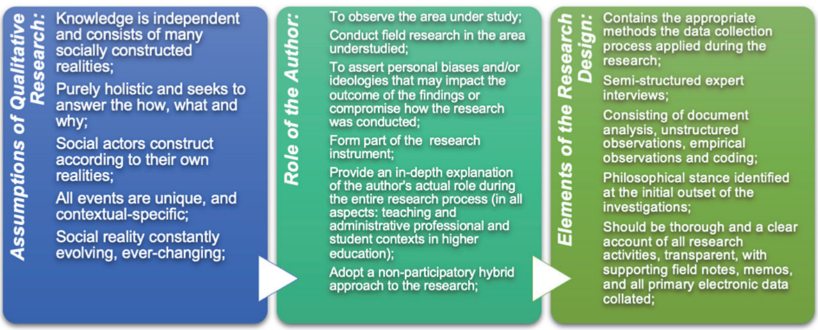


Figure 10. *Selection of the Research Methodology and Main Assumptions of the Qualitative Research*
Source: Developed by the Author

By interconnecting the philosophical, the selected methodology, the appropriate research methods and instrument, consistency and fluidity is maintained throughout the entire investigations in a systematic manner. The perspectives in which data is analyzed can affect the method of interpretation and how it is viewed. Hence, it is imperative that the appropriate methodology is chosen as it will be the main factor that demonstrates that the author aims to provide credibility and validity of the research conducting, while highlighting the research novelty and adding to the existing body of knowledge. Research methods denotes the practical aspects of the research study, 'the how' of the methodology and how the concept of the methodology was applied during the research. The philosophical position of any qualitative research is a key and fundamental step during the research.

Symbolic interactionalism is the viewpoint used to analyze data generated from grounded theory research and is deeply rooted in pragmatism (Chicago Pragmatism) (Mead, 1965; Blumer, 1969; Corbin and Strauss, 2008). Chicago Pragmatism is deeply link to the works of George Herbert Mead who was heavily influence by the perspectives of Charles Darwin (Blumer, 1969; Mead, 1965; Corbin and Strauss, 2008). As human beings are the core and driver of these ecosystems, Mead's pragmatic perspective, from a behavioral and social evolutionary approach, states that human beings are ever-changing organisms, adaptable and highly responsive to changes in their surrounding environment through actions and interactions with it, thus the changes adapted are not reactionary. Therefore, in applying this within the context of innovation and ecosystems, human beings in a false consciousness state, inadvertently create innovation and precedingly form ecosystems due to certain interaction with other stakeholders and network relevance. As behaviorists believe that human beings can be understood according the associative meanings from observed behavior, Mead points out that there is more to the meaning behind the behavior. Therefore, symbolic interactionism, the hybrid form of pragmatism and behavioral perspectives is used to reinforce the approach outlined in the research design of this dissertation study. This is due to the underlying meanings of observed behavior which cannot be taken at 'face-value' (Mead, 1965). This is relevant to human-centered design approach in strategic management systems. Applying it to the actuality of the higher education policy and the outcomes of formal training and educating of the human factor as a strategic resources for ecosystem development, the preconceived notions that individuals should be readily equipped with the skills as demanded by the local labor market of Lithuania, what then determines 'the right skill-sets'? Should it be literacy, numeracy, problem-solving skills or industry-specific skills such as engineering or nursing accumulated through formal educational processes? In an extension, does the behavioral meanings underlying the policy of higher education in approving the type of formal education offered by state and privately own tertiary institutions are set from a purely humanistic or a silo approach? Human acts, actions and interactions are characteristics of the human-centered design and human beings generally tend to 'gravitate' towards processes on the basis of the associative meanings to objects. Contextually, formal higher education systems linked to quality innovation ecosystems do not operate as silos due to the interactive acts and actions involved. Though formal education or training at quality tertiary education institutions tends to lead to meaningful employment with the associative privileges, status, benefits, skills or knowledge termed 'human-centered, self-actualized realization of talents' should be attained in order to satisfy the both human and organizational needs in strategic management. Hence, human-centric innovation ecosystems are fundamentally hereditarily human-centric due to the humanistic network feature.

The meanings formed during symbolic interactionalism are the social products of the interpretive process. This entails information exchange analyzed according to main idea or purpose of the interaction. The approach entails extracting the behavioral meanings, social interactions and roles with the researched phenomena. When the interview method is used in the symbolic interactionalism process, careful documentation and interpretation of data correctly is crucial for capturing the social reality and translating it into themes useful for the strategic processes of developing quality ecosystems. With acts and interactions between human beings, it is very imperative for minimizing ambiguities that could occur in the chosen data instruments for the empirical study. This further reinforces why the interpretive process of symbolic interactionism is applicable within the context of research studies done in the field of educational learning, management sciences especially in the managerial strategic aspects of institutional and human resources planning and management.

Qualitative research that is undertaken using the grounded theory method, must comply fully to that method in order to achieve full richness in the research process. Essentially the author in using this method for the research study, understood that these rules and steps should be adhered, fully (Glaser and Strauss, 1995). These steps include:

- Clear, analytic outline of the research
- Strategies for analyzing the qualitative data
- Coding and categorization
- Theoretical context, process and integration
- Creating diagrams and memo notes
- Theoretical sampling
- Data analysis according to the context
- Constant comparative analysis
- Integrating the categories analyzed (intermediate coding)
- Choosing a main category
- Saturating the theory developed
- Theory integration

Connecting grounded theory with symbolic interactionism, enables linking the research participants' actions to the rationale of the empirical research. On the other hand, it is not mandatory to use the symbolic interactionism perspective approach, due to the potential limitations to the scope of the framework developed from the primary data from literature. Despite this, the most attractive feature of the symbolic interactionism is that it integrates and activates processes when theorizing, which is only executed during the interactive stage with the research participants. This further justifies the selection of using the grounded theory method as it is evidenced to be more relevant to extracting the meanings behind the human-centered design for human-centered innovation ecosystems through the symbolic interactionalism approach. Moreover, symbolic interactionism tends to capture social actors in their active, normal behavior in their environment, then ascribe meanings or symbols to underlying actions or attribute observed and adapt them when the environment changes or evolves.

2.1.2. Data Collection Instruments: Unstructured Observations, Case Study of Lithuania and Semi-Structured Interview Questionnaire

Data collection instruments for the research consisted of unstructured observations, case study and a semi-structured interview questionnaire. The research area for the unstructured observations consisted of the higher education environment of the main university that the author formerly worked, other colleges the author currently works and universities that the author interned and studied. Those unstructured observations, which were done prior to semi-structured interviews with the experts in 2019, lasted for a period of three and half years, during which the internal and external ecosystems of higher education systems, administrative and academic personnel, students and social partners were monitored during all academic, social and teaching activities. The key advantage of unstructured observations as a pilot study is that it enables rich data capture while the main limitation is lack of data replicability (Sapsford and Jupp, 1996; Given, 2008). The case study that followed, focused on how the higher education sector, structured by its strategic mission, inputs and outputs contributes to the development of human-centric innovation ecosystems in the higher education sector. The main advantage of the case study method is that it provides a rich holistic account of the higher education sector, through insights and meanings to the social units linked to it, as well as its replicability feature. The main limitation is generalizability of the findings (Given, 2008). From these observations and previous knowledge, the higher education policy does contribute to ecosystem development which are formed according to their namesake. Some of them which are well-known, entrepreneurial ecosystems, innovation ecosystems, knowledge ecosystems or academic partnerships, or social partners acting as supportive networks to higher education institutions according to a recognized need. The purpose is finding the correlations between policy, ecosystems and other networks, formal higher education and other factors forming the theoretical conceptual framework of human-centric innovation ecosystems that leads to the strategic human-centered design of quality innovation ecosystems.

The questionnaire as seen in Table 6 was designed into sections that covered the demographical and socioeconomic background of the sample as well as the developed theoretical conceptual framework of human-centric innovation ecosystems and concepts from the theoretical analysis. As one of the data collection instruments, it is significant that the questionnaire is structured in parallel to the developed theoretical conceptual framework of human-centric innovation ecosystems in addition to the concepts and structure of the theoretical background analyzed.

Table 6. Structure of the Data Collection Instrument

Framework of the Semi-Structured Questionnaire	
Correlation between the higher education policy of Lithuania and the development of human-centric innovation eco-systems	**SECTION 1** Demographic background and definitions of the important terms used in the questionnaire;
	SECTION 2 a) Correlation between talent development (local and international qualified or skilled graduates with higher education) to innovation: - *Question 7, Question 10;* b) Higher education impact/ influence/contribution to innovation: - *Question 8;* c) Framework of the higher education policy feasible for the development of human-centric innovation ecosystems: - *Question 5;* d) Potential contribution of the highly educated human capital in human-centric innovation ecosystems to the knowledge and commercial economy: - *Question 11;* e) Socio-economic, industry, academia and sectorial environmental factors that potentially permits human-centric innovation ecosystems development: - *Question 1, Question 3, Question 4, Question 6, Question, 9, Question 12;* f) Skills that the highly educated human capital should possess for the development of human-centric innovation ecosystems: - *Question 2.*

Source: Developed by the Author

Therefore, the correlation between talent development to innovation is substantiated according to the theoretical concepts of Khasawneh (2010), Becker (1964: 1983), Ramírez-Córcoles and Manzaneque-Lizano (2015), Ramírez-Córcoles and Gordillo (2014) and Pedro et al (2019). The conceptual theoretical framework of human-centric innovation ecosystems demonstrates that this should occur during the consumption stage of human capital and talent development leading to the outputs of human-centric innovation ecosystems. For the research, it is important to identify the impact, influence and contribution of higher education attainment to innovation. The theoretical analysis asserts that according to research conducted by Schultz (1961), a linear relationship exists between tertiary level education attainment and economic growth. Additional research conducted by Zaharia et. al. (2016) and Chang et. al. (2019) supports that the higher education sector does contributes to both individual and societal advancement leading to the GDP growth of nations. This is further evidenced by Gao (1998) in a study conducted on the success of emerging economies such as South Korea, Singapore, Hong Kong and Taiwan. Furthermore, applying the Knowledge Base, Competencies, Resource Base and the Dynamic Capabilities View (Al-Alawi et al., 2007; Penrose, 1959; Mahoney and Kor, 2015; Teece et al., 1997) intellectual capital is perceived as an important resource for the framework of knowledge resources related to the ideas and capabilities of the human capital leading to knowledge creation (Kamath, 2007; Ramírez-Córcoles and Gordillo, 2014; Pedro et al., 2019). The theoretical analysis asserts that by applying intellectual capital framework to the context of higher education systems (Leitner, 2004; Pedro et al, 2019), higher education attainment outcomes futuristically influences or impacts the type of governance systems, mission, administration, structure and organization of higher education institutions. Therefore, as higher education attainment should occur during the consumption stage of human capital and talent development leading to the outputs of human-centric innovation ecosystems according to the developed conceptual framework, the questionnaire should substantiate these theoretical assumptions.

The potential contribution of the highly educated human capital in human-centric innovation ecosystems to the knowledge and commercial economy, New Public Governance (NPG) theory initially states that end-users of HEIs public services are research and knowledge driven organizations involved in the development, creation, dissemination and preservation of knowledge. As theoretical analysis asserts that NPG redefines the tasks and responsibilities of HEIs as critical actors in national innovation systems contributing to the Europe of Knowledge (OEU, 2006; Pedro et al. 2019), the data derived through the questionnaire should substantiate social and economic value of human-centric innovation ecosystems as a strategic resource to the knowledge and commercial economies.

The socio-economic, industry, academia and sectorial environmental factors are crucial for the development of human-centric innovation ecosystems and its subsequent implementation as a strategic resource during the planning and design stage of the higher education policy for the higher education sector. One of the main assertions found in the theoretical analysis are that reforms leading to a revised curriculum for academic and vocational education permit a student-centric type higher education necessary for human-centric innovation ecosystems development. The reforms then further lead to higher education institutions that contributed to talent development aligned to a qualifications-based innovation ecosystem, analogized to human-centric innovation ecosystems, that factors the socio-economic, industry, academia and sectorial environmental respectively. As proposed by Alva (2019), the desired competencies of the human capital should encompass one or more attributes of the Resource Base View, Knowledge Base View, Dynamic Capabilities View and the Competencies View theories (Mahoney and Kor, 2015; Teece et al., 1997; Penrose, 1959; Al-Alawi et al., 2007). The conceptual framework of human-centric innovation ecosystems asserts that all attributes embodied effectively links multilaterally the competencies of the human capital developed to academia, industry and economy when the ecosystem is used as a strategic resource. The developed questionnaire should address these theoretical assumptions.

The skills that the highly educated human capital should possess for the development of human-centric innovation ecosystems is significant according to the developed conceptual theoretical framework of human-centric innovation ecosystems. The theoretical analysis states that the key features of the human factor for human-centric innovation ecosystems are conceptually analogized through the New Institutional (NI), Resource Dependency (RDT) and Isomorphism Institutionalism theories as an intangible and tangible resource for innovation. Furthermore, as the theoretical analysis asserts that within an ecosystem context, the cognitive abilities and skills of the human capital derived from through socialization and formal academic higher education are related to quality innovation ecosystems, human-centric innovation ecosystems as a quality innovation ecosystems that utilize the intangible resources of the human capital can be a quality strategic resource for the higher education sector. The questions developed in questionnaire should substantiate this claim.

Eleven experts formed the sample of the questionnaire interviews and represented all spheres relevant to the researched environment of Lithuania. All interviews were conducted for the period of September 2019 to October 2019 in Lithuania, done in-person, with each member of the sample at their place of employment. The time duration of each interview spanned from forty-five to seventy-five minutes. Within the research context, human-centered design methods for the strategic management framework was applied in order to gain the required insights of the research. It was imperative that the questionnaire tool developed enabled stakeholder mapping across the questions formulated, storytelling to the cultural, social and historical exploratory frameworks of Lithuania's higher education and innovation according to the context of the research. An internal and external approach was applied to the questionnaire design in order to include the feedback of all the experts representing the stakeholders of the research area as well.

Table 7 provides more information on the relevance of each expert field of specialization to the research.

Table 7. *Field of Specialization of the Sample*

EXPERT	SPECIALISATION	POSITION	EXPERIENCE
DT01	Public Policy, Administration, Management and Planning (Education, and Sciences)	Minister	$\geq$ 30 – 35 years
DT02	Administrative Management and Innovation Support	Lower Management Level	$\geq$ 5 – 10 years
DT03	Public Policy (Education Policy)	Middle Management Level	$\leq$ 5 years
DT04	Public Policy (Human Capital)	Analyst	$\leq$ 5 years
DT05	Public Policy, Administration, Management and Planning (Innovation, Industry and Commerce)	Vice-Minister	$\geq$ 35 years
DT06	Public Policy (Innovation, Industry Management and Planning)	Advisor	$\geq$ 15 – 20 years

EXPERT	SPECIALISATION	POSITION	EXPERIENCE
DT07	Innovation, Industry and Commerce Management and Planning	Chief Official	≥ 5 – 10 years
DT08	Higher Education Institutions and Public Policy (Innovation, Industry and Education)	Analyst (Part-time Higher Education Institution Lecturer at Vilnius University)	≥ 15- 20 years
DT09	Public Policy (Science Technology and Innovation)	Middle Management Level	≥ 5 – 10 years
DT10	Higher Education Institution Administrative Strategic Planning and Management	Rector's Advisor (Former Vice-Rector)	≥ 15 – 20 years
DT11	Innovation	Associate Professor	≥ 10 – 15 years

Source: Developed by the Author

Further field notes was taken by the author on other additional information from the sample deemed relevant to the research. In most cases, these interviews would last for an additional thirty minutes on average. The constant comparative analysis was then applied to all data instruments used as it was key to validate the findings of the empirical research done. Using all instruments, the entire data collection process spanned for a period of four (4) years.

2.1.3. Sample Selection Criteria for the Experts' Interviews

The research examines the conditions of the higher education sector through the higher education policy to develop human-centric innovation ecosystems. Lithuania is the chosen focus country where the higher education policy of this nation researched and evaluated according to these specific parameters:

(1) The qualitative indicators and features for human-centered attributes and their associative implications to policy regulating the higher education sector;
(2) Talent development to innovation for the knowledge and commercial economies;
(3) Human-centric innovation ecosystems position in higher education sector and the qualitative and quantitative inputs, processes, outputs and outcomes from higher education sector, stakeholders and its networks.

A key way to understand the conditions that attribute to this value are finding experts with the relevant knowledge and experience. This group should be specialists and information-rich on the areas of public policy, strategic planning and management systems, innovation and technology, human capital and education policy, research, innovation ecosystems and innovation management. In addition, how human capital development and higher education attainment linked to HEIs are inclined to the human-centric strategic approach to learning and teaching. Through the New Public Management approach, how Lithuanian HEIs as public and private institutions are managed and regulated by the higher education policy influence the amount of interaction with an innovation ecosystem. As a valuable source of data frequently used in qualitative research, experts can provided greater theoretical insights and reflection in new emerging phenomena (Nohl 2009). As there are a plethora of research utilizing many types of data-analytic methodologies to analyze impact, the approach of conducting a research purely reliant on the narratives of eleven experts to explain how the impact generates expounds beyond the limitations that the quantitative approach of survey studies provide. The narratives provided by experts transmits and amplifies the information of these impacts within the set parameters provided and beyond.

Though the main drawbacks of this approach would obviously be the lack of generalizability and accurately determining the causality of the impacts with the processes, inputs and outputs of the research phenomena, this approach deters information deficits of the quantitative approach. There are already many quantitative studies demonstrating that policy regarding higher education contributes to innovation ecosystems, however the qualitative approach to research how it impacts, permits greater analysis to communicate the main features of these impact pathways. This is via way of the narrative from the experts and the empirical evidence from the case study done (Bogner et al, 2009). In addition to standardizing the empirical research, the experts chosen for the research are in a unique position in offering their expertise from their experience and knowledge of Lithuania and anecdotal evidence to validate the theoretical reflection of the area chosen. The author recognized that though the theoretical evidence of human-centric innovation ecosystems to higher education prevalently derives from hypothetically based evidence from qualitative methodologies during the literature research, the practical evidence authenticates and provides opportunities for future research.

The finalized group of experts should be individuals aged 30 years or older, having 5-10 years' experience providing independent, research-based information required to make evidence-based public policy decisions to public institutions in Lithuania. In addition, these individuals must have experience and knowledge in the areas of higher education systems, governance, monitoring and functions of Lithuanian HEIs. Knowledge and expertise on the strategic processes of education and innovation policy of Lithuania, human capital development, policy leading to strategic management and planning of human resources and institutions, as well as the strategic management of science, technology and innovation outputs in Lithuania is requisite. It is imperative that the age demographic for the research is adhered as it coincides with the period that Lithuania gained its independence in 1991, marking the transitional stage of the country from a planned to a market economy. The 'cold' contact method was used to contact the participants of the sample. Nineteen (19) experts initially had been contacted to participate in the research. Applying the snowball sampling approach to complement the purposive sampling, where the contact of one expert led the author to contact other expert(s). From the initial number of participants that were invited to participate, thirteen (13) agreed to be interviewed. The preliminary composition of the sample comprised:

- One (1) University Rector;
- One (1) former University Vice-Rector;
- Three (3) Senior Government Ministers;
- Two (2) Senior Researchers;
- One (1) Policy Analyst at the Science, Technology and Innovation Policy division at MOSTA;
- One (1) Policy Analyst at the Human Capital Division at MITA;
- Two (2) Policy Analysts at the Agency for Science, Innovation and Technology MITA;
- One (1) Senior Advisor
- One (1) Chief Official at the Ministry of Economy and Innovation.

This represented a variety of professional experiences and academic ranks.

The snowball sampling method works in conjunction with purposive sampling. While snowball sampling is not suitable as the main primary sampling approach, it was the best form of non-probability sampling method that would work well base on the defined criteria of the sample selected for the research. Moreover as a complementary strategy to purposive sampling, it enabled a deeper level of detail as well as enriched data capture and highlighted several elements of the research not initially considered. Another drawback is that there are limits set to access a larger pool of experts. Since statistical sampling methods did not form part of the research, snowball sampling method tend to include samples that form some population with common features. Additionally, snowball method also requires additional data when evaluating the impact of the higher education policy to human-centric innovation ecosystems. Hence assessing the impact indicates the correlation between both.

Another drawback of the snowball method is that if this sampling starts at the wrong point of contact, then it is possible to miss a whole network, or small sub-sets of network contacts that are linked to criteria of the research but not connected to the starting point of contact, (Hanneman, 2005). Purposive sampling approach enabled the author to cover networks related to the research by asking contacts interviewed to recommend other contacts suitable according to the selection criteria for experts (Cohen, 2013; Crabtree and DiCicco-Bloom, 2006). Purposive sampling in qualitative research is another type of non-probability sampling that permits a researcher to define the criteria of the selected sample with the purpose that the sample is representative of the chosen study area according to the criterion set (Ritchie et al., 2003). Purposive sampling not only permits the author to better critically analyze the data derived from the interviews and but also define the parameters of the population chosen for the study (Miles and Huberman, 1994). The fact that Lithuania chosen as the selected focus country for the research meant that field of expertise was quite small for the research. Prior to conducting the research, this would be problematic in finding the right sample number. However, according to research works reviewed for the selection of participants forming the acceptable sample size for grounded theory studies, Morse (1994) argued that the sample size number should be approximately thirty-fifty and Creswell (1998) twenty-five though no scientific evidence to validate these recommendations exists (Guest et al. 2006). Hence, theoretical sampling become becomes crucial during the data collection stage of the research (Thomson, 2011). A sufficient, handful of experts that fulfil the entire criterion set in the purposeful sampling can form the sample for interviewing to confirm or disconfirm the findings (Guest et al. 2006; Thomson, 2011).

Initially, though nineteen experts formed the original group of informants, it was through the snowball method the author source the qualified experts according to the criterion set and the informants' recommending them. The snowball ball strategy used at the initial start of the research aided the 'cold' contact process of the research. Initial cold contacting led to the provision of a list experts from STRATA in senior management positions that could can cover different topics for the interview. Albeit from the Science, Technology and Innovation Policy division – two experts recommended, the Education Policy division – two experts and for the Human Capital division – one expert, recommended respectively. While the author in initiating contact to organise the possible dates to conduct the interviews with the recommended experts, data saturation was prevented when only one expert per division consented to be interviewed. For the contact process at the Ministry of Education, Science and Sport, applying the snowball method, the author initially contacted four experts during the month of September 2019, The Minister, two (2) Vice-Ministers and a senior advisor at the Ministry. In this instance, the Minister agreed to participate. For the contact of top management at the State-owned, higher education institutions using the snowball method ideally it would be adequate have at least one Rector or Vice-Rector of a researched-focused HEI and a technically focused HEI participate as experts. In the end, a former Vice-rector of a State-owned HEI, which is both a researched and a technically focused HEI, participated as an expert. For the other organizations such as MITA, MRU LABS and the Ministry of Innovation and Economy the snowball method applied as well. At the Ministry of Innovation and Economy, the contact of one expert led to the contacts of three experts: the Vice-Minister, an Advisor and a Chief Official. At the MRU LABS, the contact of the first expert interviewed for the research led to the contact of the former Head of the Business and Innovation Laboratory and an additional contact from MITA that worked as a professor and researcher at Vilnius University. The final composition of the sample comprised eleven experts:

- One (1) former University Vice-Rector;
- Two (2) Senior Government Ministers;
- Two (2) Senior Researchers;
- One (1) Policy Analyst at the Science, Technology and Innovation Policy division at MOSTA;
- One (1) Policy Analyst at the Human Capital Division at MITA;
- Two (2) Policy Analysts at the Agency for Science, Innovation and Technology MITA;
- One (1) Senior Advisor;
- One (1) Chief Official at the Ministry of Economy and Innovation.

Table 8 outlines the features and background of the sample selected for the research. Accordingly, the sample participants were assigned primary codes based on the chronological date order each interview occurred.

Table 8. *Features and Background of the Sample*

EXPERT	SECTOR / INDUSTRY	ORGANIZATION	EXPERIENCE	POSITION
DT01	Government	Ministry of Education, Science and Sports	≥ 30–35 years	Minister
DT02	Innovation Support Center and Laboratory	MRU LAB	≥ 5–10 years	Lower Management Level
DT03	Public Sector	MITA	≤ 5 years	Middle Management Level
DT04	Public Sector	MITA – Human Capital Division	≤ 5 years	Analyst
DT05	Government	Ministry of the Economy and Innovation	≥ 35 years	Vice-Minister
DT06	Government	Ministry of the Economy and Innovation	≥ 15–20 years	Advisor
DT07	Government	Ministry of the Economy and Innovation	≥ 5–10 years	Chief Official
DT08	Public Sector Agency	MITA	≥ 15–20 years	Analyst (Part-time Higher Education Institution Lecturer at Vilnius University)
DT09	Public Sector Agency	MOSTA	≥ 5–10 years	Middle Management Level
DT10	Higher Education Institution (State-owned University)	Klaipėda University	≥ 15 – 20 years	Rector’s Advisor (Former Vice-Rector)

EX-PERT	SECTOR / INDUSTRY	ORGANIZATION	EXPERI-ENCE	POSITION
DT11	Higher Education Institution (State-owned University)	Mykolas Romeris University (Former Head of Business and Innovation Laboratory at MRU LAB)	≥ 10 – 15 years	Associate Professor

Source: Developed by the Author

Before interviewing the sample, a written invitation sent by email to confirm their participation in the research. Initially, though sample consisted of nineteen persons with thirteen agreeing to be part of the sample, two participants, a senior Ministry official and the other, the Rector of Vilnius University, due to each having intensive work schedules unfortunately could not participate.

The author then carried on with the research with the eleven participants forming the final sample as the percentage amount when calculated from the initial amount selected equaled to fifty-seven percent (57%), which is substantial beyond the adequate minimal ratio required for the research. In addition, bearing in mind the central theme of the main research question and the purpose of the study, the questions formulated for the semi-structured expert interviews were structured accordingly. At the beginning of each section, consent to record was granted and the author briefed each of the participants of the terms and definitions used and whether clarifications or explanations were needed, to avoid ambiguity. After this part was done, the interview proceeded. The questions that formed the questionnaires were open-ended and leading questions were used to encourage the participants to offer a deeper perspective to the answers provided along their line of expertise and observations. This was done due to the fact that all participants were 'questioned' in the English language which is not their native mother tongue and the leading questions provided support in understanding the main questions asked. In addition, each sample member were asked to share their perceptions on how they viewed their professional roles and expertise in relation to the present conditions of the higher education policy, human capital, innovation management and development, and ecosystems emergences, processes, factors and actors that they considered as significant issues.

The sampling process extended to the theoretical and data saturation phase. For this process, it was imperative have an inclusion and exclusion criteria. The exclusion criteria as already mention were the participants that were unwilling to participate in the study, while the inclusion criteria were the years of experience of the participants, which was a minimum of five to ten years of experience. For those falling short of the inclusion criteria, at least one expert should possess up to twenty years of experience and designated the leader of the organized group of the same specialty. This occurred for several experts from MITA, MOSTA and the Ministry of Innovation and Economy.

2.1.4. Methods: Qualitative Unstructured Observations, Case Study and Interviewing of Experts

The research methods are the practical part of the dissertation study and should be aligned according to the chosen methodology and philosophical perspectives. This ensures consistency throughout the research process (Cutcliffe and Harder, 2012). If this is not achieved or maintained, then uncertainty surrounding the validity of the findings and veracity of the research process can arise (Cutcliffe and Harder, 2012). In discussing the research methods carried out, the steps of the grounded theory methods that will be applied to several parts of the research are revisited below:

- initial coding and categorization;
- concurrent data collection and analysis;
- creating diagrams and memo notes;
- theoretical sampling;
- constant comparative analysis of the data using inductive logic;
- theoretical sensitivity; intermediate coding;
- identifying the categories (from the intermediate coding process);
- integrating the categories analyzed;
- choosing a main category then saturating and integrating the theory developed.

This process required the author to become fully immersed in the research as the data developed is core and integral to the entire process (Birks and Mills, 2015). Initially coding and categorizing data was the first step of the data analysis stage of the research. This method provided a way for the author to identify important words or phrases in the data, then assigning labels to them, appropriately (Birks and Mills, 2015). Using NVivo, codes were labelled from *verbatim quotes* derived from the experts while the categories formulated were the *groups of codes* that are related. The latter often is termed *'theoretically saturated'*, particularly when the new data analyzed brings forth codes that fits in the existing categories set (Birks and Mills, 2015). Crucial and first principles to the grounded theory design is the concurrent data generation process, where the data generated was collected initially through purposive sample then coded before more data is generated; the process itself is very repetitive and should be done concurrently. For this research, though no codes were initially assigned during the unstructured observations phase and collation of memos, two theoretical propositions were asserted prior to the data collection process and theoretical sampling (Glaser and Strauss, 1967; Birks and Mills, 2015), and are:

1. The higher education policy through institutions and resources formally develops inherent human-centered attributes of talent in human-centric innovation ecosystems for quality innovation.
2. The higher education policy has no effect on the development of human-centric-innovation ecosystems.

For this research, it was important to highlight the crucial role of theoretical sampling particularly when the existing information present is insufficient and more data is needed to fully saturate the categories that are underdeveloped. In this case human-centric innovation ecosystem as a category is fully underdeveloped, particularly its properties, the conditions or environment in which it progresses, its dimensions or parameters, and its relationship with *'other'* themes for its development, whether it be through the public higher education policy networks and or in private organizations networks. As this approach was applied, it aided the author in determining strategically *who* or *what* can provide the most abundant source of information-rich data needed to for the analytical aspect of the research (Strauss and Corbin, 1998).

The author therefore adopted a three-fold approach when conducting the research, where during some points of the research the author had to alternate between the roles of being 'insider' and 'outsider'. The insider role was three-fold, where the author during the early stages of research was a part-time teaching practitioner, where an inward view of the author's own practice of teaching and educating undergraduate students in social sciences subjects aimed at preparing them to be skilled specialists for the Lithuanian and EU labor market was observed as well. Then as a manager initially employed in the International Office then to the Chancellery division of the author's home university in Lithuania, Mykolas Romeris University performing entry-level, ordinary tasks associated with a bachelor's degree level qualification. Lastly, then as a doctorate student understudying and observing the practices and teaching methods of the said university in Lithuania. The role of outsider was adopted by the author when observing and 'looking' into world of Lithuanian tertiary education system. These roles adopted in a four-fold manner where the author steps away from 'being the research', then to 'the researcher' twice, is termed by Hockey (1993) as the *'local becoming the stranger'*. It was very important that the author transformed from the insider and adopt the outsider approach in all contexts in order to maintain objectivity through the research, while keeping a delicate balance between all worlds. Additionally, transitioning from the insider to the outsider lens (perspective), aided the author in reducing familiarity of the research environment(s) and at the same time remaining aware of each situational context. Despite, adopting these approaches for the observation of the research environment, it is very crucial that any researcher conducting a research using the qualitative methodology, have prior knowledge and background to the environment of interest to the research, yet maintaining an 'unflawed' perspective at the same time (Hockey, 1993). Though theoretical sensitivity can occur at the initial outset of the grounded theory methodology, researchers using this approach are likely to become fully immersed over time in the data and this should be minimized as much as possible.

Reflexivity is a key factor that should be utilized in ensuring that richness and research integrity is achieved in the final findings. As the author was aware at the initial outset that as many unfamiliar terms and concepts may arise during the research, it was not mandatory to accept them as the norm. Reflexivity is also linked to symbolic interactionism (Doyle, 2013), more on interaction aspect of social actors creating their reality. Due to the epistemological and the ontological stance of the author, reflexivity reinforces and strengthens the importance of the method for collecting data during the investigations, as it used for interacting, from an outsider role, with the participants selected for the study and should be contextualized, accordingly. The main disadvantage of not incorporating reflexivity into the research process is that the author realized that it could potentially affect the findings, where if the inability of effectively contextualizing appropriately the perspectives of the participants responses onto the time to which the actual study was carried out, the findings derived will be weak and irrelevant (Birks and Mills, 2015).

Another key important part of the research method was the constant comparison process of the data collected. This method is very imperative for correlating a theory to the data collected until categorical saturation achieved. Categorical saturation, forms part of the grounded theory as it enables the theory to be ultimately 'grounded' in as new data. Contrary to other traditional qualitative methods, the research findings treated as facts ensures that the findings presented as explanations on the connections between concepts, which is the main differentiating feature of the grounded theory method (Birks and Mills, 2015). Moreover, all the main elements of the grounded theory traces back to the data. In selecting the research sample, the author undertook a process of 'cold-calling' and 'cold-emailing' to initiate contact. It is important to note that at the time when this was done up to the interview process, the higher education system of Lithuania was still undergoing structural changes due to the State Optimization Plan of the Ministry of Education, Science and Sports. The author's own work institution at that time settling down after undergoing another major internal structural change across all departments due to changes in top management of the university.

The unstructured observations were integral to the research as it garnered, *first-hand*, deeper insights on how the students observed develop critical thinking and problem-solving skills through the learning environment. During those unstructured observations the author took consistent field notes to document what was observed, initially at a part-time teaching practitioner, then at an internship undertaken in 2018 at a private university called Dongseo University (DSU) located in Busan, South Korea. At the time DSU was hosting the annual Asia Summer Programme (ASP) 2018 which consisted of well over twenty-five partner universities and colleges from Asia, Latin America and Europe. This environment was also ideal for the unstructured observations as it gave access observe and study a larger, international platform of higher education institutions practitioners from Asia, South America and Europe. It was also the opportunity to observe local and international teaching approach and methods imparted to such a diverse array of students for several weeks. This observations lasted for a period of three weeks in July 2018 and gave a greater understanding of the context of higher education policy practices and approaches adopted in comparison to Lithuania. Moreover, all the field notes collected from all observations done from 2016-2019 enriched the analysis of the semi-structured interviews conducted with the local experts from Lithuania in 2019. This gave the author the opportunity to analyze the data from different angles, revisit it to identify the consistencies with each expert's responses to the unstructured observations. This approach aided in actualizing each context while checking for any variations arising which further led to several assumptions being raised within each context derived from the data collected.

The case study method was chosen to complement the other qualitative methods used in the empirical research. The case study method allowed further exploration and understanding of complex issues surrounding the higher education sector management and development of the human factor for human-centric innovation ecosystems. In social sciences research, Gulsecen and Kubat (2006) states that case studies are relevant, strong research methods for researching issues relating to education due to the limitations of quantitative research methods to provide a holistic view from statistical results. Moreover, it entails for this research, an in-depth analysis on present and past conditions of Lithuania's higher education sector and the behavioral actions, meanings, and features of social actors and units linked to the sector for ecosystems development. The interpretive approach for the case on Lithuania will enable testing of the data generated from the document analysis by the framework developed to create the sub-categories and concepts. This would support or refute the assumptions derived from the study. As the case study will entail a single case approach, the main advantage of this is that research is conducted within the context of its use. Additionally, data captured in its actuality of environment enables further insights on its complexities than quantitative survey methods would yield (Yin, 1984; Zaidah, 2007). The perceived limitations using the interpretive design is that massive amount of data generated from the document analysis of the single case would lead to generalized conclusions which could potentially affect the validity and reliability of the results (Yin, 1993; Tellis, 1997). To counter this limitation, the author implemented parameter establishment of the researched subject and set objectives for testing.

For the constant comparative method, it was ethical that prior to each interview session to receive their informed consent that confidentiality of personal information would be maintained during and after the research was completed. The role of the higher education policy, as analyzed using the constant comparative method, from the inductive and deductive perspectives, involved comparing all the compiled data from the field notes and observations, as well as the data sources, experts' interviews and the document analysis of literature. Moreover, as an extension to the ensuing analysis, comparison of the codes and assigning the codes to sub-themes, then concept to paradigm was necessary for the full theory development. As grounded theory is termed as a theory-building methodology, derived on inductive reasoning, it was necessary for the author to actively focus on the constant comparison of the data from all sources. Grounded theory is often referenced as a theory-building, abdicative reasoning research relating to knowledge derived from new insights (Bryant and Charmaz, 2007). The constant comparison step was essential for deduction of the themes evident in the research data for the grouping into codes. During the research as more data was generated the themes in data became more and more clear. Once clarification was achieved it was easier to formulate the features of the theoretical sample.

The next step was the theoretical sampling after the interviewing of all experts, in order to extract the queries that emerged during the analysis of the data. Theoretical sampling facilitates the verification of the responses from the interviews in order to achieve conceptual density (point of diminishing return). Conceptual density is very important for the data saturation process. Conceptual density is that point of diminishing return when the data from sample size selected no longer contributes to the new evidence and that the data collection phase is now completed (Crabtree and DiCicco-Bloom, 2006). When all the responses are the same and no new information has emerged during the interviews, it is at that point that the conceptual density process ceases. As data saturation leads to data overload, Ritchie et al (2003) suggests that for qualitative research the sample size is usually fundamentally small. This is owing to the fact that the phenomena needs only to appear once to be included as part of the analytical chart, since after some time data saturation achieved at a point called the diminishing return. Moreover, it could lead to difficulties identifying key areas and themes from the data collected using a large sample size instead. Though the perspective of Creswell (2012) for a qualitative research is to classically study few individuals or cases normal in relation to the sample size, Guest et al. (2006) adds that data saturation (conceptual density) occurs within "the first twelve interviews" conducted, as it is unlikely that new phenomena will emerge after that. This justifies the selection of eleven experts for the research, as qualitative research as a phenomenological approach is one where it is common to have small sample sizes. Moreover, it validates the choice of the grounded theory methodology as well as the use of the snowball sampling strategy as a complement to purposive sampling method. Complementary, the theoretical sampling, as an additional step, ensured verification and validation of the leading answers according to categories and sub-categories derived further down in the research.

The next step of the research was to consistently analyze the data as generated from the interviews conducted. During this stage, all the data from the experts' interviews were carefully evaluated, categorized into themes and sub-themes and then entered into the NVivo software for coding. NVivo, was selected as the productivity software tool for the qualitative research study as it quickly performs queries for key terms and phrases from the answers from research sample, then extracts, organizes, manages and analyses these answers into codes based on the sub-themes and themes developed from data collected during the research. NVivo is very compatible for analyzing qualitative data generated from the grounded theory approach, as aids the author to organize it in a very structured, comprehensive framework of codes for the evaluation and interpretation of data, objectively (NVivo, 2019). The data was then analyzed according to the open, axial and selective coding, also termed as the three stages of the coding process (Corbin and Strauss, 2008).

Open coding was done according to the source structure and style of the semi-structured questionnaire, in order analyze the emerging codes comparatively amongst the experts that formed part of the theoretical sample of the research for each questioned asked. It was imperative to sort the codes according to the structure and style of each question in order to identify the reference code and its' percentage coverage. The reference code is defined as the number of characters that have been coded at each node (theme) divided by the number of characters in the document as a whole, which gives the author a sense of whether a large portion of the data from the interviews have been covered or just a small portion (NVivo, 2019).

***Table 9.** Open Coding According to Source Style and Structure: Thematic*

Experts	Reference Percentage Rate	Number of Data Code Reference	Data Code Saturation Percentage Rate
DT01	98.94%	2	69.49%
DT02	98.05%	1	98.05%
DT03	96.46%	1	96.46%
DT04	97.51%	1	97.51%
DT05	99.16%	3	48.01%
DT06	98.98%	4	28.56%
DT07	98.81%	2	90.88%
DT08	99.51%	1	99.51%
DT09	99.36%	2	54.10%
DT10	99.58%	1	99.58%
DT11	97.78%	1	97.78%

Source: Developed by the Author

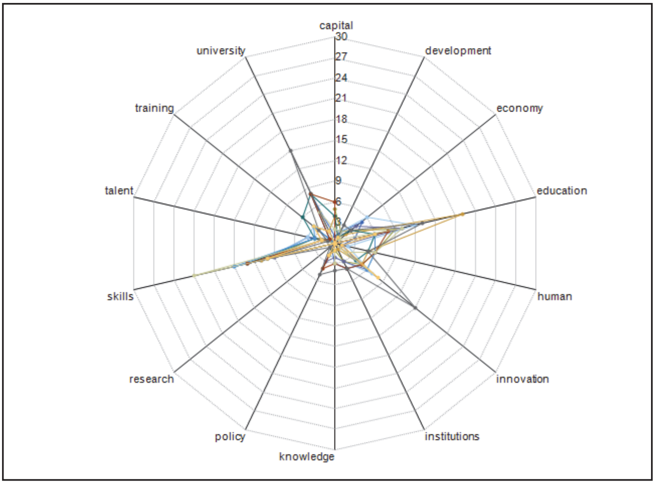
For the open coding the term *reference* denotes the interview questionnaire data instrument for Table 9 above. Next for open coding according to the thematic code per questionnaire feedback of each speaker is outlined in Table 10 below. For DT05, this speaker could not be categorically themed according to the total portion of extracted common themes detected.

***Table 10.** Open Coding According to Source Style and Structure: Relevance per Questionnaire Theme*

	DT01	DT01	DT01	DT01	DT01	DT01	DT01	DT01	DT01	DT01	DT01	Reference Codes
Q_1	–	–	9.34%	11.73%	–	6.36%	7.17%	4.20%	–	7.47%	12.40%	7
Q_2	–	–	14.08%	8.43%	–	3.91%	4.80%	2.06%	–	1.75%	9.39%	7
Q_3	–	13.67%	8.15%	4.35%	–	17.36%	16.97%	13.25%	–	8.67%	9.72%	8
Q_4	13.65%	7.62%	12.47%	10.56%	–	7.76%	15.34%	14.06%	–	8.89%	5.54%	9
Q_5	7.74%	8.41%	6.32%	2.65%	–	6.68%	7.93%	6.20%	–	12.10%	8.13%	9
Q_6	7.53%	10.54%	6.83%	8.24%	–	8.93%	9.19%	8.34%	–	8.14%	3.07%	9
Q_7	6.28%	4.22%	4.68%	6.90%	–	9.88%	10.88%	6.87%	–	7.25%	3.58%	9
Q_8	13.59%	10.46%	9.36%	10.75%	–	10.67%	15.22%	18.54%	–	13.39%	11.61%	9
Q_9	7.10%	8.65%	6.40%	12.08%	–	7.79%	1.14%	7.24%	–	15.06%	7.40%	9
Q_{10}	11.01%	5.46%	8.11%	7.31%	–	12.16%	1.75%	12.86%	7.10%	8.49%	9.52%	10
Q_{11}	5.71%	8.88%	6.15%	9.12%	–	2.26%	2.69%	2.64%	1.46%	0.95%	9.65%	10
Q_{12}	6.60%	8.64%	8.08%	7.89%	–	6.21%	6.21%	6.92%	9.67%	7.73%	10.08%	10

Source: Developed by the Author

For the thematic coding, fundamental concepts and terms were first identified and extracted during open coding. This was then mapped around three general themes that was initially formulated at the beginning of the research, then grouped onto the concepts derived. Those themes (from Graph 1 below) were extracted during the open coding stage with the following concepts.



Graph 1. *Fundamental Concepts Extracted from the Thematic Coding*
Source: Developed by the Author

The thematic categories and sub-categories as illustrated into Table 11 below.

Table 11. *Design of Human-centric Innovation Ecosystems through Higher Education Attainment: Concepts, Thematic Categories and Sub-Categories*

Thematic Categories	**Theme Sub-categories**	**Concepts**
Human capital	- Talent development through higher education - Skills competencies required for human-centric innovation ecosystems	- Producers of human capital development
Higher education policy	- Academic education and vocational educational and training - Capital and technological infrastructural support - Beneficiaries and stakeholders	- Production sites of human capital development
Human-centric innovation ecosystems	- Socio-economic incentives - Environmental factors (internal and external) - Stakeholder collaboration and cooperation - Outputs and outcomes to the knowledge and commercial economy	- Strategic outputs and outcomes

Source: Developed by the Author

Intermediate coding involved the constant comparison of data between the initial codes and the derived codes generated. This is done during the axial coding phase, where initial themes formed in the framework model of human-centric innovation ecosystems are connected to the concepts generated in theoretical framework developed for human-centric innovation ecosystems to link the themes back together and check if data saturation is reached from the data instruments used in the research. The most important feature of this process is that though open coding (initial coding) often fragments data, axial coding (intermediate coding) reconnects the data abstractedly in a conceptual manner to permit the thematic analysis to occur concurrently (Corbin and Strauss, 1990; Mills and Birks, 2015).

The next step was the selective coding stage which comprised of extracting the data from the experts' interviews, the empirical case study and the unstructured observations containing the field notes collected. This stage involved selectively coding each line to identify emerging and similar themes in the answers from the speakers and involved a very stringent process of revisiting, checking and fragmenting the data for similar themes to emerge in order for the author to appropriately categorize the themes accordingly to the main assumptions of the research (Birks and Mills, 2015). During the selective coding phase, transformation of the initial data and theoretical concepts permitted the theory to slowly emerge. Selective coding was key to the advanced final coding of the data, and distinguishes observations from categories and in this case, the core emerging theme of the research. In the grounded theory it very crucial that a main theme is selected after the final analysis for the final theory development (Mills and Birks, 2015). The selected main theme should satisfy several criteria, including being central to the research phenomena, linked to other themes in order to establish commonalities, in addition to being primarily derived from the data, frequently occurring as well as generic.

The observed concepts were constantly compared with each other in order to assign them correctly into provisional themes, which will be crucial for next step which will be the axial coding process. Therefore, applying Corbin and Strauss (2008) thematic model, the author then proceeded to condense the observations occurring during the testing of the extracted themes (codes) during the open coding stage, in a linear tabular order. Moreover, the author constantly checked, revisited and attempted to reference the data against the sub-themes ascribed in order to uncover any indication of evidence that a theory is developed from the coding stage. The author understood that it was crucially imperative that the theory developed should be validated and confirmed through a thorough comparison of the conceptual framework and practical evidence uncovered in recent research. For this research, it was the qualitative unstructured observations, case study and experts interviews used for the comparison process. Using the conceptual framework developed, it was tested according to the p*roducers, production sites* and *consumers of human capital & talent development* leading to the strategic application of human-centric innovation ecosystem. This lead to correlation of the main core category developed for its use to the other sub-categories derived. This was achieved during the theoretical saturation process as forefront for its development from the application the ecosystem as a conceptual theory. The data analyzed to achieve this process was further substantiated from experts representing various sectors of the society. In addition, the method of triangulation also confirmed the credibility of the data collected and the themes generated from all other data, thus validating the instances for the use of human-centric innovation ecosystems in the higher education sector. According to Denzin (2017), primarily triangulation methods can be of four basic type, however for the research the author applied a combination, theory triangulation that involved the analysis of the literature from several theoretical schemes for the interpretation of the phenomena being investigated. In addition, the methodological triangulation method of applying more than one approach to the data collection methods, that is interviewing, observations, document analysis and the empirical case study.

The next step was theoretical sensitivity process, which encompassed the ability to view, see and have some knowledge about the phenomena being researched (Mills and Birks, 2015; Strauss and Corbin, 2014; Glaser and Strauss, 1995). This occurred when the author was able to see the phenomena in an abstract sense, correctly link the commonalities existing between the paradigms and the codes becoming sensitized to the developed conceptual theoretical framework for human-centric innovation ecosystems. In addition, the significance of the higher education policy on its designation in the higher education sector is configurative to the strategic use of human-centric innovation ecosystem as a resource. The theoretical sensitivity stage of the research is very crucial as it demonstrates whether the prior knowledge obtained by the author was successfully merged with the new data derived from the research undertaken to validate the thematic constructs applied to develop human-centric innovation ecosystem conceptual framework and test it. Moreover, theoretical sensitivity is key to the GT methodology(Mills and Birks, 2015; Glaser and Strauss, 1995), as it demonstrates an established link with the data, codes and paradigms transiting from the abstract, theoretical to the practical levels.

2.2. Summary of the Methodological Framework and Formulation of the Tasks for Evaluating the Impact of the Higher Education Policy

The applied methodology, the grounded theory (GT) was chosen in order to develop a deeper understanding of the phenomena. The sole purpose of choosing the grounded theory methodology is to extract the theory from data that will be used evaluated to assess the impacts of the higher education policy on the development of human-centric innovation ecosystems. The epistemology behind the grounded theory methodology is Chicago interactionism. Epistemology was adopted for the methodological positioning and pragmatism as the philosophical approach. By integrating the philosophical, selected methodology, research methods and instrument, consistency was maintained in a systematic manner for the research. Symbolic interactionalism was useful to analyze the data generated from grounded theory research as it is rooted in pragmatism. The main limitation of symbolic interactionism is that its usefulness is dependent on the scope of the framework developed from the primary data from literature. Symbolic interactionism key advantage is that it integrates the use of the theoretical data during the interactive stage with the research participants. This further justifies the selection of using the grounded theory method for the research.

Data collection instruments for the research consisted of unstructured observations, case study and semi-structured interview questionnaire. The instruments were appropriate as they were complementary to the other chosen qualitative methods used in the empirical research. The unstructured observations, as a pilot study method, was essential for rich data capture during the initial stage of the research while the main limitation is its lack of data replicability. The case study method provided further exploration and understanding to the pilot study on complex issues surrounding the higher education sector management and development of the human factor for human-centric innovation ecosystems.

Case studies are strong research methods for investigating holistically issues relating to education due to the limitations of statistical quantitative research methods.

Moreover, it could provide an in-depth analysis on present and past conditions of Lithuania's higher education sector and the behavioral actions, meanings, and features of social actors and units linked to the sector for ecosystems development. The interpretive approach applied enabled testing of the data generated.

Additional data for the research was collected through interviews with experts from September 2019 to October 2019 in the Republic of Lithuania. Eleven experts formed the sample and represented all spheres relevant to the research environment Lithuania. The method for choosing the experts was by snowball sampling method in conjunction with purposive sampling. Snowball sampling is a suitable form of non-probability sampling method that works well base on the defined criteria of the sample selected for the research. Moreover as complementary method to purposive sampling, it enabled a deeper level of detail as well as enriched data capture and exploration of other areas to the research not initially considered. The main drawback is that it limits access to a larger pool of experts. Purposive sampling permitted the criteria to be set for the selected sample with the aim that the sample is representative of the chosen study area. The main advantage is that it permits critical assessment of the data derived from the sample and its main limitation is that it only works well with snowball sampling methods.

Theoretical sampling after the interviewing of the experts, permitted the conceptual density process to analyze how well all the data collected had achieved saturation level. Conceptual density occurs when all the responses are the same and no new information has emerged during the interviews. This justified the selection of eleven experts for the research as the phenomena needs only to appear once during the conceptual density process. A larger sample could have led to difficulties identifying key areas and themes from the data collected.

The next step of the research was to consistently analyze the data collected from the interviews using the coding process. Open, axial and thematic coding was applied to extract the data for the thematic categories from the experts responses for the qualitative analysis. The extractive, approach of the data enabled developing insights on ecosystems and higher education policy in management sciences particularly on the areas of strategic management and planning of human-centric innovation ecosystems. This enabled the key focus areas from the findings for evaluating human-centric innovation ecosystem's development.

An integrated qualitative evaluation is then needed to assess if the findings from the empirical research are correct and relevant to the conceptual framework developed for human-centric innovation ecosystems. The findings from experts semi-structured interviews and case study on the Republic of Lithuania will be evaluated to gain insights on how human-centric innovation ecosystems develop. Moreover the findings will be assess according to how the conceptual theoretical framework proposed is useful for the ecosystem's development in the higher education sector. The findings will then be further revised according to how the ecosystems can be strategized to improve the internal institutional environment of the higher education sector. The evaluation of the higher education policy impact on the development of human-centric innovation ecosystems should address the management issues of:

(1) Transforming the data from the research into strategic insights on the strategic management of human-centric innovation ecosystems and recommending the qualitative indicators of human-centered attributes and their associative implications to the ecosystem in the higher education sector.
(2) Identify the correlation between talent development and innovation in the areas of the knowledge and commercial economies;
(3) The position of human-centric innovation ecosystems in higher education sector;
(4) Assessing and identifying the most important features of the human capital derived from the internal and external environments HEIs, stakeholders, actors, non-higher educational factors relative to human capital development and contribution to the knowledge and commercial economy;
(5) Estimating the significance of the socio-economic, industry, academia and sectorial stakeholder environment in human-centric innovation ecosystems.

3. EMPIRICAL RESEARCH AND EVALUATION OF THE HIGHER EDUCATION POLICY IMPACT ON HUMAN-CENTRIC INNOVATION ECOSYSTEM

3.1. Higher Education and Innovation Policy of Lithuania: Description and Analysis

In the strategic planning of Governments, organizations and institutions, problem-solving entails devising solutions either through managerial decisions, the adoption of policy or a strategy. The approach to the value offerings of novel human-centric innovation ecosystems as a strategic resource will entail:

1. Defining its key stakeholders and beneficiaries needs;
2. Evaluate and assess the underlying assumptions derived on its proposed benefits and value creation.

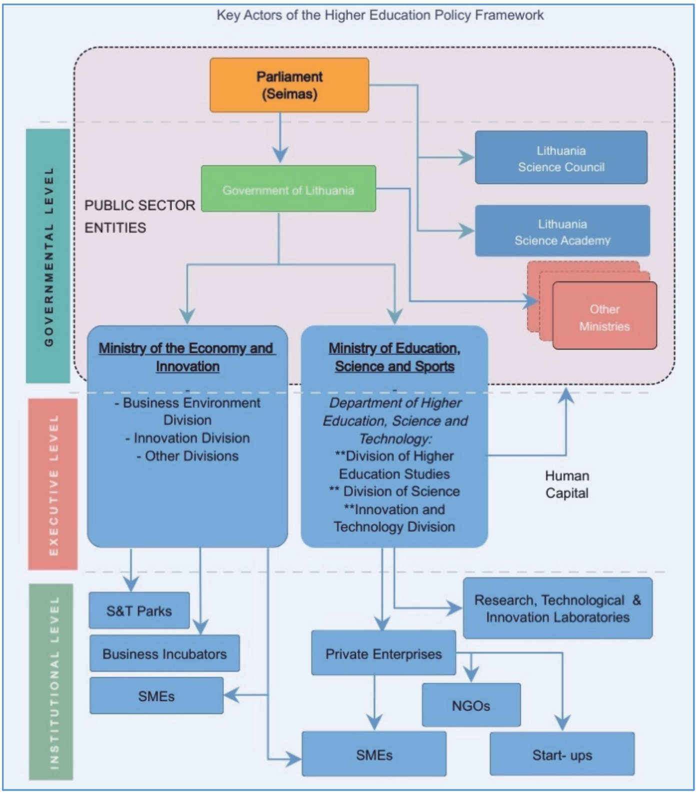


Figure 11. Key Actors of the Higher Education Policy Framework
Source: Developed by the Author

Human capital development accentuates its importance as a sustainable resource for attaining competitive advantage in organizations. New technologies and advancements in digitization have emphasized repeatedly that development of the skills, attributes and expertise of the human capital is more important due to the dual nature of its knowledge-based reserves. As such, higher education institutions have often tailored its mission, functions, operations and strategies around the training and development of this valuable resource. The case study revealed a network of actors in Lithuania tasked with research, development and innovation policy priorities related to the education policy leads to students proactively choosing study methods concurrent to innovation, labor market needs or the formation of start-ups, SMEs, etc. (according to Figure 11).

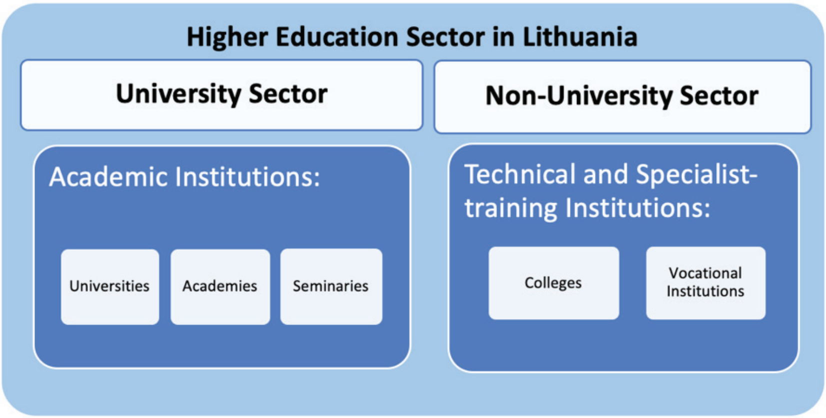


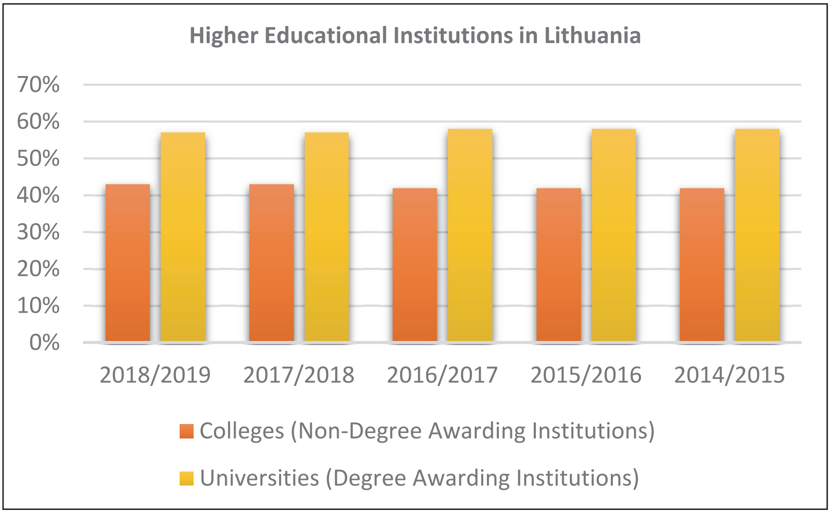
Figure 12. *Structure of Higher Education in Lithuania*

Source: Developed by the Author according to Centre for Quality Assessment in Higher Education (SKVC), 2019

Accordingly, talented human capital's vocational, educational, technical and professional development in Lithuania is organized according to the type of institutions that offer degree and non-degree studies.

From the Figure above, degree granting institutions are *universities (universitetas; e.g. Vilnius universitetas)*, *academy (akademija; e.g. Verslo ir vadybos akademija)*, or *seminary (seminarija; e.g. Vilniaus* šv. *Juozapo kunigų seminarija)*. These are collectively grouped as the University sector of higher education. The non-university higher education sector consists of Technical and Specialist-training institutions such as *colleges (kolegija; e.g. Socialinių mokslų kolegija)* and *vocational institutions (aukštoji mokykla; e.g. Tarptautinė teisės ir verslo aukštoji mokykla).*

Graph 2 below outlines the ratio of higher education institutions according to the total student enrolment as of the academic year 2018/2019.



Graph 2. *Percentage Enrolment Rates for Higher Education Institutions, 2014 -2019*

With the low number of students' enrollment figures, the case study findings revealed that Lithuania still remains as one of the leading Member States for higher education attainment for the thirty (30) to thirty-four (34) age category (Eurostat, 2019). Of approximately fifty-eight percent (58%) in total, the employment of recent graduates for Lithuania remains significantly higher at ninety-two percent (92%) than the EU average of eighty-five percent (85%) in 2018. Although increasing migration patterns have contributed to the decrease in students' enrolment rates between 2010 and 2017, the new admission requirements implemented in 2018 is expected to raise the quality of applicants in the system (EUROSTAT, 2019). The case study findings also indicate that activities that directly connects the Lithuanian Higher education sector with the industry and business is evidenced by the expansion of the creative industries sector at the international level. The sector is predominantly decentralized, with the provision of quality education operating in a networked system consisting of beneficiary and stakeholders of the higher education sector and other national institutions. Figure 13 below outlines the resources allocated to the local higher education in Lithuania in the development of smart specialization for innovation.

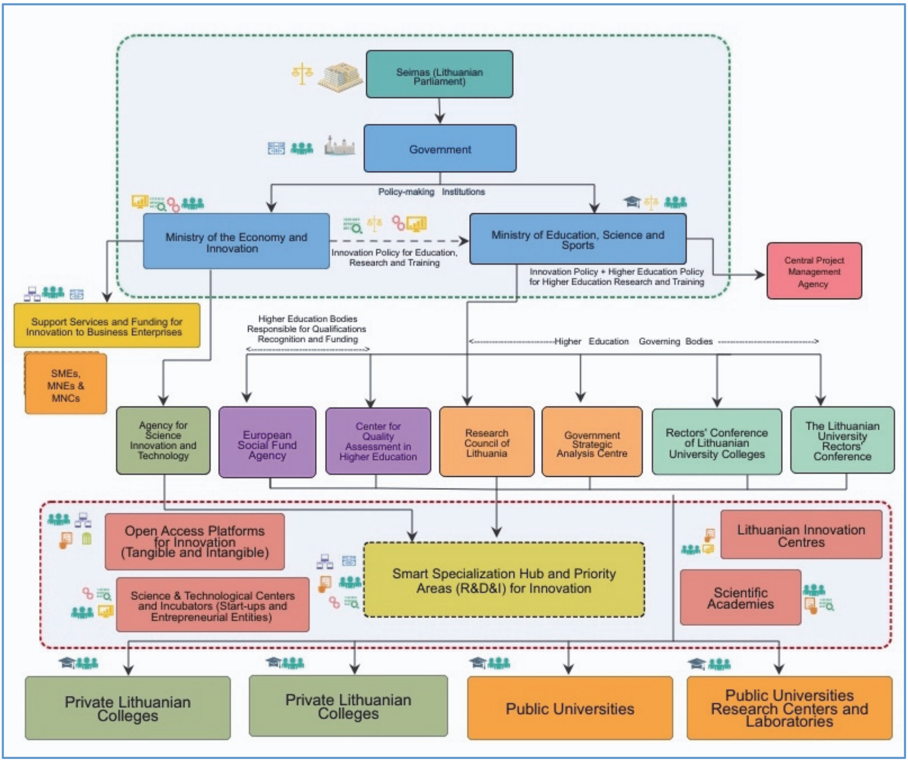


Figure 13. *Resources Allocated to the Higher Education System for the Development of Local Smart Specialization*

Source: Developed by the Author

As formal education is accessed from both public and private institutions, public institutions receive partial government subsidization, though private institutions are equally recognized and accredited under the same national higher education policy. The case study revealed that the number of higher education institutions registered in Lithuania as of 2019 are fourteen (14) are state-funded institutions (9 universities and 5 colleges) and eight (8) are privately owned institutions (5 universities, 2 seminaries and 1 academy). As of the 2018/2019 academic year, 10,744 students were enrolled in degree awarding higher educational institutions (universities), while 8016 were enrolled in non-degree awarding institutions (colleges), according to Table 12 below:

__Table 12.__ Enrolment Figures of Students in Lithuanian Higher Education Institutions from Academic Years 2014/2015 to 2018/2019

Higher Educational Institutions	Academic Years	Colleges (Non-Degree Awarding Institutions)	Universities (Degree Awarding Institutions)	Total
Students Enrolled	2018/2019	8016	10744	**18 760**
	2017/2018	8312	11203	**19515**
	2016/2017	8887	12318	**21205**
	2015/2016	9570	13486	**23056**
	2014/2015	10012	13908	**23920**

Source: Created by the Author according to Statistics Lithuania/ Oficialiosios statistikos portalas, 2019.

Although enrolment trends have remained variably consistent with an average range of fifty-seven to fifty-eight percent (57% - 58%) for universities, and forty-three to forty-two percent (43% - 42%) for colleges, there have been downward decrease in the total enrolment numbers for the five-year period. More investments to broaden the higher education sector's network of universities, hubs, research, technological, science valleys and creative workshops would potentially contribute to developing the talented human capital for research activities. Though the case study revealed that significant investments to broaden these networks and infrastructure of the higher education sector, humancentric innovation ecosystems could provide guidelines for enhancing greater strategic utilization of these resources by the Ministry of the Economy and Innovation and the Ministry of Education, Science and Sports. Consequently, prospective opportunities that create added value for the society would result.

Lithuania has increased its regional innovation and currently ranks as a Moderate Innovator. Not considering other factors, the conceptual framework of human-centric innovation ecosystems presumes that higher education attainment leading to quality innovation is linked to Lithuania's national higher education policy. The upward increase to Lithuania's position could have been due to improvements made in the industrial and business sector. Enhanced collaborations between the business sector and the scientific sector (researchers) have led to Lithuania having a high innovation status. However, evidence of specific improvement programs targeted to innovation by the Ministry of Education, Science and Sports have not contributed to the rankings directly. Nonetheless the current position of Lithuania is indicative that the nation is on the right path according to the conceptual framework of human-centric innovation ecosystems. This success attributes to increased expenditures from businesses and greater investment in R&D activities. Lithuania's innovation outcomes and outputs attribute more to its abundant source of human resources. Therefore, the attractiveness of a human-centric innovation ecosystem that strategically aligns highly qualified human resources outputs to the overall higher education policy's responsibility increases exponentially. Research and development that leads to innovations through human-centered attributes such as knowledge, learning and the formulation of value potentially gives more optimism for students to be engage in innovation and its process. As the country ranks as one of the highest in the EU for employment of personnel engaged in knowledge-intensive activities, the conceptual framework of humancentric innovation ecosystems considers whether non-intangible innovation-led income generated from international patents, trademarks and licenses in the creative sector would be high as well. Notwithstanding, for the summary of innovation index results for Lithuania when compared with the other Member States, this was quite low with a significant gap existing in the nominal EU average. This gap for Lithuania was attributed to the lack of trust and openness, attractiveness of the research system to the human resources, low number of patent applications and third country nationals (TCNs) that are doctoral graduates. For the private sector, it was due to the low amount of investments in research and development areas. While the criteria of indicators for the level of research and education is negligible, the remaining constant for Lithuania is highly-skilled human resources and not the educational level indicators. As Lithuania maintains moderate rankings for the last decade, the measurement for knowledge utilization, creativity, research, development and innovation-led activities as well ecosystems potential has changed due to digitization facilitating the human-centered design developed through the model.

According to the conceptual framework of human-centric innovation ecosystems, higher education institutions could contribute more by collaborating with businesses and with each other, rather than being just only the source for graduates. This would be achieved through knowledge transference, dissemination of research results and governing how knowledge is used and acquired for the benefit of society. Though Lithuania ranks among Moderate Innovators the main underlying problem, uncovered was the human relationships (*relations, associations, collaborations*) between the human capital. The quantity of the human factor graduating from HEIs, on average when compared to the percent of nation's population, the percentage is very high within the European Union. However, when the indicators connected to the higher education policy are added, it relatively sags down the rankings. From the conceptual framework, entrepreneurships, talent, the tertiary education (higher education) or the research sector, should collaborate with the private sector businesses as well. Moreover, as entrepreneurships is an indicator measuring innovation rankings, the case study revealed that the graduates from the Lithuania higher education sector are not entrepreneurial. This leads to graduates employed in jobs that do not required higher education qualifications. This affects the innovation indicators for Lithuania.

A human-centric innovation ecosystem works well when the higher education qualifications attained are relevant to business needs. From the students' side investing three or four years in the system to gain an advantage in the labor market is useful when the qualifications attained are pertinent to business innovations or operations. The conceptual framework thus indicates that strategic planning and monitoring of higher education programs lessens the probability of online or self-taught teaching programs to overtake on-campus, traditional higher education learning methods in the sector. These programs usually offer shorter timespan for learning and training, more relevant to the industrial and business sector labor market needs and self-regulating. The developed model would propose guidelines for a blended approach to incorporate this learning alternative to traditional learning methods.

Lithuania's higher education sector have undergone many reforms since gaining independence. In June 2017, the last set of reforms approved by the Seimas was consolidating the network of state universities. The main aim of the plan was to address the economic and social challenges that plagued the country's higher education sector. The vision was to improve the education and research sectors leading to ecosystems development, innovation and economic growth. By concretely connecting the importance of higher education to all areas of society, industry and the state, Lithuania's competitiveness and outputs in the EU for higher education and research would be strengthened extensively. Furthermore, greater alignment of higher education and research with industrial economic sector, progressive attraction and retention of international scientists and researchers as well as those of Lithuanian origins would result. The extent to which these new reforms significantly improves the delivery of higher education and its attractiveness for quality education could influence the future utilization of the human-centric innovation ecosystems. The motives to consolidate the sector are quite pragmatic, with the final decision to merge resting entirely on higher education institutions. The reforms were slated to optimize existing resources and services that would better amplify the purpose of the higher education in Lithuania. Through a reformed higher education system that cooperates closely with industry the conceptual framework developed could foster students' development according to the needs and requirements of the economic sector. Regarding the higher education policy as a catalyst impacting human-centric innovation ecosystems, this demonstrates that reforms are of significant importance in respect to the ecosystem relationship to the knowledge and commercial economy.

Pertaining to the accreditation system of Lithuania, the Qualification Framework for the European Higher Education Area is tiered at eight (8) levels. Each level indicates the learning outcomes are relevant to three dimensions crucial for quality human-centric innovation ecosystems: Knowledge, Skills, Responsibility and Autonomy. Learning outcomes of the Bologna process permeates from the State level of Member States and structured according as input dimensions from the EU level. The Lithuanian Qualifications Framework (LTQF) is structured in a likewise manner alike to the European Qualifications Framework (EQF) with eight (8) qualifications levels streamlined in a hierarchal style. Within the LTQF, there are qualifications that prepare individuals for lifelong learning, a necessary attribute of human-centric innovation ecosystems for future organizational management and planning of resources suited for innovation processes. Figure 14 outlines this layout as well as other internal parameters that affect the formation of strategic planning and management activities of higher education institutions within the European Higher Education Area.

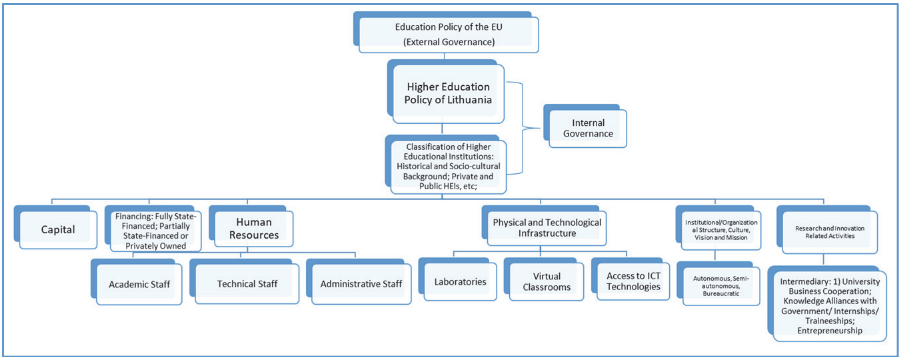


Figure 14. *Input Dimensions of Higher Education Institutions in the Economy*

Source: Developed by the Author

The output dimensions from the figure can be consolidated to two fundamental differentiated economies promulgated by vast ecosystems of institutions and networks that utilize certain human-centered features to drive them: the knowledge and commercial economies. Applying the conceptual framework of human-centric innovation ecosystems, the higher education sector contributes to the knowledge economy through its fundamental research and learning activities. The knowledge economy is thus defined as greater reliance on instant access to information generating facts and intellectual skills for the productive advancement of economic activities of private and public organizations (OECD, 2005). Additionally, institutions that contribute to the commercial economy would be bound to the exchange of goods, services, and labor activities having a set monetary value. Within the scope of the conceptual framework, the social and economic value of human-centric innovation ecosystems is evidenced through its contribution to sustainable, continuous economic growth for Lithuania through these economies. Table 13 thus summarizes the main features of the knowledge and commercial economies:

Table 13. *Output Dimensions of Higher Education Institutions in the Economy*

Output Dimensions of HEIs as a Possible Driver of Human-centric Innovation Ecosystems	
Knowledge Economy	Fundamental research conducted by the human resources of the HEIs: (students, researchers, academic staff members)
Commercial Economy	Technological innovations that generate commercial activities leading to economic growth.

Source: Developed by the Author

In a study conducted by the Ministry of the Economy and Innovation to develop the road map for industry digitalization of local ecosystems through skillful human resources, the occurrence of more customized study programs and courses in the higher education sector can lead to more ecosystem development in Lithuania (Leichteris et al., 2018). In acknowledging the human-centered approach to education operating as part of digital ecosystems networks, development of customized study programs grants better transition of the future workforce into their work environment. For Lithuania, the demand for those customized education programs are more majors in the robotics, ICTs and other digitalized, technologically related educational field areas. Thus, the higher education sector will reorient its strategic activities to contribute to Industry 4.0 ecosystems development through human resources and infrastructural facilities support, scientific consultations and training workshops (Leichteris et al., 2018). Moreover, the higher education sector through human-centric innovation ecosystems futuristically forge symbiotic relations as a 'Solution Providers' to innovation which through continuous collaborative activities that contribute to the development of the Digital Technologies sector. As a stakeholder, the study revealed that the higher education sector could proactively provide degree programs at both the master and bachelor level that are innovation-based, listed as part of the 'Solution-Providers' initiatives of the Industry 4.0 Plan. The study further revealed that the list of academic higher education institutions differentiates from those institutions that are involved in innovation-led ('Solution-Providers' activities). This is achieved through applied research (capital and technology) and traineeships and apprenticeship activities (talent). This demonstrates the level of engagement in innovation-led activities of the digital industry, one of the priority areas of Lithuania's National Innovation Development Programme 2014-2020.

The framework of this ecosystem resembles some of the elements, stakeholders and beneficiaries of human-centric innovation ecosystem conceptual framework (capital, technology and talent). An internal and external value chain system would exist to strategically attain the knowledge society and the economies of scale for the commercial economy in Lithuania, through continuous knowledge and skills transference. From the findings mapped onto the conceptual framework, the physical layout of human-centric innovation ecosystems would consist of other tangible infrastructural entities such Science Parks, Research, Innovation and Development centers (competence centers), laboratories and testing centers, etc. The findings further revealed that the intangible infrastructure such as technology, ICT services, digital technologies and the talent from higher education sector, expert services providers as well as other cluster-based human resources and associations. A symbiotic relationship then results between 'Solution-providers' (implementers of the ecosystem) and 'Consumers' (institutions that benefit from the ecosystem). According to the conceptual framework, this would be the 'Production Sites' and 'Producers' of human-centric innovation ecosystems. The common element, similar to human-centric innovation ecosystems conceptual framework, between the 'Solution-providers' and the 'Consumers' is talent. Furthermore, the case study proved that with greater unification of activities between the Ministry of Education, Science and Sports and the Ministry of Innovation and Economy, to broaden innovation potential the proposed ecosystem would work base on the strategies proposed from the conceptual model. As stakeholder and beneficiary, both ministries could set the criteria regarding the type of State-owned resources both tangible and intangible required for elevating and increasing the level of innovation-led activities in Lithuania through talent, technology, smart specialization and capital infrastructure that would be the 'Outputs' of the conceptual framework. With the main strategic goal of the program being to increase the economic competitiveness of Lithuania. By broadening Lithuania's innovation potential, the current policy is built on the premise that innovation would be a circular activity that leads to a wide range of opportunities.

According to the conceptual framework of human-centric innovation ecosystems, this should be unified, close-networked cooperative, systems consisting of all the mentioned actors, stakeholders and beneficiaries regulated under the education and innovation policy of Lithuania. This increases the higher education sector's innovation potential to address existing skills mismatch and shortages linked to quality innovation ecosystem development. Though recent reforms aimed at enhancing the contribution of HEIs to societies through innovation, the human resources, are the input commodities that facilitate creation of these networks. The higher education sector could then direct the needed Government funding to key initiatives that support teacher training, improving ICT and infrastructure for research, innovation and other developmental activities.

3.2. Experts' Interviews: Results and Discussion

3.2.1. Human Capital: Higher Education Attainment, Talent Development and Skills Competencies Required for Human-centric Innovation Ecosystems

Higher education institutions in Lithuania should be the source of academic and practical knowledge required for the development of acquired and innate abilities skills-set required for any chosen field. Through qualification attainment, higher education institutions grant the Lithuanian human capital the leverage needed to start their respective career paths and networks. Inadvertently, talent development is still a modern term not coined or fully understood by the older working generation. Since independence, the main idea was that all citizens should have access to higher education. This would increase Lithuania's attractiveness at the global level with other thriving competitive economies through the educated human capital. Though no consideration was given on ever-changing domestic and international labor market, Lithuania's rapid transitioned to the market economy enabled steady economic growth for the last three decades. This has led to an increase of research activities undertaken by public institutions in the higher education sector. At all levels the Government, various public entities play an essential role in the management and initiating of environments that shape and drive ecosystem development in Lithuania. The crucial roles that these entities play at the Governmental (national), Executive (divisional) and Institutional (local) levels in developing effective innovation ecosystems that are human-centered is purely dependent on the creation of more conducive framework conditions for these ecosystems to thrive. Hence applying the principle of strategic management and planning of ecosystems as networked systems in Lithuania, Government undertake various roles such as the regulator, facilitator, moderator, sponsor, innovation ecosystem developer and strategist. Referring to the education ministry of Lithuania, the New Public Management approach to governance and reform of higher education in Lithuania began immediately after independence in 1991. The aim is to generate innovation realization through the qualified human resources that possess higher education to enable Lithuania to contribute to innovation-led activities in the EU. Lithuania's greatest natural resource lies in its ever-abundant qualified human resources, which co-incidentally forms part of the Gross National Product. Increasing the attractiveness of the country for innovation ecosystems development lies at the forefront of the Government through continuous improvement initiatives implemented so far. These initiatives range from the advancing and improving the quality of life and implementing infrastructure for the human resources to thrive.

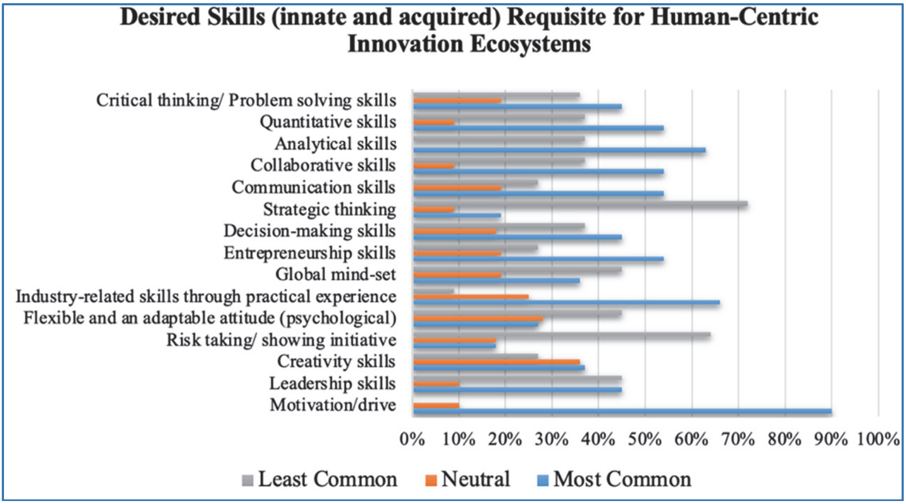
From the analysis, study programs offered by universities and colleges results in high quantity of human capital rather than the quality. This has led to the non-manifestation of talent development through the academic curricula. The higher education sector does contribute to the talent development generally, though there is 'observed' resistance by the sector in matching the actual labor market and private sector needs in providing these skills. While higher education institutions contribute at the undergraduate and postgraduate levels, vocational educational and training institutes and colleges are seen to contribute less to talent development while universities contribute more despite the high occurrence of skills mismatch. Thus academic education is very different from vocational education training because it is more oriented to practical skills development. This implies that institutions are unable to meet the expectations of the labor market and the public sector for the managerial planning of attaining a competitive advantage. In reference to doctoral programs, the main factor which serve for potential talent development at that study level, is due to the fact that as not many students are enrolled in those programs, the system of studies is purely based on individual work. In this context, talent development through the formal higher education system, individual work is key, yet this is only available at the doctoral level, as doctorate students pursuing the PhD programs in Lithuania didactic courses offered grants them the opportunity to develop knowledge and training to hone in further their research capabilities through independent organization of a PhD project. The current approach taught is more structured towards research development which is crucial and important for innovation. Furthermore, it is not the same within a project context where the ultimate aim is creating innovations through research knowledge. The application of research knowledge or rather research not knowledge skills, research qualifications required to develop innovations structured towards individual work would be ideal for talent development. It permits more an innovation mind-set which is crucial for talent development. Moreover, to develop an attitude for innovation, it is imperative that venturing into the unknown with a curriculum permitting curiosity development and willingness to take risks.

With more emphasis on effectively engaging local and international talented human capital through higher education institutions, this simultaneously creates human-centric innovation ecosystems for aspiring entrepreneurs. In strategic management, entrepreneurial ecosystems and human-centric innovation ecosystems are different ecosystem frameworks. Though for several years, entrepreneurial ecosystem has been advocated for driving regional innovation for nations, the fact is, there is no evidence of value offered garnered from those types of ecosystems. Its novel feature however is its structural framework permitting the identification of what works in organizing the creativity process that leads to the transmission and capture of value. One of the incentives that could result from human-centric innovation ecosystems, is involving all students in international projects with other partner universities in Europe. It is perceived that these methods would generate more international innovation networks that would foster value. This emphasize the human-centered need for more institutional support from the governmental level for quality innovation ecosystems development. Higher education institutions thus would not innovate in a vacuum, but also implement innovations centers in the respective academic fields of study to support students.

At the domestic external level, European Structural funds and other funding mechanisms, are available to new businesses, international and local talent to pursue innovation. However, unless they are *'integrated'* professionally or academically into the relevant environment many of them will continue to be oblivious of those funding schemes to support ecosystem development. As each country's history is subjective, *a one-size-fits-all* approach should not be drastically applied to Lithuania. Though other successful incentives already implemented in other Member States that are similar for talent to pursue innovation through human-centric innovation ecosystems. Another incentive recommended were innovation-themed training courses implemented into the study curriculums of all higher education institutions and universities in Lithuania for informal ecosystems development. This enables the creativity process of innovation to create *with the* stakeholders and beneficiaries (people), *not for*. Though central to its success are four factors: people, the knowledge attained, infrastructure and environment that supports it or facilitates it, the common element is the human factor behind each. Retention plays a key role in keeping talented, outstanding students from other countries to be *attracted* to the incentives in place locally to contribute to innovation in Lithuania. Although the immigration system and the Lithuanian Labor Exchange Agency have improved to foster this, the recruitment of highly qualified international talent from other third country territories still remain a problematic.

Though the suggested incentives could be feasible for all stakeholders and beneficiaries of human-centric innovation ecosystems, the effectiveness of universities in engaging talent are dependent on the academic personnel employed in the higher education sector. Primarily, whether academic personnel are good at motivating students to become part of internal ecosystems in the sector. So far these personnel are good teaching professionals, lecturers and practitioners employed in the higher education system. However, the drive for innovation lies within the students and is not dependent of the quality of teaching or training in the higher education system. Entrepreneurships and entrepreneurial ecosystems are differing concepts and is not synonymous to innovation ecosystems or innovation. Within this respect, innovation is perceived as *'personality-driven'* and while not every personality is inclined to a state of innovativeness, it still is a fundamental requisite for forming teams for innovation activities. Moreover, it would be an added advantage if the higher education sector of Lithuania were involved in those initiatives as it would develop the primary skills and knowledge on the important roles for innovation in a team setting. It is still a question if this would be implemented through the education policy of the education ministry. For doctorate students, the incentives lie in combining students from different fields of major or competencies, for example combining biology with management, engineering and business could potentially foster the *teamwork* mindset and extend on formal skills building through formal education. All universities should adopt this approach as it permits students from different universities and fields of major to work together. Furthermore, this initiative termed, 'student-centric ecosystems' should be implemented locally at the regional level of Lithuania, with one 'satellite' higher education institution or university in each region, for example in Vilnius, Kaunas or Klaipeda. Forging entrepreneurships and entrepreneurial spirit, was one of the challenge that deters the creation of human-centric innovation ecosystems for aspiring entrepreneurs. Human-centric innovation ecosystems could instill formal education knowledge skills-set and skills-capabilities thus converting entrepreneurs with the 'intrapreneur mind-set'. Mykolas Romeris University (MRU) is more entrepreneurship-oriented in teaching to students, when compared to other universities that are more research-oriented. Therefore, the general consensus is that though it is not evenly distributed amongst the institutions, it is present in every institution, magnified through the universities' activities, objectives, vision and mission. The findings from the case study results also confirm that universities in Lithuania are a combination of research-based and entrepreneurial-based, key strategic tools used for transitioning to the market economy. Moreover, as learning skills was mentioned as the least common other skills due to the recent trends in higher education systems. This trend from a culture of memorizing and repetitive learning to the new culture or attitude of being solution-oriented, or finding a creative, innovative solutions to problems and challenges is a key attribute indicating that the human-capital is a strategic thinker. Thus, in order to support this continuance, the higher education system should switch its' focus from the knowledge economy scale to commercial economy. This would develop and instill into the human capital other skills such as creativity, risk-taking, entrepreneurship, strategic thinking, communication, collaboration and problem solving. However, a high-quality stock of human capital possessing educational attainment is a major precondition for the development of quality innovation ecosystems. There is a definite correlation between both as innovation development could emanate through human-centric innovation ecosystem. An educated population or highly educated human capital are not directly sourced from the entire human resources. Capital is 'added-value' interlinked to both higher education (qualifications attained) and innovation ecosystem (networked systems that leads to innovation). Nonetheless, as higher education attainment, human capital, and innovation ecosystems are interlinked socially this is dependent on the content and outputs of the higher education.

The skills competencies considered ***most common*** as well as others key in adopting the strategic mindset necessary for human-centric innovation ecosystems are outlined in Graph 3:



Graph 3. *Prerequisite Skills for the Development of Human-centric Innovation Ecosystems*
Source: Developed by the Author

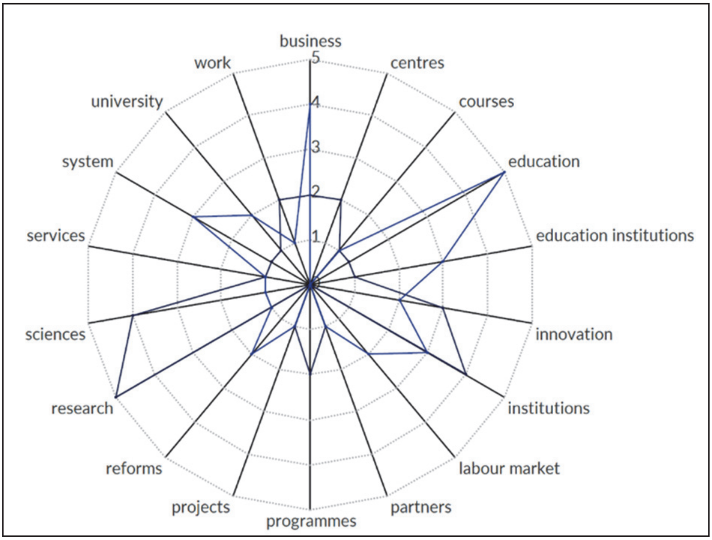
In the real societal context, graduates from the local higher education system always aspire to show that they have knowledge, yet skills mismatch indicate otherwise. Hence, higher education attainment as perceived by its beneficiaries is an insurance for the future for safeguarding their career and professional future. Therefore, persons pursuing higher education in Lithuania should focus on a specific field, form industry alliances, cooperate and collaborate to build their external competencies and networks: these are the key components for producing innovation ecosystems that are human-centric. While Lithuania has the highest rate of educational attainment figures when compared to its total number of residents in the country, the figures are not indicative that the nation is *good* in innovations. If that was the case, higher educational attainment would then be an important factor for 'quantity' innovation outputs. Consequently then, 'quantity' higher education attainment outputs cannot lead to quality innovation ecosystems development. Rather, it is the mind-set of the human capital that reflects whether it is a matter of quality or quantity. Innovativeness should be second nature in Lithuania in which case concerning the human factor, creativity and critical thinking skills are requisite. Regarding entrepreneurship skills, these ensures that the human factor has faith that the product created is for the betterment of society. In this context, certain skills such long power distance, individuality, long-term orientation and the uncertainty avoidance dimensions, quasi-dominantly, are culturally inherent in Lithuania. A stronger expression of the positive end of this dimension would be beneficial for Lithuania's innovation system and the economy as well. The skills developed through higher education system can improve the situation pertaining to innovation. In contrast, higher educational attainment is correlated to the development human-centric innovation ecosystem when considering the societal challenges at hand locally. These challenges, when identified at the EU level, do not necessarily reflect the societal challenges faced in Lithuania for innovation ecosystem development. Hence, challenges identified at the local level should be first addressed nationally then transmitted to the EU level. This enables the correct design of national higher education systems that aligns well in innovation ecosystems development, in addition to the socio-cultural, socio-economic and societal features. While skills such as:

- *a) Motivation*
- *b) Leadership*
- *c) Creativity*
- *d) Risk taking*
- *e) Flexibility*
- *f) A global mind-set*
- *g) Entrepreneurship*
- *h) Decision-making*
- *i) Strategic thinking*
- *j) Communication*
- *k) Critical thinking or problem-solving skills*
- *l) Collaborative skills*
- *m) Analytical skills*
- *n) Quantitative skills*

are related to the development of human-centric innovation ecosystems, some are exposed at higher education institutions during studies. Furthermore, persons would ultimately acquire a majority of the skills required for human-centric innovation ecosystems over time but not from the learning environment of higher education institutions. Acquiring a majority of skills needed for human-centric innovation ecosystems from the higher education sector results in quality innovation. Moreover, the Lithuanian economy have grown steadily from past inputs and with the total combined pool of local and international skills, more wealth could potentially contribute to more outputs. Therefore, learning by applying the skills taught through one's career or profession, have contributed to positive outputs such as economic growth and not necessarily through higher education and training. Though the value of having higher education training and qualification is important, national, cultural and historical features should be considered as important background factors for the development of human-centric innovation ecosystems.

3.2.2. Higher Education Policy: Academic Education, Vocational Educational Training, Capital and Technological Infrastructural Support

The available technological infrastructural support available to the higher education sector have accelerated digitalization knowledge hubs in Lithuania. These hubs provide superficial support to the creation of digital start-up companies only at the initial stage and acts as a link between universities and higher education institutions in Lithuania. Financial support available to these start-ups are through personal funding or other secondary sources such as angel investors or funding from the government or EU Structural funds. The Cluster Graph expands further on the sources of infrastructural support to potentially form human-centric innovation ecosystems according to the themes extracted from the experts' interviews.



Graph 4. *Impact of the Higher Education Policy on Capital and Technological Infrastructural Support for Academic and Vocational Education Training necessary for Human-centric Innovation Ecosystems*

Source: Developed by the Author

Additionally, local and international internships, work study practices at social partners or businesses during the higher education period are other non-technological infrastructure that contributes to the talented human capital in Lithuania. These facilities are concentrated in the developed cities of Lithuania, with Saulėtekis Valley in Sauletekis having several infrastructures in place that could foster the human capital development within the technological and non-technological fields of study. While, the support can be perceived as purely superficial, local internships and work study practices for learners could instill the practical skills needed for the development of human-centric innovation ecosystems. Moreover, supporting infrastructure, laboratories, clusters are the potential physical resources that could strategically lead to human-centric innovation ecosystem are in that city. Additionally, implementing supportive resources such as advanced teaching, R&D facilities are somewhat of a challenge when compared it implementing the physical infrastructural facilities. For the human factor, fragmentation of ideas and strategies for proper development have resulted in the current situation Lithuania is in with regards to quality innovation ecosystems development. Hence a unified approach consisting initially of a supportive environment of trust, problem-solving skills and cooperation would be fundamental, then the infrastructural, technological, academic and technical support for its development would follow. Though in Lithuania as in most other countries, recognizing the role of the human factor in innovation ecosystems, has strategically strengthens and enhances the value creation from this resource both internally and externally. Although there are instances from the case study where the Government through the Ministry of Education, Science and Sports have facilitated some form of human-centric innovation ecosystems in Lithuania. Supportive schemes such as science and technological laboratories have been used as incubators of human-centric innovation ecosystems for students to train and develop their innovation potential.

There are several mechanisms, strategies that motivate the human resources to choose certain specialties that contribute to the rankings. However, the current migration patterns of younger persons opting to study abroad gives a different perspective. While the case study has indicated that international enrolment rates are positive for the higher education sector, the business sector lacks competitive attractive and retention schemes for talent in Lithuania. The challenge identified was aligning work conditions to global requirements and long-term retention of skilled professionals to Lithuania. In the Research, Development and Innovation (RDI) sector, low attractiveness in the research careers is due to demographic factors such as emigration, fragmented higher education sector, and low birth rates which systematically contribute to skills shortages. Funding of RDI inputs and commercialization of outputs managed by the higher education sector remains relatively low and could affect how human-centric innovation ecosystems are strategically developed.

The increase in exchange students' figures, students' and academia exchange programs, joint research and common activities through HORIZON2020 projects, visiting professorships have led to higher rankings. A correlation exists between aligning supportive incentive schemes for human capital development in human-centric innovation ecosystems according to Figure 15. Applying Pearson's coefficient range of -1 to 1, there is a correlation range of 0.3 to 0.7 according to the pattern of the scatterplots in Figure 15. It means that unification of the higher education sector across local and regional borders could strategically increase Lithuania's innovation rankings.

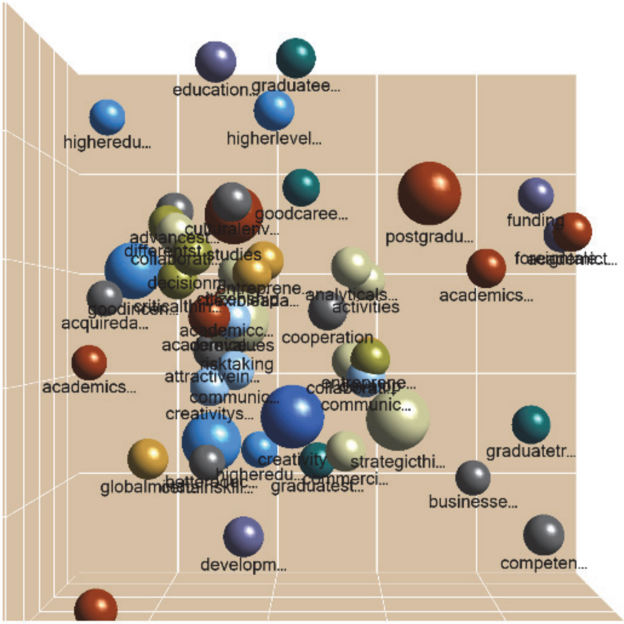


Figure 15. *Quantity Outputs of the Human Resources linked to the Existing Strategies and Mechanisms in the Higher Education Sector.*

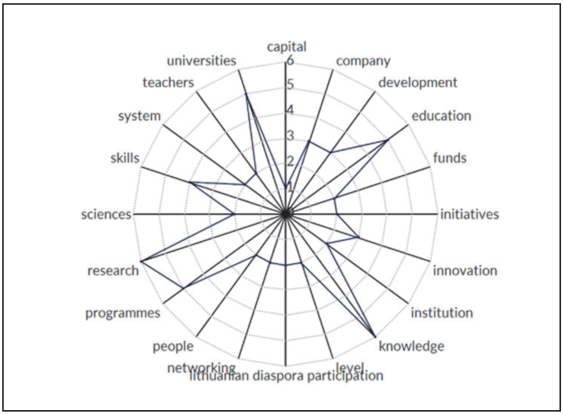
Source: Developed by the Author

Current reforms and structural changes to the higher education sector could strengthen the networks of human-centric innovation ecosystems, through a stronger multi-actor approach. However, skills gap a prevailing factor undermining the sector, is not a new phenomenon and not very specific to Lithuania or other countries of the European region. Hence, it should not be problematic for the ecosystems' development. Structural changes made to Lithuania's higher education sector should not affect the development of human-centric innovation ecosystem. In terms of reforms and structural changes, vocational institutions should benefit from improved facilities and internal scholarship programs and greater access to initiatives, schemes or projects to inspire them to create human-centric innovation ecosystems. While the decision to be innovative is inherent of the student, the field of studies, supporting environmental factors, social and economic incentives could determine whether human-centric innovation ecosystems could result. However, in order for it to be successful, the ecosystem must first begin within higher education institutions and orientated towards students as a managerial resource that create value for society.

Concerning labor market needs of businesses, the human-centric approach ensures that a balance is maintained. Human-centric innovation ecosystem networks ensures that higher education study programs developed by HEIs are oriented to industry and business actual and future needs due to closer cooperation networks. Closer cooperation with industry ensures that HEIs fulfil future requirements of the relevant skillsets the labor force should possess. This strategy ensures that higher education sector remains relevant, aware and inclined to contributing concretely to innovation development through human-centric innovation ecosystems. The new human-centered approach for the higher education sector, as for other EU nations should be strategically planned as a one roof, networked system ('under the roof' of colleges and vocational educational and training institutions co-existing together) in universities, with complete autonomy. This is how human-centric innovation ecosystems can develop. This perspective amplifies the key benefit of reforms and structural changes in Lithuania's higher education sector. Reforms then should be strategized to regulated unification of higher education institutions in order to achieve greater utilization of facilities, infrastructure and human resources to the benefit of all stakeholders involved. As resources can be transformed into capital, the sector should strategically plan and mobilize those inputs and transformations required to unify the sector before human-centric innovation ecosystems can develop.

3.2.3. Human-centric Innovation Ecosystems: Socio-Economic Incentives and Environmental Factors

Superficially, the curriculum of the higher education sector in Lithuania fundamentally do not contributes to the development of human-centric innovation ecosystems. The curriculum instead is generally more oriented toward talent development. Talent development through formal higher education systems could be fostered through performance-based financing systems catered to talent development of the human capital. Though the motivation exists for talent development, more incentives are needed socially to prompt the human resources to pursue it. Students could be mentored on how to create value during and after higher education training and as beneficiaries and stakeholders of this system, maintain strong cooperative links with other stakeholders that invest in their development. Though, talent developed by the higher education sector is just at the acceptable criteria levels, a sustainable approach to higher education learning through closer cooperation with key stakeholders and beneficiaries would multilaterally contribute to talent development of the human resources. Hence, through human-centric innovation ecosystems at HEIs, innovation is a collective effort, driven by a combinational mix of several stakeholders' participation matched with a strategic approach to the development of human capital.



Graph 5. *Impact of the Higher Education Policy on Talent Development through Higher Education Attainment*
Source: Developed by the Author

From the Cluster Graph above, witnessing innovations and other innovative teaching methods are internal strategies used to build the creative mind-set, however human-centric innovation ecosystems are influenced by external factors such as socio-economic incentives, environmental industry and academic cooperation. The uniform analysis performed by NVivo on the themes extracted from the interviews, outlines several factors contribute to the talent development of human resources in higher education systems outlined in the Cluster Graph. Table 14 shows the probability of those factors leading to human-centric innovation ecosystems' development.

Table 14. *Factors that Lead to the Probability of Human-centric Innovation Ecosystems Development through the Higher Education Policy*

Experts	Human-centric Innovation Ecosystems				Reference Sources
	Socio-economic Incentives	Environmental	Industry, Sector and Academia Cooperation	Knowledge and Commercial Economy	
DT01	13.96%	0.27%	0.01%	0.51%	4
DT02	10.95%	0.30%	0.01%	31.43%	4
DT03	2.44%	0.30%	0.01%	0.56%	4
DT04	5.02%	0.30%	0.01%	0.56%	4
DT05	5.15%	0.30%	0.01%	0.51%	4
DT06	13.19%	0.30%	0.01%	0.56%	4
DT07	15.99%	0.36%	0.01%	0.40%	4
DT08	11.90%	12.49%	0.02%	0.62%	4

Experts	Human-centric Innovation Ecosystems				Reference Sources
	Socio-economic Incentives	Environmental	Industry, Sector and Academia Cooperation	Knowledge and Commercial Economy	
DT09	12.84%	18.66%	0.02%	59.37%	4
DT10	7.36%	63.89%	0.01%	0.56%	4
DT11	0.35%	0.89%	99.75%	0.79%	4

Source: Developed by the Author

From the probability percentage range of *0.35%* to *15.99%,* external socio-economic incentives linked to its development is highly dependent on international viability and attractiveness of Lithuanian HEIs' study programs for initially forming human-centric innovation ecosystems. Human-centric innovation ecosystems can begin in higher education institutions that act as primary habitats for the development human factor. This achieved where socio-economic incentives should as technology, strong internal and external collaboration based on the Quadruple Helix model, a qualification merit-based wage remuneration system and support from all actors. Socio-demographics indicate that Lithuania is an attractive nation for talent development as the low population rates and improvement in the immigration procedures for recruitment of international talent have provided significant advantage when compared to other EU Member States. The percentage figures for the environmental factor indicates the unlikelihood of human-centric innovation ecosystems. Hence, an environment conducive to ecosystem development is accelerated through joint research projects with the human capital granted experience to create prototypes, products and services during traineeships and internships. These activities are 'facilitators' of human-centric innovation ecosystems, with HEIs providing the necessary facilities, joint funding and support to student/business spin-offs development activities. Additionally, the negative figures indicate that these activities should increase in order to foster human-centric innovation ecosystems development in those environments. Cooperation activities between businesses and vocational educational and training institutions and universities indirectly contribute to talent development. Furthermore, ninety percent of the responses indicate a low probability percentage, of 0.01% to 0.02% that industry, sector and academic may impact human-centric innovation ecosystems development in Lithuania.

This is indicative that an academic curriculum designed according to labor market needs is key. As such, deterrence of the development of human-centric innovation ecosystems results from the higher education sectors' competitive market amongst local institutions, the type of diploma awarded for each study program developed, and quality of graduates 'produced'. On the other hand, it is not uncommon for the higher education sector to cooperate with businesses in identifying talented human capital beneficial for businesses in the long-term. Several, Non-Governmental Organizations (NGOs), have implemented initiatives for technical students to develop human-centered attributes, which through human-centric innovation ecosystems can foster employable skills in the future. Moreover, there are technological parks in Lithuania that support the development of the scientific potential and practical skills of graduates. The current socio-economic conditions, industrial and sectorial environment of Lithuania are characteristically harmonious for human-centric innovation ecosystems development, however there are differing perspectives as to what constitutes a harmonious ecosystem environment. The current economic structure is purely focused on the low added value sectors, insufficient human capital prevalent for innovation ecosystems, and mismatch of skillsets. The general view is that there is still room to improve internal harmony within the ecosystem. Inherently the human factor possesses the capability to inject added-value at all levels. This includes science, new technologies, innovations, research and development targeted to created opportunities within the socio-economic sphere. Based on these parameters, the external environment of Lithuania is on course to achieving human-centric innovation ecosystems. The economic sector of Lithuania is predominantly services and manufacturing oriented. For those sectors, the manufacturing sector contributes twenty-five percent (25%) well-above EU average. Though the percentage is not derived from outputs of innovation activities, rather the outcomes of ecosystems resulting from partnership contracts between actors and stakeholders. The main attribute of the human-centered approach to innovation from which is the foundation of human-centric innovation ecosystems, demonstrates the strategic advantage of this ecosystem in Lithuania. Pearson's correlation for the Figure below, indicates 0.1 range according to the pattern of the scatterplots.

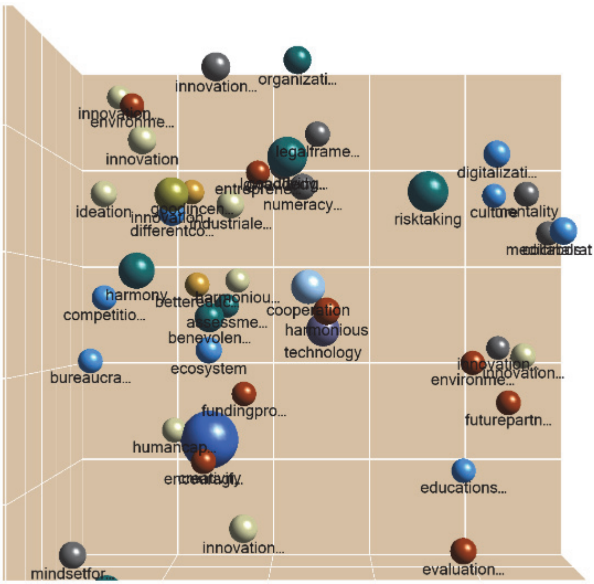


__Figure 16.__ Benevolent Condition for Partnerships and Cooperation to Flourish in the Industry and Manufacturing Sectors.
Source: Developed by the Author

Moreover, as only a small portion of the industrial, manufacturing and services sector in Lithuania are harmonious with innovation, another successful sector is the financial technologies sector. This sector which is built on a strong legal and regulatory framework is an example of the human-centric innovation ecosystem outputs where the creativity process of innovation is created *with its* beneficiaries and stakeholders. For Lithuania, this quality local ecosystems have attracted other innovative local and international actors, factors as well as funding that have converted it into a thriving and harmonious network. The ecosystem, within limited resources collaborates closely with the banking sector of Lithuania. This is a successful instance of human-centric innovation ecosystem within the financial services sector existing in harmonious environment within the legal and regulatory framework. Overall, the socio-economic incentives required to foster a harmonious human-centric innovation ecosystem is challenging yet building professional harmonious relationships should strategically begin at the departmental, then divisional, organizational, institutional, sectorial, regional then at the national level. Additionally, bearing in mind the situational context in Lithuania, ecosystems should act as the link for connecting meaningful networked structures across disciplines fields and sectors within society in a flexible manner. Regarding the internal environment, the features of the human factor centrally linked to quality innovation begins with higher education skills and values instilled in graduates. Ingenuously, graduates from the higher education sector are typically unaware that these features should be instilled during study years. Other features such as adopting a holistic approach, open-mindedness, culture-free mind-set approach, developing a proactive mindset, empathy, taking risks should form part of the education curricula. The situational context of Lithuania is that trust, a positive attitude and thinking, verbal skills, cooperative skills, preparedness and a professionally oriented career approach are core human-centric features that leads innovation linked to economic growth.

From Figure 17, though a positive linear relation (red line) is indicated for the skills developed in the internal environment of HEIs, an inverse linear (black line) correlation indicates more improvement of these skills are needed as well.

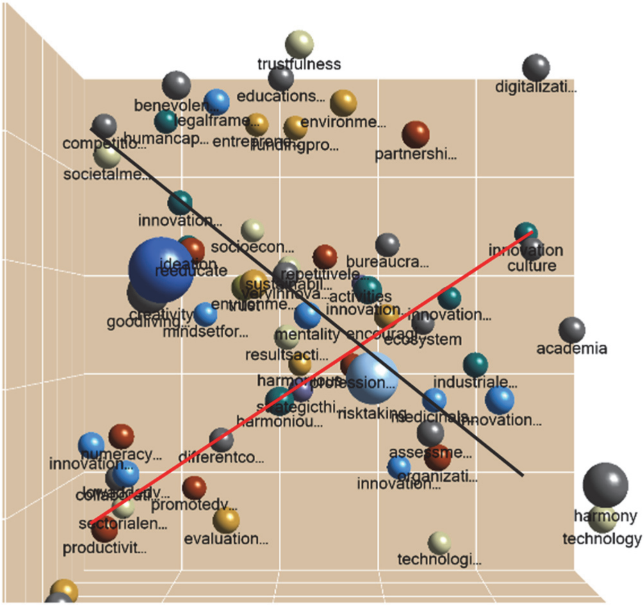


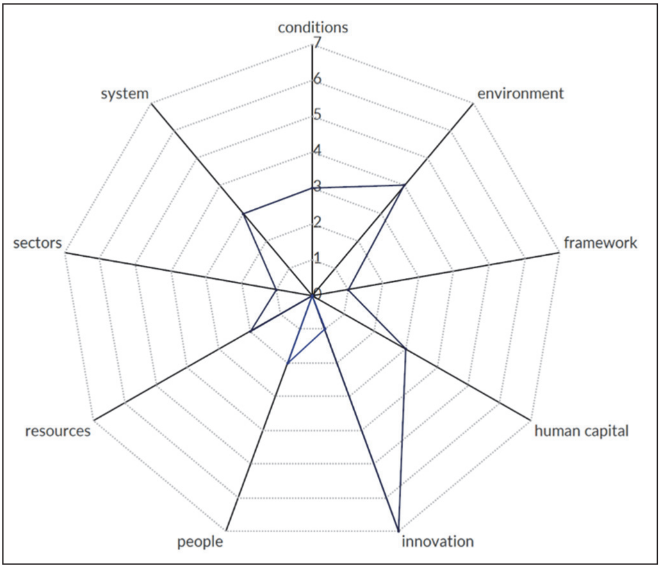
Figure 17. *Features of the Human Factor Relative to Quality Innovation.*
Source: Developed by the Author

Furthermore, these features should be normalized in the internal environment and included in all activities of higher education learning. Higher education attainment and skills as strategic resources, promulgates good governance, institutional capacity in setting the rule of law in Lithuania. This is central and a prerequisite for economic freedom, the preconditions for the framework of quality ecosystems for economic growth in Lithuania. While the features of the human factor may vary according to geographic location and the economies' specifics of a nation, investing in the higher education sector is always beneficial to nurturing this resource. Trust was construed as another weakness of the human factor in Lithuania. Enhancing more trust in each other should manifest from the individual, communities, organizations then to the governmental level. This would result in the human factor to have more trust to execute certain functions to allow operations and survival of the ecosystem. Confidence in Government bodies impacting the higher education sector would result in more trust between all stakeholders and beneficiaries of the higher education sector. The lack of trust at every level potentially impedes the 'healthy' development of ecosystems. When trust is absent it strategically impacts the distributive feature central in quality, human-centric innovation ecosystems. This feature severely compromises ecosystem development in Lithuania. Lastly, another critical feature for the human factor, important for an innovation mind-set is independent thinking. Possessing higher qualification and good competencies are ideal, yet for innovations one has to explore outside of the standardized framework and be willing to think independently. This complement 'manifested' leadership traits that inspire others in human-centric ecosystems network to follow and be led by an ascribed leader, essential for innovation outputs.

3.2.4. Human-centric Innovation Ecosystem: Industry, Business-Academia Contribution to the Knowledge and Commercial Economy

With low investments from the business sector to the higher education sector, cooperation and investments to upgrade the sector's infrastructure is high. Supportive schemes such as science and technical laboratories have been used as incubators of human-centric innovation with several Lithuanian companies cooperating academically to contribute to new academic and technical programs developed. Local industries are interested to add to the practical aspects of vocational institutions' technical program for future recruitment of graduates. Companies involved in such initiatives are those from Law, Consultancies, Biotechnology, Engineering, Photonics, Laser Technologies and Industrial Physics sectors. Moreover, due to the low level of investments by businesses to the higher education sector, the long-term effect is skills shortages in labor markets.

Though other environmental factors contribute to human-centric innovation ecosystems, the Cluster Graph below, expounds more on these general skills, according to the themes extracted:



Graph 6. *Socio-economic and Environmental Impacts of the Higher Education Policy on the Development of Human-centric Innovation Ecosystems*
Source: Developed by the Author

Greater focus placed on knowledge production rather than cooperating to implement a greater proportion of that knowledge generated into innovative products for the commercial economy is requisite.

Thus, a unified higher education system is perceived to permit a '*clearer stream*' of persons that possess the following resource skills useful for the strategic functions within human-centric innovation ecosystems according to Figure 18 below, are:

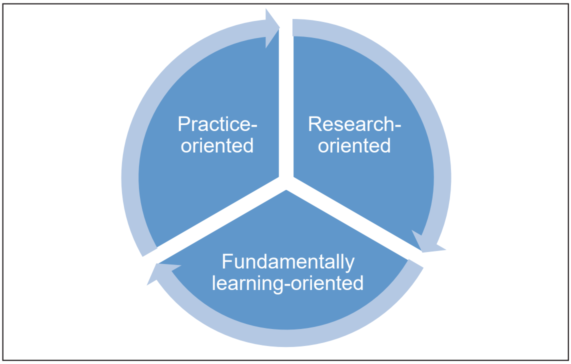


Figure 18: *Streamlined Approach to Higher Education Attainment through the Unification of HEIs*
Source: Developed by the Author

These important skills are inherent social traits possessed by students. Furthermore, it could impact how human-centric innovation ecosystems evolve, especially for the knowledge and commercial economies of Lithuania. When comparing each economy, human-centric innovation ecosystems could influence the long-term and short-term activities of each, up to 59.37%, in terms of the underlying factors, actors and conditions. Cooperation activities are necessary for organizational survival regarding quality human resources to achieve a competitive advantage. As a strategic tool, it is necessary for addressing existing skills gaps in the external environment of higher education sector. Consequently, whether it is knowledge transference, allocating or sharing of human resources, project initiation or commercialization, the main aim of these cooperation reverts to development of Lithuania's qualified human capital for the knowledge and commercial economies. Businesses and the industrial sector in Lithuania are acutely aware of the essence of cooperating with the higher education sector due to the 'added-value' features, yet organizational bureaucracy stagnates this initiative.

Research and development leading to knowledge transference are important functions of the higher education sector. While research is oriented to provide solutions to societal needs, the knowledge economy potential is limited due to reduced funding schemes for research. As vocational education and colleges do not contribute much research to society for the knowledge economy, universities contribute higher for both economies, with the highest figure being forty percent (40%). As universities are traditionally considered the knowledge pillars of society and not necessarily institutions that directly impact the commercial sector of nations or economy, they are perceived archaic by the business sector. Accordingly, the higher education sector does contribute to the commercial economy as most study programs and the teaching/learning methods are oriented towards the current needs of the labor market. Yet for the future little or no emphasis is given on what will be required. Consequently, the Table below outlines the estimated percentages figures for each economy:

Table 15. *Estimated Percentage Figure of Universities' and Higher Educational Institutions' Contribution to the Knowledge Economy and Commercial Economy in Lithuania*

Experts	Higher Education Sector	Knowledge Economy	Commercial Economy
DT01	Universities	67%	0%
	Vocational Educational and Training Institutes and Colleges	33%	100%
DT02	Universities	80%	20%
	Vocational Educational and Training Institutes and Colleges	80%	20%
DT03	Universities	75%	25%
	Vocational Educational and Training Institutes and Colleges	75%	25%
DT04	Universities	0%	0%
	Vocational Educational and Training Institutes and Colleges	0%	0%
DT05	Universities	100%	0%
	Vocational Educational and Training Institutes and Colleges	0%	0%
DT06	Universities	60%	40%
	Vocational Educational and Training Institutes and Colleges	40%	60%
DT07	Universities	50%	50%
	Vocational Educational and Training Institutes and Colleges	30%	45%
DT08	Universities	10%	0%
	Vocational Educational and Training Institutes and Colleges	20%	20%

Experts	Higher Education Sector	Knowledge Economy	Commercial Economy
DT09	Universities	80%	10%
	Vocational Educational and Training Institutes and Colleges	20%	90%
DT10	Universities	20%	5%
	Vocational Educational and Training Institutes and Colleges	30%	10%
DT11	Universities	0%	0%
	Vocational Educational and Training Institutes and Colleges	0%	0%

Source: Developed by the Author

The percentage of universities and higher educational institutions (vocational educational and training institutions, and colleges) in Lithuania that are contributing to the development of each of these economies are field specific. However, for professional focused institutions such Arts and Military Academies it is quite unclear quantitatively the actual amount that these institutions contribute to the knowledge or commercial economy. One well known practice are that representatives from businesses and the industrial sector share their knowledge through guest lecturing at higher education institutions. Another instance is research (when enterprises provide commercial research project proposals for higher education institutions). Moreover, some international companies are rather more active in enhancing human-centric innovation ecosystems, with the most active sectors including the Financial, Information and Communication Technologies (ICT) and High-tech companies.

Table 16 outlines the percentage probability levels of how the higher education policy impacts the four important dimensions necessary for the development of human capital for human-centric innovation ecosystems. According to the Table, Skills Competencies (54.44%), Higher Education Attainment and Talent Development (20.63%), Academic Education and Vocational Educational Training (33.13%), as well as Capital and Technological Infrastructural Support (20.31%), has a low impact on these four dimensions. The results indicate that these dimensions are not structured towards talent development for human-centric innovation ecosystem. Rather, attributes such as leadership, guidance and strategic-decision making are key. The human-centered skills competencies required for human-centric innovation ecosystems are nurtured through higher education and developed through supportive environments, and according to the research indicates that it should transmit from higher education systems.

Table 16. *Dimensions of the Higher Education Policy and Human Capital required for Human-centric Innovation Ecosystems*

Ex-perts	**Higher Education Policy and Human Capital for Human-centric Innovation Ecosystems**				**Reference Sources**
	Skills Com-petencies	**Higher Edu-cation At-tainment and Talent Devel-opment**	**Academic Education and Vocational Educational and Training**	**Capital and Technological Infrastructur-al Support**	
DT01	0.36%	13.75%	4.60%	8.91%	2
DT02	11.48%	11.47%	14.34%	10.39%	2
DT03	-	4.25%	2.12%	0.14%	2
DT04	0.16%	2.21%	0.14%	7.43%	2
DT05	2.68%	0.09%	5.77%	12.43%	2
DT06	10.43%	3.25%	10.72%	16.14%	2
DT07	6.80%	16.64%	14.53%	0.14%	2
DT08	0.18%	18.11%	5.88%	4.96%	2
DT09	54.44%	20.63%	33.13%	20.31%	2
DT10	0.57%	-	0.14%	17.65%	2
DT11	9.28%	8.95%	7.42%	0.29%	2

Source: Developed by the Author

3.3. Analysis of the Main Findings of the Impact of the Higher Education Policy on Human-centric Innovation Ecosystems Development

The goal of this section is to evaluate the insights developed from the empirical research findings on human-centric innovation ecosystems and assess them according to how it supports the ecosystem's development in the higher education sector according to the theoretical conceptual framework developed. The results of the qualitative case assessment and experts' feedback on human-centric innovation ecosystems development could then be further reviewed according to how the ecosystems can be strategized to improve the institutional internal environment of the higher education sector.

Human-centric innovation ecosystems are embedded in a network of actors in higher education sector due to the strategic nature of the ecosystem. For the ecosystem's development in higher education systems, its position should be at the planning stage of policy development. The case study of Lithuania revealed that policy related to education and training, lead stakeholders and beneficiaries to proactively choose methods concurrent and supportive of innovation ecosystem development.

The impact of the policy on human-centric innovation ecosystems development should be evaluated according to the kind of solutions developed to strengthen the collaborative networks with stakeholders and beneficiaries. These solutions should be oriented towards new practice and learn or innovate and research degree programs in higher education institutions. In the experts' responses, higher education institutions that are technically oriented have stronger and closer cooperation with its stakeholders and beneficiaries in businesses and industry leading to a human-centric innovation ecosystem network. These higher education institutions tend to have a high smart specialization and entrepreneurship profile. Additionally, higher education institutions that are research-oriented tend to cooperate closely with partners in HORIZON2020 projects, participate in competitive funding to support scientific and research activities leading to innovation. These institutions tend to have a high research profile. The case study of Lithuania and the experts feedback provided insights on institutions that have adopted these strategies, however more efforts could lead to stronger partnerships and cooperation to address the issues in the higher education sector. The Figure below summarizes how this process could work:

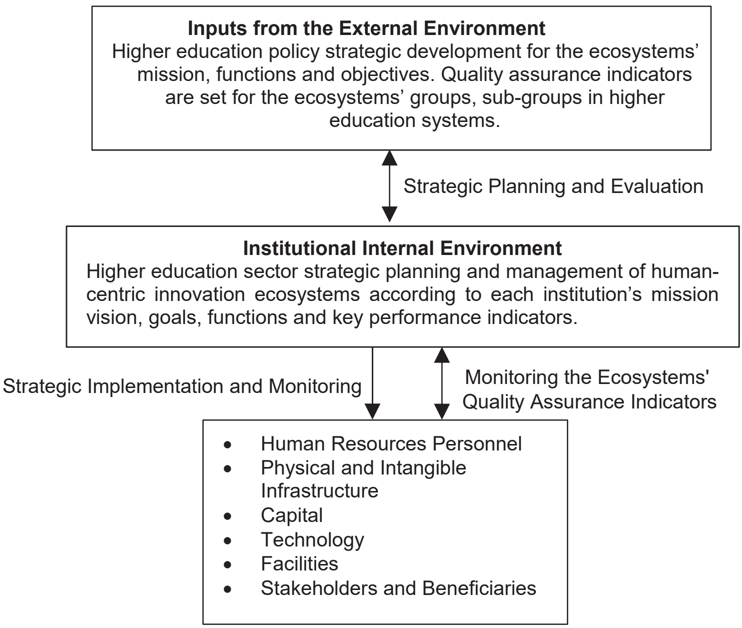


Figure 19. *Strategy Development through Human-centric Innovation Ecosystems.*
Source: Created by the Author

A general approach for aligning higher education institutions study programs to the labor market is supporting cooperation with stakeholders and beneficiaries through collectively affiliating the mission, objectives functions of the ecosystem according to each stakeholder and beneficiaries' needs. This strengthens the performance of higher education sector, structure and functions both in quality and quantity. The attributes of the human capital derived from the internal and external environments for human-centric innovation ecosystems in HEIs, are higher in entrepreneurships, being different innovative and collaborative. Within human-centric innovation ecosystems' networks of stakeholders, actors, non-higher educational factors relative to human capital development for contribution to the knowledge and commercial economy, quality assurance indicators could monitor the qualitative inputs, processes, results, outputs and outcomes. Using Pearson's correlation, the Figure below indicates a major linear relation exist between the ecosystems contribution to the knowledge and commercial economy, and as such quality assurance indicators should be formulated for the ecosystem to consistently monitor this.

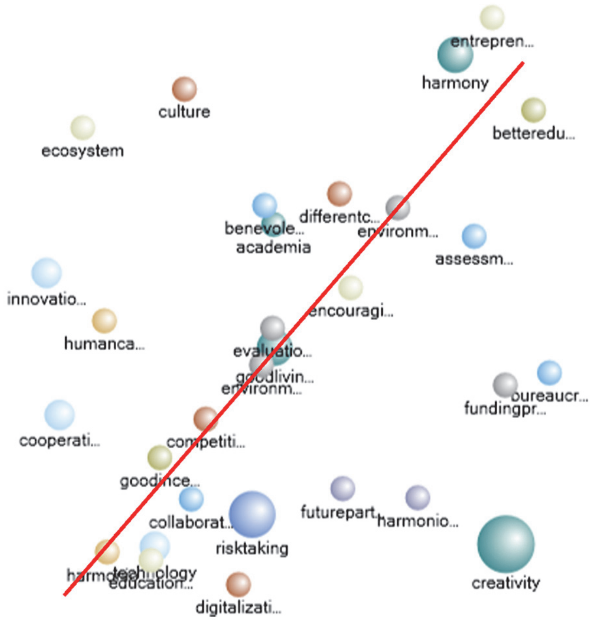


Figure 20. *Correlation between Human-Centric Innovation Ecosystems Qualitative Outputs and Outcomes to the Knowledge and Commercial Economies.*
Source: Developed by the Author

The significance of the socio-economic, industry, academia and sectorial stakeholder environment in human-centric innovation ecosystems from the case assessment and the experts' responses could permit quality assurance indicators to measure how those factors support the ecosystem's survival. According to Figure 21 using the Pearson correlation there is a relation existing between the variables, from approximately 0.5 to 1. Quality assurance indicators should be formulated to monitor this environment in the ecosystem as well.

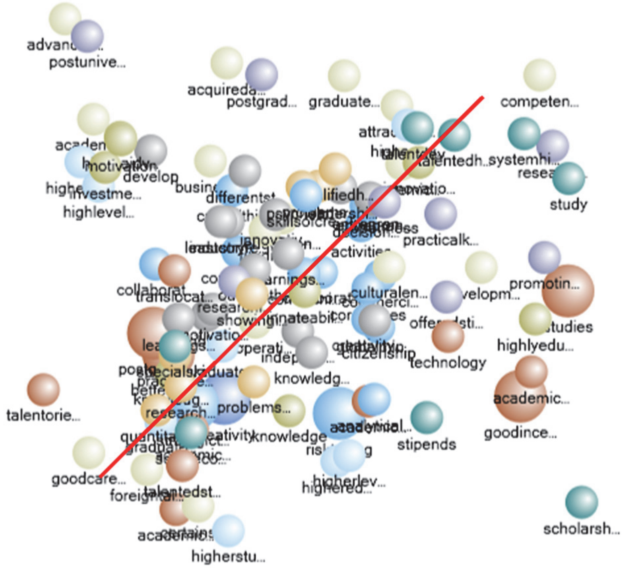


Figure 21. *Correlation of the External Environment to the Survival of the Ecosystem. Source: Developed by the Author*

These tools and resources that measure the performance, outcomes, processes and impacts on the development of the ecosystem should be done as a ratio to the inputs. From the results five key tools and resources are necessary for this assessment:

1. Quality of human capital produced
2. Incentives for talent development
3. Greater cooperation ties among key actors (stakeholders and beneficiaries)
4. Institutions in the higher education sector's strategic goals
5. Institutions functions (role) in higher education sector to innovation value creation

According to the case findings and experts' responses, more progressive institutions in the higher education sector tend to have stronger cooperation ties, an internal and external environment aligned to its vision and mission, centrality of innovation in its activities, quality human capital and talent. Assessing the impact of policy on human-centric innovation ecosystems development, strategic monitoring of the quality assurance indicators can evaluate the ecosystems' competitive advantage status through outcomes and outputs generated. This fact shows that the features and attributes of ecosystem have taken into account quality rather than quantity as well. The higher education sector should incorporate human-centric innovation ecosystems into its strategic planning and management as well as the direction in which resources are allocated to support it as a strategy.

Greater cooperation strengthens the higher education sectors' position to the knowledge and commercial economies. Through human-centric innovation ecosystems, the higher education sector closely contributes to the continuous development of these economies through the quality of the human capital produced and talent developed through its systems. Both knowledge and commercial economies requires human resources, first, to create the technology and digitization platforms for instant access to knowledge, then secondly develop the tools for its commercialization. The quality assurance indicators of human-centric innovation ecosystems evaluate the strategies for integrating more practical learning and research into studies also as a ratio of inputs to processes, outputs and outcomes in the knowledge and commercial economies. The case study findings and experts' feedback indicates that higher education institutions in Lithuania contribute to both economies however there was no mention of a qualitative strategy to evaluate their impact other than the quantitative outputs produced from the research. These institutions should according to their functions, mission and objectives, position towards human-centric innovation ecosystems which enables systemic quality evaluation of inputs into the commercial and knowledge economies. In addition, a strategy that strengthens cooperation among all stakeholders and beneficiaries could monitor relations with all the institutions in the ecosystem.

The findings from the case study and some of the experts' responses indicate that the higher education sector's systems of learning, practice and research should be aligned closer to all stakeholders and beneficiaries involved particularly for the expectations on the outcomes of higher education attainment. Human-centric innovation ecosystems ensures that institutions forming its network has a greater chance of aligning teaching methods that are relevant and inclined to the knowledge society, beneficial for stakeholders and actors and ensures that quality and quantity of outputs are measurable. Strategic partners developed through these collaborative structures and relations will have thus have greater importance and presence in policy development for the higher education sector. Utilization of human capital and talent as resource tools and strengthened collaborations across institutions results in greater resource optimization in human-centric innovation ecosystems.

The implications identified for human-centric innovation ecosystems are cultural (micro-environment), socio-economic (macro- environment), institutional (eso- and meso-environment), and individual (talent). At the institutional level the findings indicate weak *inter-* and *intra-*cooperation between institutions could impede the ecosystem's development. Internal and external institutional environment and the availability of resources, technology and infrastructure to support its functions. Human-centered attributes such as trust, communication, organizational and institutional culture to innovation are several barriers to human-centric innovation ecosystems. At the individual level, human-centered features such as skills development, aptitude and an inherent motivation for innovation were cited in the findings as barriers to human-centric innovation ecosystems. The socio-economic and cultural environment also determine whether human-centric innovation ecosystems harmoniously develop considering the factors, actors and funding to support it strategically.

This concluding section demonstrates that the methods chosen are useful for supporting the strategic management functions of the higher education sector, solves the problems of evaluating policy impacting ecosystem development using qualitative analysis methods, defines the relationship between the higher education sector and the knowledge and commercial economies. In addition, it aided in assessing the true position of human-centric innovation ecosystems in the higher education sector. As a resource, these ecosystems enable higher education institutions to set it as a strategic goal in line with their objectives, mission and vision to innovation. This demonstrates the novelty of the dissertation.

3.4. Summary

The empirical research fulfilled the aim for evaluating the impact of the higher education policy according to the theoretical conceptual framework developed for human-centric innovation ecosystems. It also validated that the theoretical conceptual framework developed for human-centric innovation ecosystems is relevant and correct. Furthermore, the suggested conceptual framework is suitable for assessing research on human-centered type ecosystem development through the human capital possessing higher education qualifications. The results obtained in the investigation, such as qualitative insights on the thematic concepts and categories that indicate quality ecosystems development, are complementary for all stakeholders and beneficiaries. This can be used for generating new knowledge about innovation ecosystems features that adopt the human-centered approach. Human-centric innovation ecosystems could be treated as a strategic resource in management sciences for understanding and monitoring quality ecosystems that create value from innovation with its stakeholders and beneficiaries of the ecosystem.

The results obtained from the empirical research provided a better understanding of the attributes required for ecosystem development. This was evaluated according to inherent features of the talented human factor, perceived as the initiator of human-centered innovation through qualifications skills attained, is new and significant for management science. This research also provided understanding on the objectives and functions of all actors, the network structure of human-centric innovation ecosystems and assists the higher education sector to identify its contribution as well as concentrate on its most important benefits and limitations.

The results of empirical research are also new and useful for institutions in the higher education sectors. The practical benefits are that these institutions applying management resources could employ the theoretical conceptual framework to develop better strategies for quality ecosystems leading to new synergies, greater use of managerial resources and improvement in its general performance in addressing the skills gap and mismatch between education and industry. This enhances the relevance of the dissertation and its practical applicability.

CONCLUSIONS

Conceptual framework of human-centric innovation ecosystem.

1. Human-centric innovation ecosystems is a strategic resource to address the managerial challenges and issues of talent development for innovation in the higher education sector. Its framework, composition and features enable focused-driven strategic design and decision making to result according to the role and functions of institutions in the higher education sector. Capturing on the cognitive abilities, skills and attributes of the human factor, the framework developed enables its development for innovation.
2. Concurringly the conceptual framework developed for human-centric innovation ecosystems value capture at all levels for each actor, stakeholders and beneficiaries of the ecosystem. This is structured according to the level and ratio of the human factor in innovation to the motivation and value of the abilities acquired. As a human-centered structured ecosystem, it is recognized that talent and motivation for innovation is shaped according the environmental culture, supporting incentives technology and infrastructural facilities as well as the approach of all agents of the ecosystem to innovation. From the most important features, internal and external institutional environmental factors and socio-economic conditions from the scientific literature, this resides on the value of cooperation between all agents for the ecosystem to flourish and achieve the strategic goals set for the higher education.
3. For value capture at each level, the conceptual framework entails strong integrative, collaborative structures between each actor and institutions of the ecosystem, which fosters its adaptability, flexibility, ease of transference of resources as well as increasing the ecosystem's efficiency as a resilient strategic resource. Moderately this results in a great degree of resources dependency between actors and institutions within the ecosystem to enable optimization, greater concentration and reallocation of resources for human capital and talent development.
4. Technological and digitalization platforms affect the technology transference within the ecosystem. Therefore, policy should ensure that through the stakeholders' relations and cooperative links, stakeholder transactional costs is reduced to access these resources for talent and human capital development. One approach to counter this would be strategic management of the technological and digital transference within the ecosystem. According to the framework structure, aligning the ecosystem according to each economic level could be problematic in terms of the differing resources available at each level and its estimated outputs and outcomes. This is alleviated by horizontally aligning key resources and platforms across the ecosystem which enables ease of their transference and greater utilization between all actors.
5. The literature review on human-centric innovation ecosystems necessitates its consideration at the decision-making level of the higher education policy for higher education institutions. Due to the nature of the ecosystems structure,

greater insights at policy levels on the approach to human capital and talent development through higher education institutions from aggregate results generated through the quality assurance indicators tools of the ecosystem. This in turn converts to strategic intangible solutions for innovation and greater identification of long-term objectives specific to the overall needs of the ecosystem.

Human-centric innovation ecosystem and the higher education sector.

1. A harmonious ecosystem environment is generated across the massive networks of institutions and actors of the higher education sector. Incentives that supports such environments typically work well in smaller networks and clusters however a tailored approach to the vast network of the higher educator sector, using human-centric innovation ecosystems would potentially foster this. Though the empirical findings indicate that internal actors of higher education institutions as well as other stakeholders and beneficiaries are generally aware of their role to foster a harmonious environment for innovation development, they generally do not take into account the benefits of its practical application within an internal institutional environment.
2. Human-centric innovation ecosystems from the empirical findings, is that as a strategic resource, it creates value from innovation due to the shared functions, shared use of resources, technology and platforms for talent and human capital development as a managerial resource for innovation. The significance is further reiterated from the current outputs and outcomes of the features of the human capital developed for innovation. The empirical findings indicate that the current status of human capital base on skills and features developed is not conducive for quality innovation.
3. The quality assurance indicators developed for monitoring and assessing the inputs, processes, outputs and outcomes of human-centric innovation ecosystems ensures that if human capital and talent development fall short of the set objectives and mission of the ecosystem, intervening corrective initiatives would be applied concurrently to ensure that they meet the criterion set.
4. The findings further indicate that though higher education institutions operate in relatively competitive environments that lack trust and openness, they would not take into account the potential underestimated benefits derived within the ecosystem's network. However, the ecosystem could permit higher education institutions to benefit from underestimated benefits that would grant a comparative advantage that enhances their institutional profile.
5. The empirical findings validate that the network structure of human-centric innovation ecosystems assists the higher education sector to qualitatively identify its contribution levels to quality innovation as well as areas of concentration to develop on as well as its limitations within the ecosystem.

Designation of human-centric innovation ecosystem.

1. According to the structure of the framework, human-centric innovation ecosystem is conceptually designated at the planning phase of policy for the higher

education sector. Human capital and talent developed within the ecosystem ensures skills gratification and simultaneously improve cooperation networks that contributed to this. As producers of human capital and talent development, the policy including other intangible and tangible inputs determines the role and functions of the higher education sector as well as the opportunities set for human-centric innovation ecosystems implementation, at the institutional level, as a strategic goal in line with their mission and vision to innovation.

2. Human-centric innovation ecosystems strategically enhance the reputation and value of the higher education sector as well as its future performance and contributions to innovation within the knowledge and commercial economies. Selection of methods strategically concurrent and favorable to the sector's internal functions as well as to the ecosystem's overall framework. The ecosystem will designate the position and benchmark levels for setting of the internal strategic design for human capital and talent development in the higher education sector. Incorporation of the results achieved is added into the overall framework of the ecosystem to improve the general outlook of the higher education sector depending on the results attained.
3. As a strategic resource for the management and planning processes for the higher education sector, human-centric innovation ecosystem enables higher education institutions to collectively affiliate with its key stakeholders its vision, mission and objectives for human capital development through improved communications systems. This strengthens its performance and garner greater support simultaneously from other actors of the ecosystem to the higher education sector in fulfilling its functions in society through stronger cooperation networks.
4. Quality assurance indicators tools developed for monitoring the non-higher education factors relative to human capital development in human-centric innovation ecosystems evaluate the processes and outcomes for the higher education sector's internal planning and allocation of resources in the future.

Use of human-centric innovation ecosystem in strategic planning and policy.

1. The quality assurance indicators developed for human-centric innovation ecosystems monitors the input levels developed from the strategic design planned for cooperation activities between the higher education sector and its stakeholders. The value creation is generated from the inputs to the knowledge and commercial economies. The quality of the solutions generated to strengthen collaborative networks with the ecosystems' stakeholders and beneficiaries support new practice and learn or innovate and research degree programs in higher education institutions which also create value for these economies.
2. From the empirical findings, the attributes of the human capital derived from the internal and external environment of human-centric innovation ecosystem are higher in entrepreneurships, being different, innovative and collaborative. These attributes achieve the practical application of smart specialization through higher education. Moreover, skills mismatch and non-manifestation of talent for

innovation is addressed through collaborative planning with the stakeholders and beneficiaries to enhance skills compatibility and talent flow to industry. The main factor dependent on its success is good communication systems in the ecosystem. The findings indicated that communication and trust lead to significant functional results and longevity of the ecosystem network. Human-centric innovation ecosystems enable greater focused-based development of human capital and talent development through better utilization of resources in the ecosystem.

3. Within human-centric innovation ecosystems, policy regulating the ecosystems' development is evaluated according to the kind of solutions developed to address the challenges in the higher education sector. The level of *inter-* and *intra-*cooperation, internal and external institutional environment and available resources, technology and infrastructure.
4. Through enhance cooperation ties, institutions of the higher education sector attain a competitive advantage through human-centric innovation ecosystem. Resolution of the challenges and issues relating to skills mismatch and non-manifestation of talent for a competitive advantage in innovation, however, is contingent of this. Comparatively, a competitive advantage is indicative of the quality generated by the sector through the ecosystem for inputs to innovation.
5. Human-centric innovation ecosystem framework enables greater use of managerial resources for improvement of the performance of the higher education sector to its stakeholders and beneficiaries. Practical applicability of human-centric innovation ecosystems is based on its use as a strategic resource for strengthening cooperation within the ecosystem itself. This enables the higher education sector to address issues and challenges through strengthened cooperation activities, optimization of its key resources and funding to achieve this.

RECOMMENDATIONS

Main Suggestions:

1. For value capture of human-centric innovation ecosystems, it is proposed that the ecosystem framework serve as a strategic resource input for innovation strategy development and implementation.

Recommendations to Scientists for Future Research:

1. In order to investigate the application of human-centric innovation ecosystems for the innovative potential of entities and institutions as an input resource, more research on assessing the practical processes, outputs and outcomes of the ecosystem for the formulation of strategy development.
2. More research to assess the impact of other actors such as regulatory accelerators and sandboxes on the development of engagement within human-centric innovation ecosystem framework.
3. In order to assess the application of human-centric innovation ecosystems in the higher education sector, more quantitative research on the managerial phases involved to utilize the ecosystem as a strategic resource to address challenges and issues in the sector as well as revealing insights from the quality assurance indicators developed for the monitoring process.

Recommendations for Stakeholders and Beneficiaries:

1. For stakeholders and beneficiaries, a formal systemic role appropriation implemented into the ecosystem's framework in order to acquire accurate and comprehensive perspectives on each actor's contribution to the ecosystem.
2. Implement a set of formal quality assurance tools to evaluate the outcomes and outputs of the ecosystem.
3. Knowledgeable and experienced human resources (personnel) should form a core part of the ecosystem's framework to develop its strategic insights, management and coordination of its activities.
4. Experts that have knowledge to access points for human capital development should form a core part of the ecosystem.
5. In order to achieve talent for innovation, implement more graduate program internships and placements through funding mechanisms to recruit outstanding talent in higher education programs aligned to the enterprise mission, vision and goals.
6. Multidisciplinary engagement and interaction with the higher education sector in the ecosystems through cooperation and partnerships that fosters joint allocation of resources for innovation.
7. Alternate tuition programs or scholarship schemes for promising, outstanding talent sponsored during the study years at higher education institutions on a semester-base performance evaluation system. Upon graduation talent is evalu-

ated according to education or technical performance outcomes for future employment.

Recommendations for the Higher Education Sector:

1. For human-centric innovation ecosystem in the higher education sector, higher education institutions that are technically oriented should coordinate study programs as mechanisms for sandbox- or incubator-led innovation outcomes to achieve skills compatibility with the industrial sector.
2. For human-centric innovation ecosystems, those institutions that are research-oriented, study programs should be coordinated through accelerator mechanism schemes for knowledge development and correct alignment of its transference to industry knowledge acquisition and utilization. This enables enhanced commercialization of research results from the higher education sector.
3. Study placements to outstanding trained human-capital should not be solely offered on an academic or technical criterion; rather as part of future placements with progressive enterprises that are stakeholders with HEIs in human-centric innovation ecosystems.

Recommendations for Governmental Ministries:

1. In order to ensure that the ecosystem operates effectively, educate the stakeholders, beneficiaries and actors about the functions, vision and mission of human-centric innovation ecosystem. Procedural, regulatory and legal frameworks should be implemented to the ecosystem to manage its functions and activities.
2. Experienced personnel should be recruited to human-centric innovation ecosystem to develop and execute solutions needed to address the issues faced by the higher education sector and mitigate future challenges that may arise. For human-centric innovation ecosystems, implement open recruitment systems in higher education institutions for the best, outstanding and talented individuals that have an interest to be trained and contribute to quality innovation outputs and outcomes. Open recruitment systems should consist of attractive incentives for talent to pursue innovation.
3. Quality assurance performance indicators should be developed in order to regulate and assess human-centric innovation ecosystems functions and objectives as well as its quality outcomes and outputs.

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Finland: https://eacea.ec.europa.eu/national-policies/eurydice/content/finland_en
France: https://eacea.ec.europa.eu/national-policies/eurydice/content/france_en
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Ireland: https://eacea.ec.europa.eu/national-policies/eurydice/content/ireland_enItaly: https://eacea.ec.europa.eu/national-policies/eurydice/content/italy_en
Latvia: https://eacea.ec.europa.eu/national-policies/eurydice/content/latvia_en
Lithuania: https://eacea.ec.europa.eu/national-policies/eurydice/content/lithuania_en
Luxembourg: https://eacea.ec.europa.eu/national-policies/eurydice/content/luxembourg_en
Malta: https://eacea.ec.europa.eu/national-policies/eurydice/content/malta_en
Netherlands: https://eacea.ec.europa.eu/national-policies/eurydice/content/netherlands_en
Poland: https://eacea.ec.europa.eu/national-policies/eurydice/content/poland_en
Portugal: https://eacea.ec.europa.eu/national-policies/eurydice/content/portugal_en
Romania: https://eacea.ec.europa.eu/national-policies/eurydice/content/romania_en
Slovakia: https://eacea.ec.europa.eu/national-policies/eurydice/content/slovakia_en
Slovenia: https://eacea.ec.europa.eu/national-policies/eurydice/content/slovenia_en
Spain: https://eacea.ec.europa.eu/national-policies/eurydice/content/spain_en
Sweden: https://eacea.ec.europa.eu/national-policies/eurydice/content/sweden_en
United Kingdom (England): https://eacea.ec.europa.eu/national-policies/eurydice/content/united-kingdom-england_en
United Kingdom (Northern Ireland): https://eacea.ec.europa.eu/national-policies/eurydice/content/united-kingdom-northern-ireland_en
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ANNEX

Annex 1: Data Collection Instrument- Semi-structured Questionnaire

SECTION 1

Expert DT0__ **Date: ___/___ /___**

Sector or Industry: ____
(Please write the sector or industry that you are employed or affiliated with)

Position in the Organization or Company:
a) Top-Level Management;
b) Middle-level Management;
c) Low-level Management;
d) Other___________________;

Years of Experience: ____

Important Terms and Definitions to the Questionnaire:

- *Commercial Economy.* Aspects of an economy tied to the exchange of goods, services, and labor activities having a set monetary value (Business Dictionary, 2020).
- *Human-centered Innovation.* An accommodation of the major forces driving innovation in today's global economy: the accelerating business trend to designing innovations to serve human requirements first, and the burgeoning demand for transparency and accountability in pursuit of positive, sustainable economic development (Perelman, 2007).
- *Human-centric Innovation*. Inspired talent is the engine of innovation**.** At its most effective, innovation is an inherently human endeavor. Successful innovation happens when people with skills, experience, and capabilities come together to understand or predict, and then address, other people's challenges. Talent, like capital and technology, is a key success factor for innovation. Inspiring potential talent will drive innovation and growth. (The Global Innovation Index, 2014).
- *Innovation Ecosystems.* A network of interconnected organizations, organized around a focal firm or a platform, incorporating both production and use side participants, and focused on the development of new value through innovation (Autio and Thomas, 2013).
- *Knowledge Economy.* Greater reliance on instant access to information generating facts and intellectual skills for the productive advancement of economic activities of private and public organizations (OECD, 2005).

SECTION 2

Interview Questions:

1. Please explain how the curriculum of academic education and vocational educational training provided by higher education fundamentally contributes to talent development in Lithuania.
2. Please choose the skills that the higher education policy of Lithuania deems **most common** or **least common** for human-centric innovation ecosystems:
   a. Motivation/drive ______
   b. Leadership skills______
   c. Creativity skills______
   d. Risk taking/ showing initiative______
   e. Flexible and an adaptable attitude (Psychological)______
   f. Industry-related skills through practical experience______
   g. Global mind-set______
   h. Entrepreneurship skills______
   i. Decision-making skills______
   j. Strategic thinking______
   k. Communication skills______
   l. Collaborative skills______
   m. Analytical skills______
   n. Quantitative skills______
   o. Critical thinking/ Problem solving skills______
   p. Other skills ______
3. Please describe the infrastructure already in place in the higher education system that enhance the knowledge of population in various technological and non-technological fields of study? Please describe the basic, advanced teaching and research and development facilities that helps to form the talented human capital?
4. How can Lithuanian universities and higher education institutions be more effective in the engaging talented human capital (local and foreign talent) and simultaneously created a human-centric innovation ecosystem for aspiring entrepreneurs? Please describe what the right kind of incentives are in the Lithuanian system that allows human capital to pursue innovation.
5. Recently Lithuania has moved up its place in its regional innovation activities. How has the higher education policy contributed to this advancement? Please comment on actual instances.
6. Are the present socio-economic conditions, industrial and sectorial environment of Lithuania harmonious for innovation ecosystem to thrive? Please comment on a few examples.
7. Several factors such as technology, capital and human capital contribute to innovation. What features of the human factor is responsible for innovation and economic growth in Lithuania?

8. There have been recent reforms and structural changes in the higher education system of Lithuania. To what extent will these new reforms significantly impact the development of human-centric innovation ecosystems **now** and **in the future**? Have these reforms been impacted by the steady migration/emigration patterns in Lithuania?
9. How involved are businesses and the industrial sector in Lithuania in enhancing the higher education system? Which sectors are more active/ inactive with the system?
10. How can higher education inspire potential talented human capital to drive innovation and growth in Lithuania? Can this be achieved through a formal academic education offered by universities or vocational educational training offered by higher education institutions? What are the necessary components for such ecosystems?
11. Human-centric innovation ecosystems are fundamentally built on the knowledge and commercial economy. Please explain the percentage of universities and higher educational institutions in Lithuania that are contributing to the development of each of these economies:
    a. The knowledge economy.
    b. The commercial economy.
12. Please describe whether higher education and a large stock of highly educated human capital (educational attainment) is correlated to the development of human-centric innovation ecosystems? Would having higher education training or qualification contribute more economic activities and wealth in Lithuania?

- THANK YOU -

APPENDICES

Appendix 1: The Descriptors that Define Each Level of the European Qualifications Framework (EQF)

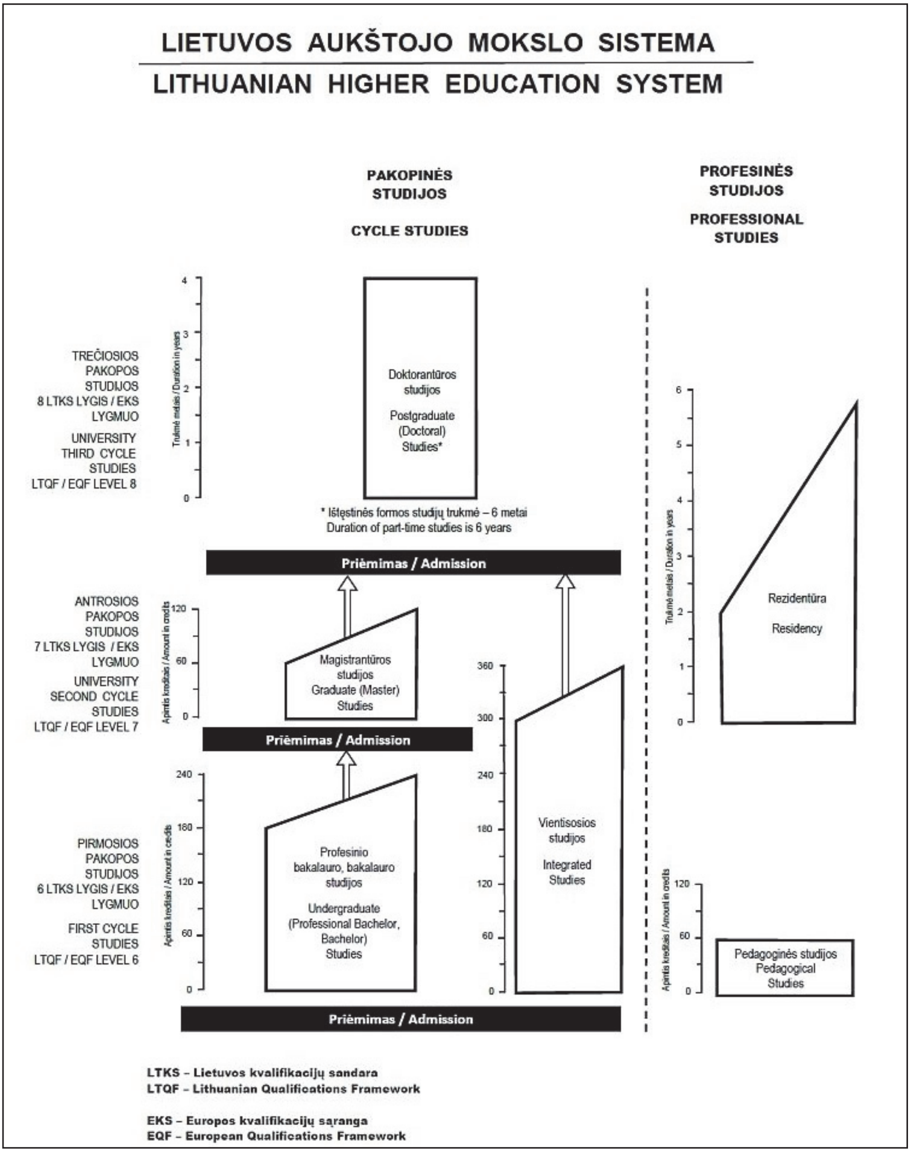
Tier Levels	**Knowledge:** In the context of EQF, knowledge is described as theoretical and/or factual.	**Skills:** In the context of EQF, skills are described as cognitive (involving the use of logical, intuitive and creative thinking) and practical (involving manual dexterity and the use of methods, materials, tools and instruments).	**Responsibility and Autonomy:** In the context of the EQF responsibility and autonomy is described as the ability of the learner to apply knowledge and skills autonomously and with responsibility
Level 1	**The learning outcomes relevant to Level 1 are:**		
	Basic general knowledge	Basic skills required to carry out simple tasks	Work or study under direct supervision in a structured context
Level 2	**The learning outcomes relevant to Level 2 are:**		
	Basic factual knowledge of a field of work or study	Basic cognitive and practical skills required to use relevant information in order to carry out tasks and to solve routine problems using simple rules and tools	Work or study under supervision with some autonomy
Level 3	**The learning outcomes relevant to Level 3 are:**		
	Knowledge of facts, principles, processes and general concepts, in a field of work or study	A range of cognitive and practical skills required to accomplish tasks and solve problems by selecting and applying basic methods, tools, materials and information	Take responsibility for completion of tasks in work or study; adapt own behavior to circumstances in solving problems
Level 4	**The learning outcomes relevant to Level 4 are:**		
	Factual and theoretical knowledge in broad contexts within a field of work or study	A range of cognitive and practical skills required to generate solutions to specific problems in a field of work or study	Exercise self-management within the guidelines of work or study contexts that are usually predictable, but are subject to change; supervise the routine work of others, taking some responsibility for the evaluation and improvement of work or study activities

Tier Levels	**Knowledge:** In the context of EQF, knowledge is described as theoretical and/or factual.	**Skills:** In the context of EQF, skills are described as cognitive (involving the use of logical, intuitive and creative thinking) and practical (involving manual dexterity and the use of methods, materials, tools and instruments).	**Responsibility and Autonomy:** In the context of the EQF responsibility and autonomy is described as the ability of the learner to apply knowledge and skills autonomously and with responsibility
Level 5[1]	**The learning outcomes relevant to Level 5 are:**		
	Comprehensive, specialized, factual and theoretical knowledge within a field of work or study and an awareness of the boundaries of that knowledge	A comprehensive range of cognitive and practical skills required to develop creative solutions to abstract problems	Exercise management and supervision in contexts of work or study activities where there is unpredictable change; review and develop performance of self and others
Level 6[2]	**The learning outcomes relevant to Level 6 are:**		
	Advanced knowledge of a field of work or study, involving a critical understanding of theories and principles	Advanced skills, demonstrating mastery and innovation, required to solve complex and unpredictable problems in a specialized field of work or study	Manage complex technical or professional activities or projects, taking responsibility for decision-making in unpredictable work or study contexts; take responsibility for managing professional development of individuals and groups
Level 7[3]	**The learning outcomes relevant to Level 7 are:**		
	Highly specialized knowledge, some of which is at the forefront of knowledge in a field of work or study, as the basis for original thinking and/or research Critical awareness of knowledge issues in a field and at the interface between different fields	Specialized problem-solving skills required in research and/or innovation in order to develop new knowledge and procedures and to integrate knowledge from different fields	Manage and transform work or study contexts that are complex, unpredictable and require new strategic approaches; take responsibility for contributing to professional knowledge and practice and/or for reviewing the strategic performance of teams

Tier Levels	Knowledge: In the context of EQF, knowledge is described as theoretical and/or factual.	Skills: In the context of EQF, skills are described as cognitive (involving the use of logical, intuitive and creative thinking) and practical (involving manual dexterity and the use of methods, materials, tools and instruments).	Responsibility and Autonomy: In the context of the EQF responsibility and autonomy is described as the ability of the learner to apply knowledge and skills autonomously and with responsibility
Level 8[4]	**The learning outcomes relevant to Level 8 are:**		
	Knowledge at the most advanced frontier of a field of work or study and at the interface between fields	The most advanced and specialized skills and techniques, including synthesis and evaluation, required to solve critical problems in research and/or innovation and to extend and redefine existing knowledge or professional practice	Demonstrate substantial authority, innovation, autonomy, scholarly and professional integrity and sustained commitment to the development of new ideas or processes at the forefront of work or study contexts including research

[1] The descriptor for the short cycle developed by the Joint Quality Initiative as part of the Bologna process, (within or linked to the first cycle), corresponds to the learning outcomes for EQF level 5.
[2] The descriptor for the first cycle corresponds to the learning outcomes for EQF level 6.
[3] The descriptor for the second cycle corresponds to the learning outcomes for EQF level 7.
[4] The descriptor for the third cycle corresponds to the learning outcomes for EQF level 8.

Appendix 2: Structure of the Lithuanian System of Higher Education



Appendix 3: Human Capital Higher Education Attainment and Talent Development: Skills Competencies required for Human-centric Innovation Ecosystems Table of Number of Coding References

Name	Description	Files	References
approach		0	5
conventional approach		2	2
culture-free mind-set approach		1	1
holistic approach		1	1
innovative approaches		1	2
integrative approach		1	1
professionally-oriented career approach		1	1
subjective approach		1	1
unified approach		1	1
business		0	8
business incubators		1	1
engaging business		1	1
local business sector		1	3
private sector businesses		1	1
region business		1	1
science business cooperation		1	1
conditions		1	3
framework conditions		1	1
socio-economic conditions		1	2
economy		0	3
circular economy		2	3
commercial economy		2	4
knowledge economy scale		2	3
education		0	18
academic education		2	2
education attainment		1	1
education goals		1	2
education sector		1	12
education system		2	2
quality education		1	1
tertiary education		1	1

Name	Description	Files	References
environment		1	5
friendly business environment		1	1
innovation environment		1	3
right environment		1	1
sectorial environment		1	1
framework		1	2
certain framework		2	2
framework conditions		1	1
present framework		1	1
primary framework		1	1
regulatory framework		1	1
standardised framework		1	1
human capital		1	3
human capital		1	3
infrastructure		0	7
aforementioned infrastructure		1	1
educational infrastructures		1	1
infrastructural facilities		1	1
infrastructural resources		1	1
modern infrastructure		1	1
non-technological infrastructure support		1	2
secondary infrastructure		1	1
several infrastructures		1	1
supportive infrastructures		1	1
innovation		2	44
benchmarking innovation development		1	2
breakthrough innovation		1	1
good innovations		1	2
harmonious innovation ecosystem		1	1
human-centric innovation ecosystem		1	1
innovation ecosystem		1	2
innovation ecosystems development		1	4

Name	Description	Files	References
innovation environment		1	3
innovation mind-set		1	1
innovation potential		1	1
innovation scoreboards		1	1
innovation system		2	2
innovation trust		1	1
innovative approaches		1	2
innovative capabilities		1	1
innovative players		1	1
innovative product		2	3
innovative products		1	1
innovative solution		1	1
measuring innovation rak-ings		1	1
model innovations		2	2
moderate innovators		2	3
regional innovation activities		1	5
institutions		0	10
educational institutions		1	3
governmental institutions		1	1
research institutions		1	1
state institutions		1	1
state-owned institutions		1	1
training institutions		1	3
level		0	8
academic level		1	1
international level		1	1
local level		1	1
professional level		1	1
quality level		1	1
regional level		1	3
people		1	2
different people		0	0
mind-set people		1	1
network people		1	1
research		0	8
bio-technological research		1	1
fragmented research		1	1

Name	Description	Files	References
international research facility		1	2
joint research		1	1
research institutions		1	1
research laboratories		1	2
research results		1	1
research sector		1	1
research services		1	1
scientific research		1	1
resources		1	9
financial resources		1	1
human resources		1	4
infrastructural resources		1	1
legal resources		1	1
little resources		0	0
science		0	10
materials science study		1	2
medicinal sciences		1	1
natural sciences field		1	2
science business cooperation		1	1
science technology		2	2
science valleys		1	1
social sciences		1	1
sector		0	21
economic sector		1	1
education sector		1	12
financial technologies sector		1	1
fintech sectors		2	2
industrial sector		1	4
private sector businesses		1	1
sectors		1	1
sectorial environment		1	1
skills		0	3
additional skills		2	2
cooperative skills		1	1
digital skills		1	1
problem-solving skills		1	1

Name	Description	Files	References
skills gap		1	1
skills mismatch		2	2
specific skills		1	1
verbal skills		1	1
study		0	8
materials science study		1	2
quality studies		1	1
specialised study		1	1
study curriculum		1	1
study programme		1	1
study years		1	1
technological study field		1	1
system		1	6
education system		1	1
evaluation system		1	1
innovation system		1	1
re-skilling systems		1	1
separate system elements		1	1
training		0	11
educational training		2	2
training colleges		1	1
training institutes		1	1
training institutions		1	3
training workshops		1	1
vocational training		1	3
university		0	3
basically universities		1	1
education universities		1	1
famous university		1	1
local universities		1	1
much money university		1	1
state-owned universities		1	1
university degrees		1	1
university libraries		1	1
well-known university		1	1

Appendix 4: Human-centric Innovation Ecosystems: Industry Sectors, Academia, Knowledge and Commercial Economy Table of Factors Number of Coding References

Name	Description	Files	References
approach		2	5
conventional approach		2	2
culture-free mind-set approach		1	1
holistic approach		1	1
innovative approaches		1	2
integrative approach		1	1
professionally-oriented career approach		1	1
subjective approach		1	1
unified approach		1	1
business		1	8
business incubators		1	1
engaging business		1	1
local business sector		1	3
private sector businesses		1	1
region business		1	1
science business cooperation		1	1
economy		3	3
circular economy		2	3
commercial economy		2	4
knowledge economy scale		2	3
education		3	18
academic education		2	2
education attainment		1	1
education goals		1	2
education sector		1	12
education system		2	2
quality education		1	1
tertiary education		1	1
environment		2	5
friendly business environment		1	1
innovation environment		2	4

Name	Description	Files	References
right environment		1	1
sectorial environment		2	3
framework		3	2
certain framework		2	2
framework conditions		2	2
present framework		1	1
primary framework		1	1
regulatory framework		1	1
standardised framework		1	1
infrastructure		1	7
aforementioned infrastructure		1	1
educational infrastructures		1	1
infrastructural facilities		1	1
infrastructural resources		1	1
modern infrastructure		1	1
non-technological infrastructure support		1	2
secondary infrastructure		1	1
several infrastructures		1	1
supportive infrastructures		1	1
innovation		4	44
benchmarking innovation development		1	2
breakthrough innovation		1	1
good innovations		1	2
harmonious innovation ecosystem		1	1
human-centric innovation ecosystem		1	1
innovation ecosystem		1	2
innovation ecosystems development		1	4
innovation environment		2	4
innovation mind-set		2	2
innovation potential		1	1
innovation scoreboards		1	1

Name	Description	Files	References
innovation system		2	2
innovation trust		1	1
innovative approaches		1	2
innovative capabilities		1	1
innovative players		2	2
innovative product		2	3
innovative solution		1	1
measuring innovation rankings		1	1
model innovations		2	2
moderate innovators		2	3
regional innovation activities		1	5
institutions		1	10
educational institutions		1	3
governmental institutions		1	1
research institutions		1	1
state institutions		1	1
state-owned institutions		1	1
training institutions		1	3
level		2	8
academic level		1	1
international level		1	1
local level		1	1
professional level		1	1
quality level		1	1
regional level		1	3
research		1	8
bio-technological research		1	1
fragmented research		1	1
international research facility		1	2
joint research		1	1
research institutions		1	1
research laboratories		1	2
research results		1	1
research sector		1	1
research services		1	1

Name	Description	Files	References
scientific research		1	1
resources		2	9
financial resources		2	2
human resources		1	4
infrastructural resources		1	1
legal resources		2	2
science		2	10
materials science study		1	2
medicinal sciences		1	1
natural sciences field		1	2
science business cooperation		1	1
science technology		2	2
science valleys		1	1
social sciences		1	1
sector		2	21
economic sector		1	1
education sector		1	12
financial technologies sector		1	1
fintech sectors		2	2
industrial sector		1	4
private sector businesses		1	1
skills		2	3
additional skills		2	2
cooperative skills		1	1
digital skills		1	1
problem-solving skills		1	1
skills gap		1	1
skills mismatch		2	2
specific skills		1	1
verbal skills		1	1
study		2	8
materials science study		1	2
quality studies		1	1
specialised study		1	1
study curriculum		1	1
study programme		1	1

Name	Description	Files	References
study years		1	1
technological study field		1	1
system		3	6
education system		2	2
innovation system		2	2
re-skilling systems		1	1
separate system elements		1	1
training		2	11
educational training		2	2
training colleges		1	1
training institutes		1	1
training institutions		1	3
training workshops		1	1
vocational training		1	3
university		1	3
basically universities		1	1
education universities		1	1
famous university		1	1
local universities		1	1
much money university		1	1
state-owned universities		1	1
university degrees		1	1
university libraries		1	1
well-known university		1	1

Appendix 5: Human-centric Innovation Ecosystems Socio-economic Incentives and Environment Table of Factors Number of Coding References

Name	Description	Files	References
approach		0	5
conventional approach		2	2
culture-free mind-set approach		1	1
holistic approach		1	1
innovative approaches		1	2
integrative approach		1	1
professionally-oriented career approach		1	1
subjective approach		1	1
unified approach		1	1
business		0	8
business incubators		1	1
engaging business		1	1
local business sector		1	3
private sector businesses		1	1
region business		1	1
science business cooperation		1	1
conditions		1	3
framework conditions		1	1
socio-economic conditions		1	2
economy		0	3
circular economy		2	3
commercial economy		2	4
knowledge economy scale		2	3
education		0	18
academic education		2	2
education attainment		1	1
education goals		1	2
education sector		1	12
education system		2	2
quality education		1	1
tertiary education		1	1
environment		1	5

Name	Description	Files	References
friendly business environment		1	1
innovation environment		1	3
right environment		1	1
sectorial environment		1	1
framework		1	2
certain framework		2	2
framework conditions		1	1
present framework		1	1
primary framework		1	1
regulatory framework		1	1
standardised framework		1	1
human capital		1	3
human capital		1	3
infrastructure		0	7
aforementioned infrastructure		1	1
educational infrastructures		1	1
infrastructural facilities		1	1
infrastructural resources		1	1
modern infrastructure		1	1
non-technological infrastructure support		1	2
secondary infrastructure		1	1
several infrastructures		1	1
supportive infrastructures		1	1
innovation		2	44
benchmarking innovation development		1	2
breakthrough innovation		1	1
good innovations		1	2
harmonious innovation ecosystem		1	1
human-centric innovation ecosystem		1	1
innovation ecosystem		1	2
innovation ecosystems development		1	4

Name	Description	Files	References
innovation environment		1	3
innovation mind-set		1	1
innovation potential		1	1
innovation scoreboards		1	1
innovation system		2	2
innovation trust		1	1
innovative approaches		1	2
innovative capabilities		1	1
innovative players		1	1
innovative product		2	3
innovative products		1	1
innovative solution		1	1
measuring innovation rakings		1	1
model innovations		2	2
moderate innovators		2	3
regional innovation activities		1	5
institutions		0	10
educational institutions		1	3
governmental institutions		1	1
research institutions		1	1
state institutions		1	1
state-owned institutions		1	1
training institutions		1	3
level		0	8
academic level		1	1
international level		1	1
local level		1	1
professional level		1	1
quality level		1	1
regional level		1	3
people		1	2
different people		0	0
mind-set people		1	1
network people		1	1
research		0	8
bio-technological research		1	1

Name	Description	Files	References
fragmented research		1	1
international research facility		1	2
joint research		1	1
research institutions		1	1
research laboratories		1	2
research results		1	1
research sector		1	1
research services		1	1
scientific research		1	1
resources		1	9
financial resources		1	1
human resources		1	4
infrastructural resources		1	1
legal resources		1	1
little resources		0	0
science		0	10
materials science study		1	2
medicinal sciences		1	1
natural sciences field		1	2
science business coopera-tion		1	1
science technology		2	2
science valleys		1	1
social sciences		1	1
sector		0	21
economic sector		1	1
education sector		1	12
financial technologies sector		1	1
fintech sectors		2	2
industrial sector		1	4
private sector businesses		1	1
sectors		1	1
sectorial environment		1	1
skills		0	3
additional skills		2	2
cooperative skills		1	1

Name	Description	Files	References
digital skills		1	1
problem-solving skills		1	1
skills gap		1	1
skills mismatch		2	2
specific skills		1	1
verbal skills		1	1
study		0	8
materials science study		1	2
quality studies		1	1
specialised study		1	1
study curriculum		1	1
study programme		1	1
study years		1	1
technological study field		1	1
system		1	6
education system		1	1
evaluation system		1	1
innovation system		1	1
re-skilling systems		1	1
separate system elements		1	1
training		0	11
educational training		2	2
training colleges		1	1
training institutes		1	1
training institutions		1	3
training workshops		1	1
vocational training		1	3
university		0	3
basically universities		1	1
education universities		1	1
famous university		1	1
local universities		1	1
much money university		1	1
state-owned universities		1	1
university degrees		1	1
university libraries		1	1
well-known university		1	1

Appendix 6: The Higher Education Policy Mandated Academic and Vocational Education Training Impact on Capital and Technological Infrastructural Support Table of Factors Number of Coding References

Name	Description	Files	References
business		2	6
business partners		1	1
business sector		1	1
friendly business environment		1	1
medium business		1	1
region business		1	1
science business cooperation		1	1
centres		1	2
communication centre		1	1
open centres		1	1
courses		2	2
learning courses		1	1
open courses		1	1
education		2	6
education institutions		2	4
education specialists		1	1
universal education		1	1
education institutions		2	4
education institutions		2	4
innovation		2	5
human-centric innovation ecosystem		2	2
innovation hubs		1	1
innovative approaches		1	1
regional innovation activities		1	1
institutions		2	7
education institutions		2	4
educational institutions		1	1
governmental institutions		1	1
state institutions		1	1
labor market		1	2
labor market		1	2
partners		2	2
business partners		1	1
social partners		1	1

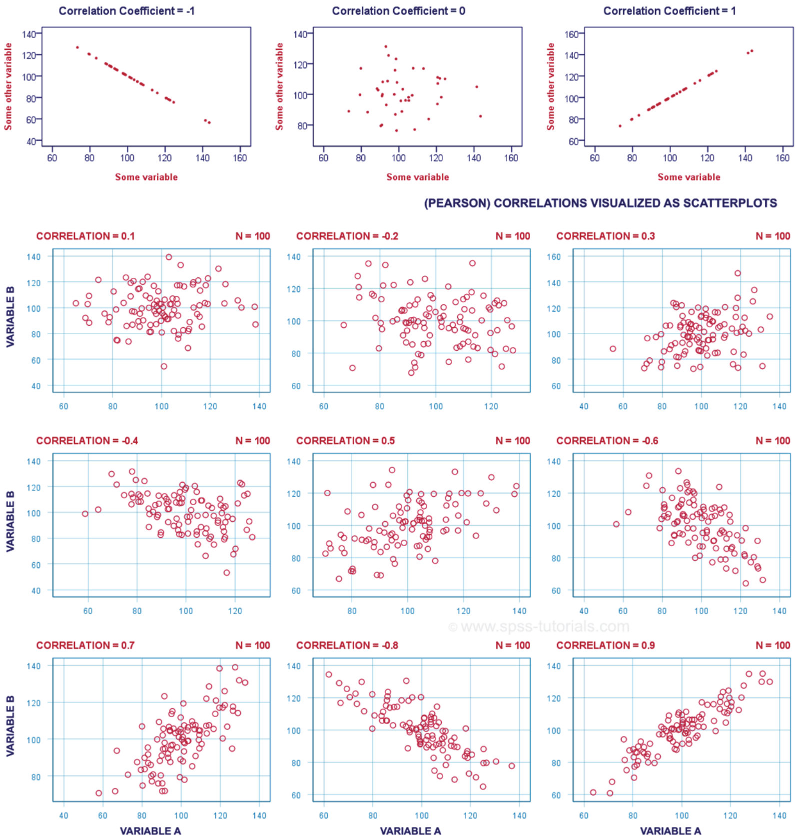
Name	Description	Files	References
programmes		1	2
international programmes		1	1
specific improvement programmes		1	1
projects		2	2
consulting projects		1	1
regional projects		1	1
reforms		1	2
recent reforms		1	1
various reforms		1	1
research		2	6
bio-technological research		1	1
international research facility		1	1
research areas		1	1
research laboratories		1	1
research services		1	1
scientific research		1	1
sciences		2	5
material science		1	1
natural sciences field		1	2
science business cooperation		1	1
social sciences		1	1
services		2	2
public services provision		1	1
research services		1	1
system		2	4
different system		1	1
re-skilling systems		1	1
separate system elements		1	1
whole system		1	1
university		2	3
basically universities		1	1
famous university		1	1
university libraries		1	1
work		2	3
huge work		1	1
previous work		1	1
world works		1	1

Appendix 7: Pearson Coefficient and Scatterplots

A correlation of -1 indicates that there is a negative linear relation between the variables

A correlation of 0 indicates that a linear relation do not exist.

A correlation coefficient of +1 indicates that there is a positive linear relationship.



Appendix 8: Feedback from the Semi-structured Questionnaires

QUESTION 1

Please explain how the curriculum of academic education and vocational educational training provided by higher education fundamentally contributes to talent development in Lithuania.

DT01:

I am going to say that the quality assurance system that we have here is working according to the principles of the Bologna Process and it ensures that the whole study model, the architecture of studies is based on competencies and oriented towards what the labour markets wants and needs as well. We want to move towards a talent-oriented system but by way of adjusting the funding system, the way we fund our higher education we have this bachelor model we have these set of things which will brings us like a free bachelor educational level. I am certain that towards making that model to make the system more talent-oriented, for example, the twenty-five percent drop-out system that we discussed before and also we are moving towards a more performance-based funding principle where a certain amount of funds are going to allocated to institutions according to their fulfilling of certain criteria, for example, one of them could be orientation towards talent. We are still discussing the details, but the Minister believes that it should be oriented towards the personnel level, not oriented towards the institutions' level

QUESTION 2

Please choose the skills that the higher education policy of Lithuania deems **most common** or **least common** for human-centric innovation ecosystems:

DT01:

Motivation/drive: **most common**
Leadership skills: **most common**
Creativity skills: **most common**
Risk taking/ showing initiative: **least common**
Flexible and an adaptable attitude (Psychological): **least common**
Industry-related skills through practical experience: **most common**
Global mindset: **most common**
Entrepreneurship skills: **most common**
Decision-making skills: **least common**
Strategic thinking: **least common**
Communication skills: **least common**
Collaborative skills: **least common**
Analytical skills: **most common**
Quantitative skills: **most common**
Critical thinking/ Problem solving skills: **most common**
Other skills: **citizenship**

QUESTION 3

Please describe the infrastructure already in place in the higher education system that enhance the knowledge of population in various technological and non- technological fields of study? Please describe the basic, advanced teaching and research and development facilities that helps to form the talented human capital?

DT01:

It would be easy to solve the physical infrastructure questions but the tough part is working with the skills-set and the competencies that the teachers have because quite a big part of them still stick to archaic methods, they do not seek new approaches of how to interact with students and how to involve them in a deeper level, and could affect talent development.

Right now, the situation is quite good in terms of especially when we compared to ten years ago and it is still getting good because Lithuania has been using the support given by the European Union and other international projects to you know to move forward to this. We have good international level good centers of research with labs, like Life Sciences in Vilnius University, Kaunas Technology university bases in some universities as well. There is less progress in non-technological fields when we talk about infrastructure. But there is still an understanding in the system that you can still look for certain approaches in social fields as well like MRU Psychology labs social sciences lab.

QUESTION 4

How can Lithuanian universities and higher education institutions be more effective in the engaging talented human capital (local and foreign talent) and simultaneously created a human-centric innovation ecosystem for aspiring entrepreneurs? Please describe what are the right kind of incentives in the Lithuanian system that allows human capital to pursue innovation.

DT01:

One of the tools that even have results is a participating in international projects. This a variety of tools on international scale both on the exchanges of students and other forms like the European universities initiatives that we are just getting into and these are all the tools that seeking talented inside the institutions and also outside them and also practices on how to approach these issues/ questions of talents involvement as well. This Ministry (The Ministry of Education, Science and Sports) and the Ministry of the Economy and Innovation are encouraging institutions to implement not only innovate, but also implement innovations centers in the respective fields. One the examples, that the Minister have just seen by himself, is the Akademijos Stulginskis which was used to be a standard university but now it is under Vytautas Magnus University, in how they can help out the sector in Lithuania at implementing these innovations in the field of agriculture and also how it is actually done by cooperating with relevant Ministries and in this case with the Ministry of Agriculture and the businesses of course. Collaborations. There certain funds that are oriented towards young businesspeople where they can get a starting capital for a small company or where they can take loans at a very advantage situation. This is not a tool that the Ministry of Education, Science and Sports controls but we are very happy that these *tools exist. We have very two very visible initiatives, "Create for Lithuania", is a where we recruit Lithuanian students that have finished studies abroad and they work with institutions such as ours in solving certain issues or you know progressing certain ideas so that is innovation in governance (innovation at the governmental level) and social engineering as well. Also we have "Invest Lithuania" which works like a mediator between educational institutions and a new company trying to figure out what their needs are going to be and so on. These schemes are mostly for Lithuanian students, but the scheme Create for Lithuania also involves international students that finish their studies here in Lithuania as well.*

QUESTION 5

Recently Lithuania has moved up its place in its regional innovation activities. How has the higher education policy contributed to this advancement? Please comment on actual instances.

DT01:

We have higher educational institutions that we see as regional mostly these are

Kolegijos, but some universities are seen as those that apply their use according to regional needs (in Lithuania. And it is natural that these partners are regional development councils and businessmen sit on those councils, there are ten of these councils so the institutions, through these councils they see what kind graduates of graduates they need to provide what kind of innovation they need to implement and so on. And in many cases where these universities are not understood as regional, they still work with these regional councils because many of their social partners are from those regions. For example, Kaunas Technological University they have partners in a few regions, wherever there is certain engineering technology, you know, developed. There is a plan to merge Šiauliai University with Vilnius University and is one the purpose why we see it useful is that Vilnius University's scientific capacities can be applied to the northern Lithuanian region. Vilnius university have a plan of not only providing the region with IT and Business Development Specialists but also on how to provide innovation to develop businesses up there as well.

QUESTION 6

Are the present socio-economic conditions, industrial and sectorial environment of Lithuania harmonious for innovation ecosystem to thrive? Please comment on a few examples.

DT01:

I see that some of the regions that we have up there is oriented towards it a lot. There are many regions working with this, Klaipėda, Kaunas, Vilnius, Visaginas which have good examples of being oriented towards medicinal sciences (bio-medicine) at the professional level and also a new example is in Naujoji Akmenė which is developing a free economic zone and they also understand they do only need these exemptions from taxes but also the human capacities as well. A very recent example is in Kaunas where there is a company called Continental trying to establish in there and is going to working with very innovative products and we are sort of creating a pyramid where both at the academic of Kaunas Technological University, Kolegija of Kaunas Technology and also the other *professional schools out there could serve and help out with this development by providing you know by providing human capital and so on. And this situation encouraged us at the Ministry of Education Science and Sports to try out a new model where different levels of institutes, universitie, kolegijos and professional schools are creating an association with a pure aimed of actually helping out these new company to establish itself.*

QUESTION 7

Several factors such as technology, capital and human capital contribute to innovation. What features of the human factor is responsible for innovation and economic growth in Lithuania?

DT01:

Higher educational institutions, once again, Kaunas Technological University for example, where they realize their role that they need to provide the system with graduates that have both these more technical skills but also more these general skills listed (so Kaunas Technology University is answering these needs so far):

Motivation/drive
Leadership skills
Creativity skills
Risk taking/ showing initiative
Flexible and an adaptable attitude (Psychological)
Industry-related skills through practical experience
Global mindset
Entrepreneurship skills
Decision-making skills
Strategic thinking
Communication skills
Collaborative skills
Analytical skills
Quantitative skill
Critical thinking/ Problem solving skills

It also starts with higher education institutions that realize that they need to instill these qualities to graduates because these graduates do not know that beforehand that they will need them in a new system of new companies and so on.

QUESTION 8

There have been recent reforms and structural changes in the higher education system of Lithuania. To what extent will these new reforms significantly impact the development of human-centric innovation ecosystems **now** and **in the future**? Have these reforms been impacted by the steady migration/emigration patterns in Lithuania?

DT01:

We believe that if we would define the quality of studies as a set of these competencies that we have already discussed, most of the tools that we are trying to introduce this drop-out principles, this increase of bachelor degree vouchers and so on (vouchers from the

Education Ministry to support the financing of bachelor studies) they are aimed at giving institutions freedom, and with that freedom we hope that they are not only oriented towards surviving, but also actually providing that skills-set that the graduates. We are also hoping that we will not pressure people too much, choosing something that the government and the country needs but choosing something that they would personally want and of course we will provide certain benefits if it aligns to what the government wants as well, like scholarships, incentives and so on, but not too much pressure. Also, this idea of contracts between the Ministry of Education, Science and Sports and the institutions that would be performance-based that would allow us to have a format where we could direct them towards these innovative approaches and quality of studies overall. First of all, the Minister would like to mention this inside immigration (internal immigration) between the regions, because now we do see a draw between the larger cities, that they do take you know smart people from the regions and we do believe that these reforms could direct them back to the regions, especially if we talk about complex tools not only scholarships, but also for example career possibilities and certain respect to certain careers in the reserve and that would encourage them to go back to their regions to take care of their needs as well. Now if we talk about the external emigration now something, to and from Lithuania, we would say that we are already feeling these waves of re-emigration (brain gain)and it's also a good sign and we believe that these reforms would have a ripple effect that would increase the numbers of people coming back to the country. And innovative business in innovative industries, what we need to provide people coming back to Lithuania interesting jobs and fulfilling salary-wise and fulfilling jobs as well.

QUESTION 9

How involved are businesses and the industrial sector in Lithuania in enhancing the higher education system? Which sectors are more active/ inactive with the system?

DT01:

It is still a weakness. Even when we have a government system that is aimed at creating this bridge between the business and the universities, we still don't have this a you know, level of cooperation that we would like to as there is some cases of getting rid of corruption (proving or uncovering corruption) in the health sciences universities and so on. The businesses are willing to express their needs, what kind of graduates that they want, but they are not willing to invest in that as well as it usual in some foreign countries. But we do have some good signs, where the Rectors of universities they tell us that some the businesses are willing to cooperate like in a different culture and like they are willing to invest in the universities themselves. It is also worth to mention that with foreign capital, we also bring in a very different perspective on how this cooperation can be managed, like the same example Continental, they are willing to put their brains to work at reviewing study programmes going into much deeper-based levels of cooperation and a more value-based. It gives the hope that it will impact the environment.

QUESTION 10

How can higher education inspire potential talented human capital to drive innovation and growth in Lithuania? Can this be achieved through a formal academic education offered by universities or vocational educational training offered by higher education institutions? What are the necessary components for such ecosystems?

DT01:

The idea that that we must focus in and invest into talent is getting a paced, right now these scholarships are the most wide-spread tools and have a variety of them both based at the national and international level that is provided by the institutions themselves. The Minister mentioned that one of the examples is we give a scholarship to a person going to an elite institution (top 500 universities in the world) abroad but he/she has to sign a contract, like approximately fifteen students all got enrolled in the top 500 universities worldwide. It is not a popular practice to cooperate with businesses at identifying this talent and creating more, let's say more creative approaches at how, to get the talent well interested at certain topics and working in something that you know maybe interesting to businesses. Like a couple of a good examples from abroad is that we could have NGOs working under the institutions providing like a small capital for students to even go bankrupt with their first company, first idea just to give bravery that you know it is ok to have this risk taking, and so on or a working with investment and so on. Basically, like a lab or an experiment to allow them to you know risk. But we do also have these technology parks that have similar tools, but they are oriented towards graduates not students that are now studying. We also have quite interesting practices in internal education, with school pupils with funds that provide them with a means to establish their own small businesses, one example is a company that is still running to our knowledge that makes dry soaps. And this style has an effect on universities and kolegijos as well and they are considering it at least.

QUESTION 11

Human-centric innovation ecosystems are fundamentally built on the knowledge and commercial economy. Please explain the percentage of universities and higher educational institutions in Lithuania that are contributing to the development of each of these economies:

DT01:

Many of the universities have these specific fields they are quite good at research like at Klaipėda University and sea technologies, but we also have like arts academies, military academies where it is doubtful the amount of knowledge economy etc. it all depends on the research. The knowledge economy is more important as every university must produce knowledge, participate in research, develop research as this is a necessary role of university. So sometimes it is hard to say that the produce from a certain institution is actually you know a part of the knowledge economy. Is it music? Arts? It is difficult to say.

The knowledge economy: *Universities: 67%; Higher Educational Institutions:*
The commercial economy *Universities: 33%; Higher Educational Institutions: 100%*

QUESTION 12

Please describe whether higher education and a large stock of highly educated human capital (educational attainment) is correlated to the development of human-centric innovation ecosystems? Would having higher education training or qualification contribute more economic activities and wealth in Lithuania?

DT01:

There is a question of generations because twenty years ago the generation was less oriented towards innovation eco-systems. If we look at the past five years, there is much more attention for innovation ecosystems. The bologna process and the exchange in higher education has created certain similarities in Europe and allowed us at better understanding of how higher education can provide in this case. To answer the second questions, is without any doubt, we now have a President that looks at education as very multifunctional, with sectors that can provide Lithuania with a wide variety of success, I am talking about the economy, health, better life index and so on. And we are very new fresh members of OECD and education, is at the center of it and what the value of it (education) is. We are now valued by the same criteria; Lithuania is ranked highly in the top five for Education by the OECD.

QUESTION 1

Please explain how the curriculum of academic education and vocational educational training provided by higher education fundamentally contributes to talent development in Lithuania

DT02:

The formal curriculum of academic education is more oriented toward knowledge acquisition than talent development. Standard tests, achievement measurement can serve as examples. Talents are developed more through non-formal education.

QUESTION 2

Please choose the skills that the higher education policy of Lithuania deems **most common** or **least common** for human-centric innovation ecosystems:

DT02:

Motivation/drive: **most common**
Leadership skills: **least common**
Creativity skills: **least common**
Risk taking/ showing initiative: **most common**
Flexible and an adaptable attitude (Psychological):
Industry-related skills through practical experience
Global mindset: **most common**
Entrepreneurship skills: **least common**
Decision-making skills: **most common**
Strategic thinking: **most common**
Communication skills: **least common**
Collaborative skills: **most common**
Analytical skills: **most common**
Quantitative skills: **most common**
Critical thinking/ Problem solving skills: **least common**

Other skills: HE in Lithuania is very cliché/fashion/trend based and usually does not provide unique and innovative approaches in terms of human-centric innovation.

QUESTION 3

Please describe the infrastructure already in place in the higher education system that enhance the knowledge of population in various technological and non- technological fields of study? Please describe the basic, advanced teaching and research and development facilities that helps to form the talented human capital?

DT02:

Lithuania invested a lot into research and educational infrastructures from EU structural and investments funds. For example, Mykolas Romeris University has the most modern infrastructure for R&DI in social sciences and humanities including 16 research laboratories, Doctoral and Post-Doctoral research areas, Research and Innovation Support Centre, Library and Information Technologies Centre. In September 2015, a new building of International Studies, Research and International Mobility Centre at the address of Didlaukio g. 55, Vilnius, with the total area of about 3.075 m^2 was opened. The building accommodates 16 modern laboratories on the 2 and 3rd floor, a Doctoral and Post-Doctoral Areas, Research and Innovation Support Centre and Social Innovation Doctoral School on the 4th floor, and 2 open halls for scientific events including mobile job places, group work and meetings for researchers, students and business people. The educational and research facilities help to form the talented human capital with regard to research.

QUESTION 4

How can Lithuanian universities and higher education institutions be more effective in the engaging talented human capital (local and foreign talent) and simultaneously created a human-centric innovation ecosystem for aspiring entrepreneurs? Please describe what are the right kind of incentives in the Lithuanian system that allows human capital to pursue innovation.

DT02:

I believe that Lithuania should be more open with regard to involving foreign talent and search for opportunities to increase more active Lithuanian diaspora participation in innovation ecosystem. For example, to provide funding for higher education studies at Lithuanian universities for Lithuanian diaspora (it was used previously, but I am not sure if it still used today).

QUESTION 5

Recently Lithuania has moved up its place in its regional innovation activities. How has the higher education policy contributed to this advancement? Please comment on actual instances.

DT02:

I think that Lithuanians have learned how to PR and position the country better in international rankings. Higher education system has also learned how to PR itself better and the term "innovation" has become a trendy, fashionable phenomenon more than it is in reality. PR is also a skill people gain in higher education. Of course, higher education system is progressing, better reflects society's needs, people with higher education working in state institutions and business sector make decisions of better quality, created better legislation, more friendly business environment, more justifiable solutions in other areas of public life.

QUESTION 6

Are the present socio-economic conditions, industrial and sectorial environment of Lithuania harmonious for innovation ecosystem to thrive? Please comment on a few examples.

DT02:

I believe that the country has benevolent socio-economic conditions, industrial and sectorial environment to innovation ecosystem to thrive. The legal and societal mentality are ready to be innovative, majority of population have higher education. However, innovation is more about risk-taking and creativity which need to be developed in the society at all age levels, especially among young people. The greatest problems, I believe, are in high schools, were children are still taught to memorize and repeat, the evaluation system is based on numerology and risk-taking, creativity, different that conventional approach is not encouraged. The higher education system then has to deal with the mindset developed earlier and sometimes even to re-educate young people. The discrepancy between basic promoted values behind secondary education system hinders innovation.

QUESTION 7

Several factors such as technology, capital and human capital contribute to innovation. What features of the human factor is responsible for innovation and economic growth in Lithuania?

DT02:

Such human factors as creative and analytical thinking, wholistic approach and risk taking, I believe, are core values behind innovation. Therefore, they should be included in all activities of educational system.

QUESTION 8

There have been recent reforms and structural changes in the higher education system of Lithuania. To what extent will these new reforms significantly impact the development of human-centric innovation ecosystems **now** and **in the future**? Have these reforms been impacted by the steady migration/emigration patterns in Lithuania?

DT02:

The recent reforms in the Lithuanian higher education system, I believe, are not related to the development of human-centric innovation ecosystem, they are more related to consolidation of power of certain institutions at the cost of others. For example, the preparation of education specialists was only moved from one institution to the other in different cities (from Vilnius to Kaunas and from Šiauliai to Vilnius). As the objectives of reforms are not clear, so are the results. I don't think that the migration/emigration patterns are related to the reforms, except the case that more young people choose to study abroad or not to study in HE institutions at all due to the ambiguity of the reform.

QUESTION 9

How involved are businesses and the industrial sector in Lithuania in enhancing the higher education system? Which sectors are more active/ inactive with the system?

DT02:

Business and industrial sector is rather young and weak in Lithuania due to historical background and geographical limitations of the market. Local business sector is more concerned about their survival than about societal impact and cooperation with universities. Although there few beautiful examples of university-business cooperation, the general pattern is poor involvement of business in enhancing higher education system. Local industry is more concerned about enhancing vocational training and receiving labor force. Some international companies are more active in enhancing human-centric ecosystems. The most active sectors include financial, ICT, high-tech companies.

QUESTION 10

How can higher education inspire potential talented human capital to drive innovation and growth in Lithuania? Can this be achieved through a formal academic education offered by universities or vocational educational training offered by higher education institutions? What are the necessary components for such ecosystems?

DT02:

Higher education has to develop personality as a whole, moral values and teach young people creativity, risk-taking, entrepreneurship, strategic thinking, communication, collaboration, problem solving.

QUESTION 11

Human-centric innovation ecosystems are fundamentally built on the knowledge and commercial economy. Please explain the percentage of universities and higher educational institutions in Lithuania that are contributing to the development of each of these economies:

DT02:

The knowledge economy 80 %

The commercial economy 20 %.

I believe that majority of higher education (about) 80 percent are contributing to knowledge economy while about 20 percent – to commercial economy. There is a gap between how universities view business and business view universities. Universities traditionally considering themselves as the knowledge pillars that has nothing to do with lower, commercial activity. Business, on the contrary, traditionally view universities as theoretical, distant from practice. Currently the situation is changing, but breaking those mind frames takes time.

QUESTION 12

Please describe whether higher education and a large stock of highly educated human capital (educational attainment) is correlated to the development of human-centric innovation ecosystems? Would having higher education training or qualification contribute more economic activities and wealth in Lithuania?

DT02:

I think that there is a direct correlation between higher education and human-centric innovation ecosystem but all educational system has to identify its core values and work on them. It is the shift in the system, for example, from memorizing and repeating to finding a creative, innovative solution to the problem/challenge. Higher education should switch from the knowledge economy scale to commercial economy and develop skills of creativity, risk-taking, entrepreneurship, strategic thinking, communication, collaboration, problem solving.

QUESTION 1

Please explain how the curriculum of academic education and vocational educational training provided by higher education fundamentally contributes to talent development in Lithuania.

DT03:

One of the features that could be the promotor for talent development in Lithuania is that the country scores highly on population with tertiary education, e.g. tertiary education segment of the system is developed and maintained significantly taking into account not big population and territory of the country.

QUESTION 2

Please choose the skills that the higher education policy of Lithuania deems **most common** or **least common** for human-centric innovation ecosystems:

DT03:

Motivation/drive: ***most common***
Leadership skills: ***most common***
Creativity skills: ***most common***
Risk taking/ showing initiative: ***least common***
Flexible and an adaptable attitude (Psychological: ***least common***
Industry-related skills through practical experience: ***most common***
Global mindset ***least common***
Entrepreneurship skills ***most common***
Decision-making skills: ***least common***
Strategic thinking: ***least common***
Communication skills: ***most common***
Collaborative skills: ***less common***
Analytical skills: ***most common***
Quantitative skills: ***most common***
Critical thinking/ Problem solving skills: ***most common***
Other skills

QUESTION 3

Please describe the infrastructure already in place in the higher education system that enhance the knowledge of population in various technological and non- technological fields of study? Please describe the basic, advanced teaching and research and development facilities that helps to form the talented human capital?

DT03:

High number and network of universities, hubs, research, technology and study valleys, creative workshops, etc.

QUESTION 4

How can Lithuanian universities and higher education institutions be more effective in the engaging talented human capital (local and foreign talent) and simultaneously created a human-centric innovation ecosystem for aspiring entrepreneurs? Please describe what are the right kind of incentives in the Lithuanian system that allows human capital to pursue innovation.

DT03:

More exploring international student exchange programmes (like Erasmus), research networking programmes (like COST), internship programmes (like NASA programme), missions (recently focused on China, Singapore, Japan). To use existing incentives more intensively. To make incentives more widely accessible.

QUESTION 5

Recently Lithuania has moved up its place in its regional innovation activities. How has the higher education policy contributed to this advancement? Please comment on actual instances.

DT03:

It could be supposed that participating international programmes and platforms made Lithuania movement up in its regional innovation activities.

QUESTION 6

Are the present socio-economic conditions, industrial and sectorial environment of Lithuania harmonious for innovation ecosystem to thrive? Please comment on a few examples.

DT03:

Results and activity of Biotechnology, Laser physics, ICT, Nanotech and new materials, Robotics, Business model innovations, Fintech sectors show the development of innovation ecosystem.

QUESTION 7

Several factors such as technology, capital and human capital contribute to innovation. What features of the human factor is responsible for innovation and economic growth in Lithuania?

DT03:

Leadership, Creativity skills, and Entrepreneurship.

QUESTION 8

There have been recent reforms and structural changes in the higher education system of Lithuania. To what extent will these new reforms significantly impact the development of human-centric innovation ecosystems **now** and **in the future**? Have these reforms been impacted by the steady migration/emigration patterns in Lithuania?

DT03:

It could be minded that now it is only initial impact, in the future we can expect the development of human-centric innovation ecosystems with strong multi-actor approach.

QUESTION 9

How involved are businesses and the industrial sector in Lithuania in enhancing the higher education system? Which sectors are more active/ inactive with the system?

DT03:

Business and industrial sector investment to higher education system could be much greater. Biotechnology, Laser physics sectors are most active. The rest ones - less.

QUESTION 10

How can higher education inspire potential talented human capital to drive innovation and growth in Lithuania? Can this be achieved through a formal academic education offered by universities or vocational educational training offered by higher education institutions? What are the necessary components for such ecosystems?

DT03:

Higher education institutions organize hackathons which contribute as a main component for the ecosystem.

QUESTION 11

Human-centric innovation ecosystems are fundamentally built on the knowledge and commercial economy. Please explain the percentage of universities and higher educational institutions in Lithuania that are contributing to the development of each of these economies:

DT03:

The knowledge economy. 75%

The commercial economy.25%

QUESTION 12

Please describe whether higher education and a large stock of highly educated human capital (educational attainment) is correlated to the development of human-centric innovation ecosystems? Would having higher education training or qualification contribute more economic activities and wealth in Lithuania?

DT03:

Yes, definitely. Highly educated human capital is one of the conditions that contribute to welfare state buildup.

QUESTION 1

Please explain how the curriculum of academic education and vocational educational training provided by higher education fundamentally contributes to talent development in Lithuania.

DT04:

In Lithuania, vocational education is provided by vocational education schools (post-secondary non-tertiary, ISCED 4 or together with lower and upper secondary education). Higher education is provided by higher education institutions (HEIs) (ISCED 6-8, colleges ("kolegija") providing ISCED level 6 only).

HEIs ensure the provision of both academic and practical knowledge needed to develop a certain skillset (acquired abilities) of the field chosen. It also enhances and develops individual innate abilities. In a broader sense, HE provides a jump start for talents in order to set up their career paths and networks. Furthermore, HE graduates are the main supply to the labour market, specifically – high level occupations.

QUESTION 2

Please choose the skills that the higher education policy of Lithuania deems **most common** or **least common** for human-centric innovation ecosystems:

DT04:

Motivation/drive
Leadership skills ***least common***
Creativity skills
Risk taking/ showing initiative
Flexible and an adaptable attitude (Psychological)
Industry-related skills through practical experience
Global mindset: ***least common***
Entrepreneurship skills
Decision-making skills
Strategic thinking: ***least common***
Communication skills
Collaborative skills ***most common***
Analytical skills ***most common***
Quantitative skills ***most common***
Critical thinking/ Problem solving skills
Other skills

QUESTION 3

Please describe the infrastructure already in place in the higher education system that enhance the knowledge of population in various technological and non- technological fields of study? Please describe the basic, advanced teaching and research and development facilities that helps to form the talented human capital?

DT04:

-

QUESTION 4

How can Lithuanian universities and higher education institutions be more effective in the engaging talented human capital (local and foreign talent) and simultaneously created a human-centric innovation ecosystem for aspiring entrepreneurs? Please describe what are the right kind of incentives in the Lithuanian system that allows human capital to pursue innovation.

DT04:

Collaborations and joint research projects with business and international leaders in specific fields can fasten the creation of the ecosystem by giving the access to product and service development and its application in the market. To add, HEIs could support and establish initiatives to co-fund and provide other necessary facilities for student/staff spin-offs. A very simple approach would be to start working or strengthen alumni networks.

QUESTION 5

Recently Lithuania has moved up its place in its regional innovation activities. How has the higher education policy contributed to this advancement? Please comment on actual instances.

DT04:

-

QUESTION 6

Are the present socio-economic conditions, industrial and sectorial environment of Lithuania harmonious for innovation ecosystem to thrive? Please comment on a few examples.

DT04:

It might be harmonious enough for the ecosystem to start its existence, but I'd doubt if it's the right environment for it to "thrive". The current economic structure is focused on the low added value sectors, there is not enough graduates with human capital that is most prevalent for innovation system. While other conditions can be debatable, human capital (if measured by pupil attainment or adult use of skills) there is a lot of room for improvement.

QUESTION 7

Several factors such as technology, capital and human capital contribute to innovation. What features of the human factor is responsible for innovation and economic growth in Lithuania?

DT04:

Higher attainment and skills would contribute in ensuring good governance and institutional capacity in setting the rule of law, which, in sense, also describes the economic freedom and preconditions for innovation system and economic growth (level of corruption, trade barriers, business establishment regulations, migration and other).

QUESTION 8

There have been recent reforms and structural changes in the higher education system of Lithuania. To what extent will these new reforms significantly impact the development of human-centric innovation ecosystems **now** and **in the future**? Have these reforms been impacted by the steady migration/emigration patterns in Lithuania?

DT04:

No clear ex-ante assessment, to my knowledge, was made on these various reforms and it is hard to predict as several different measures were introduced and their effects can be different. In regards to migration – it depends which reforms we are talking about. In general, there should be a reduction in spending on public services provision for a smaller size of society to cater for, however it very much depends on the 'social contract' and many political aspects as well as separate system elements.

QUESTION 9

How involved are businesses and the industrial sector in Lithuania in enhancing the higher education system? Which sectors are more active/ inactive with the system?

DT04:

In some cases more than the others and these cases can be reflected by looking at the shortage of labour in the market. Business that face high shortage of labor supply are very active in looking for good specialists at HEs as well as making sure the study programme content is relevant for their needs. While looking at the bigger picture, I'd say the business are not active, on average, in engaging with HEs as well as HEs are not active in engaging business, thus works both ways. This can also be reflected by some studies measuring the collaboration between business and HE institutions. Important to mention, that there are almost all necessary policy arrangements for business to be involved in setting up and accrediting new study (or VET, as well) programmes.

QUESTION 10

How can higher education inspire potential talented human capital to drive innovation and growth in Lithuania? Can this be achieved through a formal academic education offered by universities or vocational educational training offered by higher education institutions? What are the necessary components for such ecosystems?

DT04:

HE does not offer vocational education at the moment. Necessary facilities, support (scholarships, initiatives, schemes, projects..) as well as success examples can inspire the talented human capital to drive innovation and growth

QUESTION 11

Human-centric innovation ecosystems are fundamentally built on the knowledge and commercial economy. Please explain the percentage of universities and higher educational institutions in Lithuania that are contributing to the development of each of these economies:

DT04:

The knowledge economy.

The commercial economy.

Can‘t give the exact share but I would assume that very little, this can be seen in R&D expenditure, innovation scoreboards and other indicators. And if to compare those both, a subjective evaluation would be that HE currently contribute more towards knowledge rather than commercial economy as commercial economy also requires some financial stability and resources as a precondition.

QUESTION 12

Please describe whether higher education and a large stock of highly educated human capital (educational attainment) is correlated to the development of human-centric innovation ecosystems? Would having higher education training or qualification contribute more economic activities and wealth in Lithuania?

DT04:

Yes, if educational attainment (not participation in HE per se) is high, then this is the major precondition for the innovation ecosystem. Highly knowledgeable society can contribute and initiate the development of the ecosystem while having right skill-set, systemic incentives and support.

QUESTION 1

Please explain how the curriculum of academic education and vocational educational training provided by higher education fundamentally contributes to talent development in Lithuania.

DT05:

Can you specify about why you ask me about the higher education training together with the studies? Are you talking about tertiary level education? Yes exactly- I am not sure if in Lithuania we have tertiary education at all. Are you sure that we have? Maybe some kind of tertiary education we have. Ok, so we now are talking we are talking about the skills?Do you think that the motivation is the skill? So actually you are talking about, not about the motivation as I…. so as I understand you are talking about the motivation not as about this cue but more about the drive and the understanding how to raise the driving inside the human being? Ok

QUESTION 2

Please choose the skills that the higher education policy of Lithuania deems **most common** or **least common** for human-centric innovation ecosystems:

DT05:

Motivation/drive: most common
Leadership skills: most common
Creativity skills: most common (different tools as skills)
Risk taking/ showing initiative: least common
Flexible and an adaptable attitude (Psychological): most common
Industry-related skills through practical experience: most common
Global mindset: least common (also depends)
Entrepreneurship skills: most common
Decision-making skills: most common (it depends)
Strategic thinking: least common
Communication skills: most common
Collaborative skills: most common
Analytical skills: most common
Quantitative skills: most common
Critical thinking/ Problem solving skills: most common
Other skills: *I don't know*

QUESTION 3

Please describe the infrastructure already in place in the higher education system that enhance the knowledge of population in various technological and non- technological fields of study? Please describe the basic, advanced teaching and research and development facilities that helps to form the talented human capital?

DT05:

There is a lot of infrastructure, it depends on what you are talking about in the higher education. But when we are talking about the infrastructure, we are talking about… look there is a buildings (laughing), it is an infrastructure. So, if we talk about the higher education, I could not imagine that the higher education is only the building. We have laboratories, incubators, accelerators, in the universities. In an integrative strategy between the Ministry of the Economy and Innovation and the Ministry of Education, Science and Sports but actually there is a lot of problems, as well as opportunities for the problems. So, talking about the level of integrative, it's another one topic so I am very sure that the education system is very well integrated into the society and into the community but on the other hand there is a lot of opportunities and plenty room for improvement. Actually, it's too general question, in my opinion because I understand the ecosystem very well and I know how it works. You know I will think a little bit differently, because actually education is important, but the education without the implementation is not important because why do, why do I need education if I not use it? Why do I need it? If I never do for society. Actually, when we are talking about the education, we need to understand that it's a, the education is necessary for the human being in order to create the added-value for himself and the community, if and if you could not create the added-value, so why do you need the education? So I would look to the education ecosystem from the point of innovations and if you look to the education ecosystems from the point of innovations, we *will see that there is a lot of things which we need to improve because sometimes education is too long on time because the improvement of innovations for example, let's take an example of the mobile phones the each year there is they give to the market a new type of telephone, each year and each company, and sometimes not one model but a three or four of different models of new telephones, so what we are talking- we are talking about the innovation of the new product. So, the question is how many technologies during (for) one year we can to develop for the telephone? How many knowledges in the field of science in the area of science as fundamental research that is necessary for the new innovative product? How many? But in general, for the new product you need new technologies not new skills and not new knowledges but also we need skills to develop the technology and also we need skills to develop the innovation, so if the education will be disconnected from the innovations, and I am talking about the process, about the production process, because the production process is really important for the innovation for the new product, I am talking about the materials, if it will be disconnected from the new materials, if it will be disconnected from new understanding of manufacturing ability, I am talking about of the ability to manufacturing a new type of product, it will be bad education. So, what we are talking I don't know, I think that the higher education should be closely connected with the real life, with the factory floor. I think it exists but on the other hand it is the level of existing starting from zero up to ten, up to one hundred percent or from zero to ten the level of existing the scale, (and this scale) is dependent from different areas, it depends on from, for example the engineering industry it's really a wide range of different industrial solutions are made in the engineering industry, its metal working, its machinery, its mechatronics, its electronics, its electricity, its electrical equipment, its plastics so it's really wide of different technologies and different areas for of human being activities so it depends, it depends but in general I that it is in somewhere around six, seven (the scale).*

QUESTION 4

How can Lithuanian universities and higher education institutions be more effective in the engaging talented human capital (local and foreign talent) and simultaneously created a human-centric innovation ecosystem for aspiring entrepreneurs? Please describe what are the right kind of incentives in the Lithuanian system that allows human capital to pursue innovation.

DT05:

What does it mean effective? But look, do we talking about efficiency or about the effectiveness? But I would like to talk about the efficiency not about the effectiveness because in my opinion the efficiency is not much more important than the effectiveness, because when we playing a football, basketball, the dribbling, playing with ball could be really effective without the result, so actually talking the activities of the universities, we not need active effectiveness, we need efficiency. Ok, so I would to say that when we are talking about the innovations the speed of innovations in the last fifteen years was increase incredibly by hundred percent, hundred percent and when we are talking about the education, the speed of education, was it increased? No. but still we have three or four or five or seven years, it depends on the degree which you want to get in the higher education. So, the *speed of education does not match it. So, I am sure that actually, actually we need speed, we need speed because we have actually four problems, four problems in economy, first of all lack of talents, next one lack of scale-ups, lack of venture capital and fourth one most important we are too slow. The speed of decision-making and implementation is really, really slow. Look when we are taking about the education, for example, we are taking about the product, not about the education, about the product, who is the product?*

I don't know how to answer you, you know actually, we have three areas, first of all science, the area of science, next one, I am talking about the area of policy making, next one is technology and the third one is innovations, so when we are talking about the science so the universities are the actors who act in the area of science and they are doing some activities for example fundamental research, applied research, and that's the activity of the science, when we are talking about the technology, so in that area we have some kind of institutes and kiosk and they act as, as some actors that provide some kind of applied research and experimental development, in order to produce the technology as the final result. And when we are talking about the innovations, so in the area of innovations, the innovators do actually innovation activities and there is the result in the product, which is applied/ deployed to the market. So, when I read the question what the universities can do in order to create human-centric innovation ecosystems, I don't understand the question because universities do not create innovation ecosystems. So maybe it could be a training courses as innovation that are needed as innovation, more innovation there. I don't know, because you know the universities are not under my responsibility, I am responsible for the area of technology and innovations. Actually you mentioned that you have read the roadmap of digitalization of industry, so in the roadmap we more than foresee more than fifty different type of incentives for the development of the ecosystems, so I think that there is a lot but all those incentives is actually there is in four areas, this is people, knowledge, this infrastructure and environment, so actually we need incentives in all those four areas, and those incentives should be integrated between with each other. They actually should be drafted in order to provide synergy between them, for example, they should help for people get skills, for innovators get the investment, for example.

QUESTION 5

Recently Lithuania has moved up its place in its regional innovation activities. How has the higher education policy contributed to this advancement? Please comment on actual instances.

DT05:

Yes I have seen a link but actually you are talking about the scoreboard, I am talking about the European Innovation Scoreboard or about the Global Innovation Index, so actually they were all the most improvement done in the field of industry made by business, just maybe the collaboration of researchers with the companies was improved in the actually last 6 years or maybe the improvement of cooperation with the researchers and the engineers in the companies or lets say co-working between them was actually only one point where we have big improvement. Another one topic that actually should be improved. And maybe talking about the education or the higher education, that's also *one of the areas where Lithuania has one of the quite good point. So maybe those areas where we have good improvement.*

QUESTION 6

Are the present socio-economic conditions, industrial and sectorial environment of Lithuania harmonious for innovation ecosystem to thrive? Please comment on a few examples.

DT05:

I think yes, I think yes. As always we have plenty of room to improvement but I think that yes in harmonious because as I have mentioned that the productivity in all of us are, ability to produce added-value in all levels as well in the areas of science technology and innovations could be improved of course and there is a lot of possibilities to do that and the socio-economic conditions actually relative of that.

QUESTION 7

Several factors such as technology, capital and human capital contribute to innovation. What features of the human factor is responsible for innovation and economic growth in Lithuania?

DT05:

So, in general you know there is a consultancy company Simon and Kutcher, you know them, once I have a discussion one the manufacturing queues with Mr. Simon and the discussions was with the CEOs of different European companies. I am talking the big companies, higher than 1 billion euros, and during the discussions actually Simon said that you know in Germany we have four big challenges, first of all the speed of implementation and decision making, next one lack of scale-ups, third one lack of venture capitals and the fourth one lack of talents, so talking about the technology capital and human capital, exactly everyone contribute to the innovations, but in general all Europe feel the lack of those four things, even in Lithuania, that's the problem of all Europe and talking about the different countries actually the features of the human factors are completely different everywhere on the same time somewhere they are the same, so for example talking about the vocational education and training in Lithuania we have invest a lot of in the infrastructure but we still don't have a professional orientation career planning clear ecosystem, so we need to build it. On the other hand, as well we have invested in several projects on order to boost the professional orientation ecosystem in Lithuania, but it still doesn't work as properly as we want. So, first of all we should invest in the into the education of upskilling of the teachers, the same we must do with the professional professors in the vocational education and training. Once more actually, we need to revise the curricula of the most action/actual areas, in the most areas, we should connect the standards of education together with the curricula so actually I think that the most one, most of different features should be the area of education first of all, next one what is really important for us, the lack of venture capital, so we need to improve the ecosystem of venture capital and what we foreseen to do in our Lithuania we would like to establish a big innovation fund, so now we are working on the law of innovation fund.

QUESTION 8

There have been recent reforms and structural changes in the higher education system of Lithuania. To what extent will these new reforms significantly impact the development of human-centric innovation ecosystems **now** and **in the future**? Have these reforms been impacted by the steady migration/emigration patterns in Lithuania?

DT05:

I am not sure that it has reformed (higher education), I think that there is always will to reform. I don't know because it depends on how it happens. Because for example, the transformation of higher education Kaunas for example, as you know it was really strange situation when Aleksandras Stulginskis University was connected with Vytautas Magnus University, I don't know why, because a, it was actually a technical university, so now in Kaunas we have Kaunas Technological University and I don't know what type of university is Vytautas Magnus University, is it technical? Is it humanitarian? I am not sure about the mix. But I am not really good on universities that's not my topic I don't know anything about them, I can talk about the technology, the innovations. I don't know maybe.

QUESTION 9

How involved are businesses and the industrial sector in Lithuania in enhancing the higher education system? Which sectors are more active/ inactive with the system?

DT05:

I think there is two areas, its area of engineering industry, engineering, as well, the area of information or ICT. They are most active they try to change the situation in general in education. And they have strategies for the development of education ecosystem.

QUESTION 10

How can higher education inspire potential talented human capital to drive innovation and growth in Lithuania? Can this be achieved through a formal academic education offered by universities or vocational educational training offered by higher education institutions? What are the necessary components for such ecosystems?

DT05:

Actually for the first question could be a why orientation, but orientation of people, orientation of students not only on the knowledge and the education but also on the understanding on what the people are doing in real life, what the researchers are doing, what the engineers are doing, what the policy makers or civil servants are doing and how the real life is look like, so maybe why let's say more ground-based orientation they can help for students to understand where they want to be. Do they want to be researchers, do they want to be engineers, or lets say, applied science activities, it could be engineering, it could be construction, it could be something related with real life and a maybe by helping to understand them, maybe they want to be entrepreneurs and to create the ecosystem inside the higher education or university, which can orientate it to grow for students to be orientated, because now we actually working at the factories, I am talking the universities, we are working at the factories and the final product of universities are bachelors and masters, so we actually don't need bachelors and masters, we need highly educated people *which know exactly what they want to do and how they want to create value for society. It could be achieved, but it depends about the integration of the education system at all, because now we have factory of pre-school education and I am not sure, is it connected with basic education? and once again we have factory of basic education and I am not sure is it connected with vocational education or for example higher education, I don't see clear inter-links between them. I still think that if you want for example to change the situation, why do students from university, never meet students from vocational education and trainings schools? Why? Because the curricula is built in order to get the bachelor but not the leader (universities) in order the curricula is built to get the bachelor but not the manager (vocational education and trainings schools). So, on my opinion if you want to get the leader, during the study process, you should meet the people and to lead them. So, for example, vocational educational and training schools which has really good and well-equipped infrastructure for training the blue-collar workers in real life on the factory floor and the factory actually is build in most of the vocational, educational and training schools. It could be good environment for the teaching factories, where the students can work as the managers, as an accountant as a technical director, together with the students from the vocational education and training schools by producing the right things.*

QUESTION 11

Human-centric innovation ecosystems are fundamentally built on the knowledge and commercial economy. Please explain the percentage of universities and higher educational institutions in Lithuania that are contributing to the development of each of these economies:

DT05:

I think maybe in Lithuania we also have a social economy. So then an answer could be that we have both economies and for example talking about the knowledge-based economy, maybe it could be good example where a we have a researcher in the LT he say, find something that is really valuable because of the knowledge and because of that knowledge crispas which was developed by that Professor is a really valuable and it is knowledge-based. But a, and that could be the example of knowledge economy because he finds the technology of crispas. And yes, it based of course on universities' activities. And that it's an example of knowledge-based, how the knowledge-based research activities can be developed to the economical level activities because now he has a company, but this is start-up, but now the universities can produce start-ups. But when we are talking about the commercial economy, we need not only the start-ups we need also scale-ups, so economical or commercial economy or economy could be driven by both, by knowledge and by commercial economy. But on a knowledge economy it's a much a, how to say, it is much more long-term orientated and the commercial is much shorter, but if we will see this possibility to develop the scale-up so the scale-up could also be commercial and long-termed based economical approach, so they both could be long-term and of course they both could be short-termed. I think just Universities contribute to both these long-term and short-term activities of the knowledge and commercial economies and I think just colleges contribute much more or less than they can contribute.

The knowledge economy: *Universities: 100%; Higher Educational Institutions:*
The commercial economy *Universities: 0%; Higher Educational Institutions: 0%*

QUESTION 12

Please describe whether higher education and a large stock of highly educated human capital (educational attainment) is correlated to the development of human-centric innovation ecosystems? Would having higher education training or qualification contribute more economic activities and wealth in Lithuania?

DT05:

In general, yes. First of all, we are talking about the skills in the beginning to implement the skills into their lives, because only implemented, used skills can actually change the situation in the world and used skills does not change the situation so I am sure that it could be.

I will say that we need not only research but we also need developmental activities, not only research but also the development and the result of the development could be different kind of studies for example different types of social technologies, even different type of educational transformations, so we need not only research but we need also a lot of developmental activities in order to solve the problems in order to produce social technology for example for better education curricula because the education curricula is not only the educational curricula it is actually the social technology for the production of better skilled workers. So actually what we need exactly, we need the knowledge which is implemented via the development of solutions. It could be social solutions, it could be commercial solutions, it could be technological solutions, it could be process, process solutions on the factory floor. It could be solutions of the improvement of the ecosystems in the cities, it could be solutions for reducing the climate changes and so on. And what we need exactly is a lot of development not only in researchers and that is topic of the European Commission because we looking to the European Commission and looking for the history of the European Commission for example for the period of the F P7 programme, The Financial Programme of the European Commission for Science in the period of 2007-2013, so the directorate general was called research and they buy the knowledge and development or the research and development and in this upcoming period in 2021-2027 the directorate will be "innovation in use" so you see no research, no development it will be innovation in use and in that directorate will be science, education, culture, innovation and youth. It is completely different totally different, so the approach is that not knowledge drive innovation but innovation pull the knowledge, so if we want to produce a new innovative product, we need a lot of technologies and the technologies will get via the development of the knowledge we acquire vis the research activities. So, the innovation actually driving everything not the knowledge driving innovations. If we want to drive innovations by knowledge, we should develop it into the technology and implement it into the products and if it doesn't have the development, we have a lot of troubles with the innovations, so on my opinion any research, any development are parallel. Equally important, so that's why we start innovation reform in Lithuania. And the approach of seventy percent of expenditures for research and thirty percent for development, we would like to transform thirty percent for research and seventy percent for development. The timeline for the results of this new policy, could be for a few years, I don't know but we will see.

QUESTION 1

Please explain how the curriculum of academic education and vocational educational training provided by higher education fundamentally contributes to talent development in Lithuania

DT06:

Yea, the problem with this country is that the people from the older times they think that everybody has to have higher education, everybody has to have a university degree and this is the belief and the children are encouraged by the parents to at any cost they have to go to the university. Without thinking of what happens in the future and what will be the labour market in the future. So now there are programmes that encourage children who are in school to do the vocational training, in other words to have a specialty, not a degree, but a real specialty that could be applied to real life. Which could be, which could lead to sure employment. So, this is I think is the situation here and if it is related when it comes to talents, so the talents in, in they manifest if a person is gifted it manifests in whatever he does. He usually learns well at the university and plays the piano for example. And of course, there are skills and programmes to support the talents. Talent is manifested not implemented by the academic curricula of higher education.

QUESTION 2

Please choose the skills that the higher education policy of Lithuania deems **most common** or **least common** for human-centric innovation ecosystems:

DT06:

Motivation/drive: **most common**
Leadership skills: **least common**
Creativity skills: **most common**
Risk taking/ showing initiative: **most common**
Flexible and an adaptable attitude (Psychological): **least common**
Industry-related skills through practical experience:
Global mindset: **most common**
Entrepreneurship skills: **least common**
Decision-making skills: **most common**
Strategic thinking: **least common**
Communication skills: **most common**
Collaborative skills: **least common**
Analytical skills: **most common**
Quantitative skills: **least common**
Critical thinking/ Problem solving skills: **most common**
Other skills

QUESTION 3

Please describe the infrastructure already in place in the higher education system that enhance the knowledge of population in various technological and non- technological fields of study? Please describe the basic, advanced teaching and research and development facilities that helps to form the talented human capital?

DT09:

Yea, I think that each establishment of higher education whatever, whatever area it specializes in, it has the technical equipment for the development of the students in that area, meaning laboratories, facilities, etc., etc. If that is not enough the government is supporting or the EU via the government, or its fifty/fifty sometimes is supporting the development of testing facilities like digital innovation hubs which are related to the development of say digitalization and nobody is preventing students from using these digital innovation hubs and creating start-up companies for example. They would be helped from the very beginning. They would be guided through the process of establishing a company securing type patents, developing business plans etc., etc. so this is like digital innovation hubs like my colleague mentioned, the clusters of companies and technology parks, etc., etc. So being a student, I don't think anyone prevents a person if he is being interested in developing his professional career and getting deeper insight in some of the technologies or whatever to, to go there and these are free access facilities. So, this support is not only given at the initial stage for start-ups, then you go to the higher level of support for example to two – there years, whereby you can, um, you can get the money from the government, not all of it of course in addition to your private money or angel supporters, angel investors, you can have some money from EU, some money from Lithuanian government, to develop your business and for example digital innovation hubs they are paid to help you to develop business plan so if it is working if you have already created a company so they will help you find contacts. They will help you to establish networking within other countries or even within this country. So, this is ongoing, it' s just a matter of creativity and being able to use the information that you are getting to in for the advantage of your company for example.

They are getting the knowledge and trying then to make it possible to sell for businesses or businesses can take the technologies and knowledge from the center and make more, what makes them more competitive or improved. So many of students are working there, polishing their skills and getting the knowledge. Next what is done regarding this question, we from DIGGS, I believe there may be some clusters as well which as well I cannot identify correctly, we have around seventy in Lithuania. Maybe some of the cluster. One next organization that supports the knowledge passing I believe is Research and Technology Organization RTO, it was not so long created in Lithuania. With our like facilities, RTO organization is helping regarding this question and of course the governmental guidance, we are preparing the smart specialization strategy and the skills question is incorporated there in this new strategy period for 2021 to 2027. So, there will be some guidelines for the future plans on how we should strive our talents and people knowledge which is needed for the smart specialization which is high for Europe.

QUESTION 4

How can Lithuanian universities and higher education institutions be more effective in the engaging talented human capital (local and foreign talent) and simultaneously created a human-centric innovation ecosystem for aspiring entrepreneurs? Please describe what are the right kind of incentives in the Lithuanian system that allows human capital to pursue innovation.

DT06:

I can only add that according to this roadmap that you have seen, there are specific measures being drawn up as we speak, to a first of all to have students from other countries and to try keep the students from other countries who are good in talent so that is we are trying to developing sort of incentives, list of incentives, measures, you know this better and in practice and another thing is like they are trying to set up less complicated immigration procedures for talented people, that is, as I hear now for example from the mass media that it is, no problem to say employ a person to be a driver or a construction worker but it would be very difficult to employ a professor for example. It is much more complicated. Bureaucracy, yes because being a professor you need to prove that but for a driver you show your driver's license, maybe you prove some experience. For a professor, there are a still different systems of authorization for example in different countries. So, diploma in this country is not valid to the diploma in that country but now the system is getting rationalized, more simplified, made more human-like, user friendly.

QUESTION 5

Recently Lithuania has moved up its place in its regional innovation activities. How has the higher education policy contributed to this advancement? Please comment on actual instances.

DT06:

I do not know any specific improvement programmes from the Ministry of Education, Science and Sports, but looking from the side so to say, it looks like we are going in the right direction, because naturally there are processes in the society, that are urging young people to choose the specialties that are necessary and apparently it is giving fruit because as you mentioned Lithuania is getting higher in the rankings, unfortunately a lot of the young people are leaving to study abroad. But there are some people who stay here and that are learning here, and I believe that the situation is improving. All the universities are getting more and more internationalized. There are exchange students, students' exchange programmes, which were unimaginable in our time, for example so now if you want to study and if you want to achieve something the cards are in your hands. You only have to play them right. You only have to show some will what you want to do so that is the impression. So, the contribution from the higher educational institutions is that they have made internationalization more possible in Lithuania.

QUESTION 6

Are the present socio-economic conditions, industrial and sectorial environment of Lithuania harmonious for innovation ecosystem to thrive? Please comment on a few examples.

DT06:

We have a very interesting document developed in 2012, which by the way coincides with the start of industry for zero in Germany, so if we take the vision of that document, which is called the 'National Progress Strategy 2030'. If you take a vision of that strategy, it says 'what do we want to have by 2030? We want to have a smart Lithuania in which it would be a…', a good to live…, good is not the… yea, let's say good… 'in which one would feel a person would feel good to work and live.' So, this sounds like harmony doesn't it? So in order to reach that harmony we have to, I think we are on the road and on a good road because, when we compare industry problems in the EU countries, you can still feel that Lithuania is a developing country because these big countries, they now claim that they are on a different level, they have industry running like clockwork, they have their own problems, say Germany for example. But they are already thinking on the next level, industries, industries, it is running and generating workplaces and revenues, etc., etc. they are already talking about how does this, this all this contribute to the well-being of each person in the society. We are so far on the level that we have to compete to have the industry running well and this will be a prerequisite for some time later. Only then in a few years we will start thinking the, of each person, each person in the society is happy, then we can talk about harmony I guess. So now we are trying hard to, we are on this way to harmony, to Smart Lithuania where it is good to live and work.

QUESTION 7

Several factors such as technology, capital and human capital contribute to innovation. What features of the human factor is responsible for innovation and economic growth in Lithuania?

DT06:

Yea, I would like to add that in general, to be open in Lithuania, we are very stubborn and there is a, I guess in the society, there is a too much of a negative thinking. Yea because when I went to work for that a, this Minister, I read a lot of documents, and strategies and programmes being prepared and everything is so nice, so forward into the future, so even futuristic but when you think about these programmes, very nice programmes, very talently developed, or copied from other countries, it doesn't matter, but still they are good, they are future forwarded, so I thought that it would be, I see difficulties in implementing them in Lithuania, because you have to do a lot of explanation, you have to show a lot of good examples for people to believe in them. So, there is a, I think that we as a nation, we have suffered a lot and we find it a difficult in expecting nice things in the future. but the young generation is changing that now, watching our children, watching young people, students for example. I met some of my teachers at the universities, so we have this saying, that we: 'what are you doing…

I am studying a... the occupation was being a student is that you are not learning what you are learning but the emphasis is on the learning on the knowledge but you are sort of on a student, you are enjoying student way of life. You know what I mean? But now they say that it is a shame for a student to come to a seminar unprepared, they compete, they start competing in knowledge, they start competing who is better prepared for the seminar, who knows more, etc., etc., so they have a different mindset already, which is very, very worrying, so I would say that the qualities should be open-mindedness and proactive thinking etc.

QUESTION 8

There have been recent reforms and structural changes in the higher education system of Lithuania. To what extent will these new reforms significantly impact the development of human-centric innovation ecosystems **now** and **in the future**? Have these reforms been impacted by the steady migration/emigration patterns in Lithuania?

DT06:

Regarding this skills gap, yes that was established by the experts, and this is nothing very new and not very specific to Lithuania, the same for other countries, especially post-soviet countries and we were speaking about the prestige of a university diploma and being not sure that it will secure employment for you when you graduate from the university, so the programmes are being drawn up to reduce this gap from what we have now in education and especially the older part of the society who have to be reskilled, retrained to use modern, innovative, digital technologies, and the other side of this burden is on the universities and institutions of vocational training so even in school these people already know what is in this four zero or five zero. And we are somehow by the media, we are made guilty, feel guilty about immigration, about migration, my daughter is working in London and she was studying in Mykolas Romeris University Psychology and after two years she decided that it was not very good choice and she decided she wanted to see the world before deciding anything further, so now she is seeing the world for the fifth year already, but I don't think, I don't think it is anything wrong, because it is a free world and free movement. Some parents decide or some pupils decide that it is better for their children to study in London if they can afford it for example or in some famous university if they can afford it but I think that the majority of this people not feeling our guilt the majority of this people will come back I am sure. Like seventy percent and I imagine it's not forever and in the end its not very many who will stay in Great Britain for example. Because I for one could have left a long time but now its already…, we are settlers.

QUESTION 9

How involved are businesses and the industrial sector in Lithuania in enhancing the higher education system? Which sectors are more active/ inactive with the system?

DT06:

I think it's nothing specific in Lithuania when you have you see the movies in United States for example, that the head hunters in companies they go to universities they start tracking people, start tracking talents, tracking students who learn well, so the same here and there are special, each industry, I hope each industry has some sort of open day shows or whatever, whereby they, tempt students or good students especially to come and see the facilities and looking for some good employment opportunities in the future because, now we were talking to some, we have a working groups in Industry 4.0 platform and we were talking to the one of the chairman and he said we said, 'what about human resources' and he said 'its not human resources anymore its human capital'. Because a lot of industries we were meeting, last week we were meeting with representatives of the printing houses and they were complaining that they do not have enough people especially people with a digital skills, because this happens to people who do not have the most digitized businesses. They said you'd be surprised because they were already digitized thirty years ago. Fully digitized so I think its like a Lithuania is not different in any way from any countries, so human capital is human capital and in order to get good employees you have to start early. Being proactive

QUESTION 10

How can higher education inspire potential talented human capital to drive innovation and growth in Lithuania? Can this be achieved through a formal academic education offered by universities or vocational educational training offered by higher education institutions?

DT06:

I wouldn't make a very strict division because in order to to, to act in life you still need this formal education. You still need these basic things and based on these basic things, how you know them, how the universe works, then you can fantasize, then you can play around on that. Of course you need the division I don't think it's a very applicable because you need to have this a basic training to understand how the world works to understand the different how people work how different cultures work and then you can improvise on them I mean and be successful, so vocational training is different, what I was saying is that there is a prestige to have a university degree but people who have only vocational training they are specialists in their own area and they are well but they don t have this university paper, so but in other countries they are so happy, he knows his sphere he is a very good expert in that area and he is happy about that. So still we need to work on it a bit. So, first of all this is basic education, then when you know, when you know the basics you can start improvising, you have the basic education and then you can manifest yourself in what is called as the applied scientist, sciences but you have to know the science in order to have it applied. When you apply the sciences, you as a scientist for example, if you decide to become a scientist you start thinking of selling your knowledge, voyuerization. We were visiting Groningen University in Holland, and it's surprising that to be a professor seems like a very difficult job, because you are not expected to write scholarly articles in high press, you are supposed to give ideas which is supposed to be entreprenerd, which could be patented which could be commercialized and then you created a start-up etc., etc. and then you go all the way to be a millionaire for example. So, this university entrepreneurship, university entrepreneurship, applied science systems. We have some good examples in Europe but I don't think it's working here yet but I think we are on the right way. We are making progress and making effort in that area.

QUESTION 11

Human-centric innovation ecosystems are fundamentally built on the knowledge and commercial economy. Please explain the percentage of universities and higher educational institutions in Lithuania that are contributing to the development of each of these economies:

DT06:

The knowledge economy: Universities: 60%; Higher Educational Institutions: 40%
The commercial economy Universities: 40%; Higher Educational Institutions: 60%

QUESTION 12

Please describe whether higher education and a large stock of highly educated human capital (educational attainment) is correlated to the development of human-centric innovation ecosystems? Would having higher education training or qualification contribute more economic activities and wealth in Lithuania?

DT06:

So this is higher education versus qualification? No we already half the way to accomplishing this, compared of course if you take Denmark, Finland, Norway for example, they have, as I have mentioned before they have economy in place, they have high standard of living in place and then now they can think of this higher spiritual things so to say, not what the person has to contribute to the society, but what the society has to contribute to the person and in order to do that the society has to be rich and be based on something wealth for example. And on the other hand there are countries which are less advanced and Lithuania is somewhere in the middle, we have good examples and we are looking at them and we are striving to reach them and we are trying we are trying hard to be on that level so we are not in a bad position and we are actually trying hard to improve it still. Its working progress

QUESTION 1

Please explain how the curriculum of academic education and vocational educational training provided by higher education fundamentally contributes to talent development in Lithuania

DT07:

Just I am not sure how it goes directly to talent development because here every student is like a trained equally with the whole group, however if the, it depends on the student basically, if he show some knowledges some talent, he is offered like a financial support or is guided to another programme say he is involved in a working in a science projects or can be headhunted by the partners of the university like a entrepreneurships companies looking for people with certain skills, so there are, there is some cooperation between universities and businesses. Some businesses support for talented students with *special skills and just motivates them to learn and gather some packages of competencies and knowledge just to prepare for his future. So, just to say that there is some kind of way technically for talent- No, it depends on the single person what he can he offer to the science to the university, then if he shows potential, there are some mechanisms that will help him to develop.*

QUESTION 2

Please choose the skills that the higher education policy of Lithuania deems **most common** or **least common** for human-centric innovation ecosystems:

DT07:

Motivation/drive: ***most common***
Leadership skills: ***most common***
Creativity skills: ***neutral***
Risk taking/ showing initiative: ***least common***
Flexible and an adaptable attitude (Psychological): ***least common***
Industry-related skills through practical experience: ***least common***
Global mindset: ***neutral***
Entrepreneurship skills: ***most common***
Decision-making skills: ***least common***
Strategic thinking: ***least common***
Communication skills: ***least common***
Collaborative skills: ***neutral***
Analytical skills: ***most common***
Quantitative skills: ***most common***
Critical thinking/: Problem solving skills: ***most common***
Other skills: *Outside the box thinking*

QUESTION 3

Please describe the infrastructure already in place in the higher education system that enhance the knowledge of population in various technological and non- technological fields of study? Please describe the basic, advanced teaching and research and development facilities that helps to form the talented human capital?

DT07:

Regarding the practical usages in universities, as far as I know at I believe in last semester, or last course or like period, almost like in every programmes you need to do like practice, so you must go to some kind of firm, institution and work there for a month or two, so basically each university as far as I know has like a list of suggestions if this list doesn't comply for the students he doesn't do the practice in from that list he is free to choose the company of his own and go there and ask if they would to like employ him for this practice and he does the practice there, there polishing his skills and getting new ones like practical skills seeing the environment of the future. This practice needs to be related to his studies of course. Another point there these talents and competencies could be polished, I believe we have digital innovation hubs, like it's a new trend. It's like a network of *laboratories that are testing new technologies, do research in new technologies and they, we were, a month or two ago in one of these digital innovation hubs, we call it DIGGS, in Vilnius, we have a total of about nine I believe in Lithuania these digital innovations hubs, in Vilnius I believe we have three, more or less, if I am not mistaken what they can be. These DIGGS are like working with universities, like binding point of the academic structures and businesses. They are getting the knowledge and trying then to make it possible to sell for businesses or businesses can take the technologies and knowledge from the center and make more, what makes them more competitive or improved. So many of students are working there, polishing their skills and getting the knowledge. Next what is done regarding this question, we from DIGGS, I believe there may be some clusters as well which as well I cannot identify correctly, we have around seventy in Lithuania. Maybe some of the cluster. One next organization that supports the knowledge passing I believe is Research and Technology Organization RTO, it was not so long created in Lithuania. With our like facilities, RTO organization is helping regarding this question and of course the governmental guidance, we are preparing the smart specialization strategy and the skills question is incorporated there in this new strategy period for 2021 to 2027. So, there will be some guidelines for the future plans on how we should strive our talents and people knowledge which is needed for the smart specialization which is high for Europe.*

QUESTION 4

How can Lithuanian universities and higher education institutions be more effective in the engaging talented human capital (local and foreign talent) and simultaneously created a human-centric innovation ecosystem for aspiring entrepreneurs? Please describe what are the right kind of incentives in the Lithuanian system that allows human capital to pursue innovation.

DT07:

So to pursue innovation we have quite a few measures like invest EU, supported measures from government, via European Structural funds or other funding mechanisms, as mentioned before in the questions, we are supporting the new businesses the new ideas, the innovative ideas, because this is a goal of our country, be the leaders of innovative businesses in certain areas that Lithuania is strong, like the laser technologies, the artificial intelligence. So if the idea of a person or a student shows to be good he can created a start-up or company which we are support measures are having get a facilitator which would give him possibilities to connect and just get involve in value chains through Europe, getting the partners and start this innovation going he is thinking of. So, it's not like a going through years when we have some measures that support in the beginning, facilitating in establishing a strong thing, then he goes just to another from start-up to scale-up, we have another measures just to support him as long as this is showing potential, so he can always apply to another measures, like eco-innovations, because it's not basically if like you are starting from scale-up grow to the business, there are other mechanisms. So basically, through whole life of your businesses you can get support in which areas Lithuania is strong, through smart specialization as one of the possibilities. So, there is a gap, I know from my personal experience, if you want to employ some kind of professional *which is specialized in some narrow work, he needs to fit it perfectly in Lithuania and if it's some, only around eighty percent, then it starts a bureaucracy, so 'like no you cannot work full time because we only have full-time employment and then it stops (the recruitment process of hiring the professional). So, some say that 'ok I cannot do what I want when I go here in Lithuania' and we lose talent in this case from the bureaucracy. But now it's better, it's getting constantly better as we see in world ranking. We in Lithuania is stepping up these steps each year but still a lot of work still needs to be done before we have any fruitful results in this sector*

QUESTION 5

Recently Lithuania has moved up its place in its regional innovation activities. How has the higher education policy contributed to this advancement? Please comment on actual instances.

DT07:

So our division helped, first of all, so our Ministry (The Ministry of the Economy and Innovation), we prepared this roadmap of digitization, we showed, we did the analysis, a huge work of the situation in Lithuania in different sectors on a regional level, on the big cities level and with the human resources we have identified what are we lacking, what are our weakness, in which points, so we have knowledge where we are strong where we are weak, we now know what kind of opportunities we can use in the future, what are our strengths. So and as this work was done and not only by governmental institutions, it was done also with the help of experts from the academic level, and from businesses so everybody was involved in this and we have good results on what we need to do in the future so basically just to round up an analysis of the whole country situation was done, and we now know what we have to do to step up even better as we already stepping this year higher so it means that what our work has produce some results, and we will keep going with the guidelines which were indicated during our previous work.

QUESTION 6

Are the present socio-economic conditions, industrial and sectorial environment of Lithuania harmonious for innovation ecosystem to thrive? Please comment on a few examples.

DT07:

So, to say that it is fully harmonious, it would be not really right. We still have problems, with I believe mentality when we do not see the partnership possibilities, we only see conquerors like and now what we are trying to do to like get industrial symbiosis going like to striving to the circular economy where we have to work, everybody needs to contribute to the main goal, unfortunately there is a lot of work to be done still. Just to say it is harmony between government between businesses, between academia no, there is not, if there wouldn't be like contract, I wouldn't go there at the moment, however, we know these issues and we are working however through the bureaucracy and like we are trying to get to the sustainable future and these sustainable results is very difficult to produce the good results fast so it takes time even longer than we would like to be, however we have *division, we have our ambitions to get to this harmony like in cooperation with all sectors. There everybody knows what we can do then maybe we can do and how we can do. So, it's one of our goals in future goals, so of course getting the memory of ten years ago, it was like even bigger mess however we are improving. However, it's like generation change eventually I believe we will see the more partnerships possibilities than really conquerors*

QUESTION 7

Several factors such as technology, capital and human capital contribute to innovation. What features of the human factor is responsible for innovation and economic growth in Lithuania?

DT07:

So, if we start about economic growth of Lithuania, we like industrial country, we have a strong manufacturing sector, we have a quite strong export policy, which are generating a lot of GDP, however what we see we are lacking in high value products. It means basically that the old struggle is that we are like getting outsourced, we are not creating higher value-added products. So, if the feature of the human factor, I would say, most, we need to somehow train ourselves to think outside the box, create new products create innovative products. Another thing, like entrepreneurship skills I believe. We need to know how to sell our products, sell our company names, how to sell ourselves, in other words to make us known, through the Europe and through the world. Just to like to integrate in thats strategically value chains, which creates free will and free work, new products new ideas, and maybe some also like human resource factor like if we have ideas we have a knowledge, we can share them, we can sell the knowledge which is one of the products also can be done here. I would add the also what we leave, we are like a stubborn world, very conservative, evaluating risks, is sometimes, is we do not evaluate risks, oh its risky, i won't do it. But you do not evaluate what you can get from the risks, pros and cons of the risk, its just the risk means for us very negative thinking. But if we look into middle thinking the risk is opportunity, so we have to try somehow think about risk not only as negative thing but as an opportunity and to learn how to evaluate risks is also a very valuable tool too.

QUESTION 8

There have been recent reforms and structural changes in the higher education system of Lithuania. To what extent will these new reforms significantly impact the development of human-centric innovation ecosystems **now** and **in the future**? Have these reforms been impacted by the steady migration/emigration patterns in Lithuania?

DT07:

It's not really our competencies to answer this question. It's just that I can give my humble opinion, yes, we had this a education reform not so long ago and as far as I remember, educational reforms in Lithuania, quite a common thing, ever since independence in 1990. When I was studying myself, I believe I lived through three of them. So, to say to evaluate the results of the last one, I am not sure- its hard to tell. I believe what I can say is we are getting better, so we are learning, lessons learnt, we are learning from our mistakes so hopefully, and eventually we can develop some kind of good reform that will give us the best results we can. However, as you can see, it's still on the road, the road: try fail, try fail, try improve and so on. Its everchanging and its good that it is everchanging because it shows that we are capable of changing things. We need to get some good practices from our neighbors, from other countries and somehow just to improve, we have to improve and what are the plans for in the future so in the future I believe will be as well another reform because still we are now on the verge of transformation. As in the Industry 4.0 we had to get more with digital skills and our industry will transform into a zero-waste industry, circular economy, there will be a lot of changes in the future (fourth industrial revolution). And our education will need to adapt to the needs of industry, so we believe that, now what we have we prepare the students and they try to find the work and it doesn't work very well. May we are now working with some regional projects when we looking into some re-skilling systems and interact projects there the business say to come we need, we need these skills, we need these human resources, ok and then a universities adapt their programmes or just colleges adapt their programmes. How to produce the things business's needs, the industries' needs not to produce what we can but produce what is needed, so there is work done regarded this case and believe this is the changing which will happen in the near future or in another reform hopefully this change will be soon just to produce what is needed not what is possible to produce.

QUESTION 9

How involved are businesses and the industrial sector in Lithuania in enhancing the higher education system? Which sectors are more active/ inactive with the system?

DT07:

QUESTION 10

How can higher education inspire potential talented human capital to drive innovation and growth in Lithuania? Can this be achieved through a formal academic education offered by universities or vocational educational training offered by higher education institutions?

DT07:

QUESTION 11

Human-centric innovation ecosystems are fundamentally built on the knowledge and commercial economy. Please explain the percentage of universities and higher educational institutions in Lithuania that are contributing to the development of each of these economies:

DT07:

The knowledge economy: Universities: 50%; Higher Educational Institutions: 50%

The commercial economy Universities: 30%; Higher Educational Institutions: 45%

QUESTION 12

Please describe whether higher education and a large stock of highly educated human capital (educational attainment) is correlated to the development of human-centric innovation ecosystems? Would having higher education training or qualification contribute more economic activities and wealth in Lithuania?

DT07:

If we see the situation now, what we have we are lacking, like in the whole Europe the same weakness the same struggles like the bottle neck of talents and not enough qualifications, human qualified human resources for some sectors, like IT sectors is always lacking of personnel, another digital skills are still lacking, because everybody, not everybody most of the people want to be a, I want to be a manager and these like a simple professions are forgotten like physics or something, they are not interesting, however in the future, now we are lacking them in the future we would deepen field, we would get in a deeper hole, if we do not produce such qualifications so I believe at the moment we have quite high education training level and we are still lacking to attracting the people into qualification training.

QUESTION 1

Please explain how the curriculum of academic education and vocational educational training provided by higher education fundamentally contributes to talent development in Lithuania.

DT08:

It is quite a difficult question because an academic education is very different from vocational education because vocational education is more oriented to practical skills development let's say for workplace development and academic education is more universal I would say and of course it gives knowledge as in knowledge about the system of the specific areas of your studies so quite difficult to say and it very much depend on lecturers who provide this education and from my personal opinion if academic institution let's say come speaking about innovation if academic institution is perfect in research and is capable to deliver the newest knowledge to the students in the specific areas so then they very much add to the talent development so of course there are needed to develop other skills which are very important but without the background of good knowledge good goaled skills how to develop the knowledge I think its worthless. All the things do not work if you do not have something very important in the system. It depends on area, but I would say natural sciences maths, information communication technologies, technology sciences yea perhaps less in social sciences for now but it improves a lot and I think MRU did a lot in law area, but I think that Vilnius University is catching in economic, economic area but perhaps management it's difficult to say cause I am not so much familiar but management is also strong in some universities. It depends very much, I said on people.

QUESTION 2

Please choose the skills that the higher education policy of Lithuania deems **most common** or **least common** for human-centric innovation ecosystems:

DT08:

Motivation/drive: **least common**
Leadership skills: **least common**

Creativity skills: **least common**
Risk taking/ showing initiative: **least common**
Flexible and an adaptable attitude (Psychological): **least common**
Industry-related skills through practical experience: **most common**
Global mindset: **least common**
Entrepreneurship skills: **most common**
Decision-making skills: **most common**
Strategic thinking: **least common**
Communication skills: **most common**
Collaborative skills: **least common**
Analytical skills: **most common**
Quantitative skills: **most common**
Critical thinking/ Problem solving skills: **most common**
Other skills ____

QUESTION 3

Please describe the infrastructure already in place in the higher education system that enhance the knowledge of population in various technological and non- technological fields of study? Please describe the basic, advanced teaching and research and development facilities that helps to form the talented human capital?

DT08:

I would say that equipment I think, let's say equipment and all other things not of course in all but in most of areas are in place but regarding intangible how to use and so on I think there are a lot of questions here and a lot of inexperience I would say so it's very much depend, it very much depend on culture when we want to have most advanced equipment but we do not have people who worked with this equipment, who can teach to work others with this equipment how to use it how to say not at basic levels but at advanced levels, so its um, I would say we still need to a lot to learn. And also of course Lithuania is a small country very much depend on Lithuanian research priorities. But it also kills some initiatives, if you have initiatives to explore something different than you have infrastructure for then you should go abroad to do this. So, it's very difficult question for policy to decide which one research areas would be a priority. So, basically what I see in Lithuania as I told you before regarding bachelor sciences and all other like STEM and so on, I think they all have basic facilities and I think most of them have the facilities for advanced teaching and for research and development. For social sciences just yesterday, I browsed two books for quantitative methods in econometrics, just two books that are issued in 2009 and 2015 and they are not in the Library of Vilnius university. And these are, let's say these are key books for economics studies, at least at PhD level and I think at master level perhaps in statistics and they are not here and when I ask librarian and she told ok we can order this and ok and I thought we can order but we do not have this. And I think with social sciences its much worse situation we do not have enough money for software for let's say for for for these books and so and its very bad because, for both public and private companies, because private companies save the money that they don't use. Buts what's the worse if social sciences like economics and management were not developed enough, it means that we cannot speak about intangible things and you can have a lot of technologies you can have a lot of facilities, you can have a lot of great ideas and develop some technologies but if you do not know how to use them further how to commercialize them or how to put them to the market or to the people its worthless and I think there is a lot of bad things going on there. So Of course, I am not saying that social sciences is the most important but they should be developed enough. I see let's say in Vilnius university faculty of economics and business administration they have now for two years new programmes for bachelor's degrees, quantitative economics as I recall in English and they have very good lecturers here who came from Cambridge from other foreign institutions, Lithuanian ones who come came back here to do something good for Lithuania they moving very good and they have very great students so I think they will push this somehow but of courses it will require some time to do this. For Management field they had somehow some good facilities but of course they can also they could be improved and so on. But I think a, I think it's a change of generations and so on it should be going on so. Regarding for research, I think for advance teaching the facilities are enough except for some cases but for research and development like using further the knowledge science produced it's a question for me because science works science, question about collaboration, question about business how do they understand science it's always a question because a business leaders could have very great ideas which are not possible from theoretical point of view and I heard stories when they try to do something in chemistry bio-chemistry but without consulting scientists first and they receive funding and they came to scientists and ok help us.. and scientist can't help because it's not possible. I think Ministry of Education, Science and Sports trying to push this, and I think the Ministry of the Industry and Economy trying to push to collaborate but still it's very difficult to do but. They are pushing but I think it's a question about they not already pushing but also cooperating and they try to do this but still it's a question it's little bit better situation but still is need a lot of work to do and I think they need facilitators who (intermediate ones) who could put together business who are not from academia, not from business, let's say like our agency.. it's not there not there but under two minutes we can be facilitators and because we can together put these two sides but of course it's requires some effort. Yea, but they try to do some things but of course there are interests of business and interests finance, I think Lithuania is too small to look at business in such way because we are a very small country very scarce resource and we should put together… still a lot of work to do… and of course…trust issues also.

QUESTION 4

How can Lithuanian universities and higher education institutions be more effective in the engaging talented human capital (local and foreign talent) and simultaneously created a human-centric innovation ecosystem for aspiring entrepreneurs? Please describe what are the right kind of incentives in the Lithuanian system that allows human capital to pursue innovation.

DT08:

Its very difficult question regarding universities and higher education institutions if we speak about colleges but colleges came from, I just read an article but It's true, the colleges are how to say they were created from some institutions that were vocational ones in soviet union times and now they are allowed to give bachelor degrees and from vocational point of view if you have a bachelor degree in accountancy or information technology from college and I do knew that employers are very happy at such employees so they are very professional they have practical skills to do the work and its ok. If we speak so colleges still are in the vocational stage and they do a lot of I know they have projects, initiatives they try to create some entrepreneurial spirit and its ok I can't say that it is bad what I see in the job market they all can have work and they can do the work they are trained for. Regarding this division, so its policy makers decision, I think universities try to attract more talented perhaps with more universal view on to the world and so on. So, it's difficult to say is it good or bad it is like as it is. And it not only like in UK that you can go from the vocational to the master's degrees and the universities and the same goes for Germany and Austria and so on… but Lithuania is different. Regarding universities' more effective in engaging talent… first all students who are study they should have very good teachers and very good lectures to have very good knowledge and second they should have some spirit to do innovation. But it's not like how to say, it depends very much on personality and not every personality needs to how to say be innovative it should be let's say a team for innovation it's important to have a team. And if institutions or universities are doing something to form the skills to work in the team to have some roles in the team, I think it's enough. Do they do this? It's also a question and if they do, how do they do, if they have like a lecturers to train the skills so its difficult to say because I was far away from this. As my first education was in genetics. At this time, there was only about knowledge in the field so it was not about doing projects together… no. it was more training for future researcher, than for working as a team but its laboratory works so you know you should have all these skills so will you go further then it very much depend on you how you go. So, it's very difficult to say for now. Also, at phd or at doctoral level you should do research by yourself so it's also more personal work not teamwork so and innovation requires a lot of teamwork. So, I think there are some incentives when they release programme study programmes which are aimed to create innovations and they put together students from different fields let's say like from biology and management, like for engineers and business and so on. So if you put law or design if you put such programme in place and you can mix competencies of course there will be a work to form a team and so on if you can deliver this and they can create with some practical some examples so its ok. What I think it would be very good for Lithuania to have let's say not for one university but for all universities like I don't know programme or platform where students from different universities, different fields can work together. So, it would be very nice at least at city level like Vilnius, like Kaunas or Klaipeda. And I think perhaps that it would be good also that there would be there also college students in and if you mix a lot its always feature of ecosystem. In biology we were taught that ecosystem should have a lot of features a lot of subjects with different features because at some point some feature it could means survival of the system so from this point of view if we come from nature, so a lot of difference is very good but at the moment there are some efforts at university levels and at college levels to do such programmes but it would be good to have these programmes at not only at university or college levels or more.

QUESTION 5

Recently Lithuania has moved up its place in its regional innovation activities. How has the higher education policy contributed to this advancement? Please comment on actual instances.

DT08:

Ah but did you… you mean innovation scoreboard? Because I didn't know now it depends on… according to my understanding Lithuania has moved up because there was a how to say there was expenditures from businesses and R&D activities had increased and there was some, some indicators like this how much education is in this? It's difficult to say because I think that higher education institutions are public R&D expenditures. So, it's good for Lithuania to move to how to say higher in innovation scoreboard. But this indicator doesn't mean anything without appropriate output or results. You can look at expenditures and economic effect and if you look you will see economic effect of this whole expenditures is still very low in Lithuania. So, when you should look on only the overall place but look deeper in the economic part. So it means we put a lot of effort and we put a lot of money in R&D activities and we are still low on the results, so to fill this gap, I think higher education institutions could do a lot but once again, it means they should cooperate collaborate with businesses (collaborate with each other) two sectors should collaborate more and should look business should not have a look that higher education should produce workforce only. It's a little bit different the mission of higher education institutions its more broad, has more inside than business things, so but at the same time, I think higher education institutions, could do more on communication and dissemination between business on what they can offer what they can do what they can do together and so on and to promote the researchers or scientists so labs or whatever to business I think this is missed feature in this whole system, and perhaps it's also because Lithuanian researchers because I know many. They are quite modest they don't like to brag, and I think this is why it's happening. But Lithuanians do not celebrate until its done. Me also I also don't like to brag, but some things need to be communicated as show and of course there are a lot of issues like somebody could stole our idea, they don't want to share. But all ideas could be how to say in done in different ways. They don't need to be afraid of this if one will do better than you, be happy for them, and I think we could find another one.

QUESTION 6

Are the present socio-economic conditions, industrial and sectorial environment of Lithuania harmonious for innovation ecosystem to thrive? Please comment on a few examples.

DT08:

It's quite difficult to say, let's say from funding programme what I see there is a lot of possibilities to get funding for your new idea, your new start up so, you can do this. Question is about ideas and about the quality of these ideas. So, ideas regarding innovative solutions, products and so sadly to say they are nor so new. They are not so innovative in the mass, most of them are just incremental as they say innovations, that's the usual how to say some improvements of something. Its not breakthrough innovation, they are not breakthrough innovations and this a problem, as the problem again lies in people. Because they are not taught to think differently. To do something differently, they are very much from the schools and through in universities most and in colleges also, they are not, they are like, put in frame on a creative, creative things and in the frame only one piece of the creativity and in all others we cannot do, like, there is an example, I have a seventeen years-old daughter and they have to read some books and then tell about what they have read and how they understand and they should do in the frame that was set up by the Ministry of Education, Science and Sports. You should see this, how to say, if it's a book and if it's a literature, so everybody gets what he how to say, what he can get as a personality, and when you put a frame that you should see this like this… and I also wanted to say like this… why so its very bad from the beginning. So, at the universities it's the same because it should be allowed to think differently to discussed at different point of view and literature like art it should not be viewed from some critics' point of view why?? And the same goes for all other things, because you should learn how to say vocabulary and but sentences you created, its very different thing so in studies you can learn a lot of theory and methods and get a lot of knowledge. But if you put a frame on this you cannot do something differently, and you cannot innovate. So, in the beginning innovation culture is not fostered (no) and of course let's say my daughter she is very good in communicating but still she doesn't like to do so much projects, because usually at schools it means that somebody does something and other person doesn't do anything. But let's say special cases, but it would force to be more creative, I think it would be better. So I think this a let's say social economic conditions if we speak about society, so you can say that it is allowed to do something differently but its very difficult to change others mind form industrial and sectorial environment, it also very much depends on people who work on these sectors because if they allowed to something differently its ok, as you see from the beginning you are put on some railways going in this destination and you cannot turn to the left or to the right, so I think it's more about at every level in academia as well so like I will have my PhD defense board at the end of this month and when I presented my work, they told "ok, but what…. What theory??" empirical research is about they things in theory and questioning the theory but it's like a show…

QUESTION 7

Several factors such as technology, capital and human capital contribute to innovation. What features of the human factor is responsible for innovation and economic growth in Lithuania?

DT08:

So mostly in economic research, the most important thing about human capital is education. And without higher education you cannot think about any innovation. If we speak about personal level so everything you wrote here in the second question its true but I think what we the lack in Lithuania is about empathic skills, so and but it's also more a feature of Lithuanians not only culture but nation, national features so let's say I myself very different from other and my children too but my husband is too Lithuanian so he keeps everything inside and like it's very difficult he doesn't communicate and I think the most of them know. So also communication, lets say communication skills you could learn like how to cooperate you could learn, decision making you could learn, entrepreneurship also you could also learn something things, but let's say be creative, not to be afraid to be different, you cannot learn, its inside and should be encouraged but it's not and it's a I think very difficult also Lithuanians are very much locked in Lithuania. Or locked in the Baltic states they don't have this global mindset as a people they do not look further outside the area, they are very locked in either Lithuania or either in the area they work or they do research and so on, so it's, like in economics there are a lot of items to use some methods from natural sciences, to use in economic studies so and its very good does help does it not it's other question but at least they are trying so I am not sure how much does other scientists do the same. Its only about research but all other things. Of course, you should not invent a new bicycle, you should check before you get on it. But otherwise I think this creativity this empathy lack of empathy and also to be brave to be different it's very difficult. Also, there is also a lot of fear of different people in the culture and its also it does not help, it does not help in all innovation ecosystems. Empathy what do I mean it's a understanding of the people, understanding not only from rational point of view but from psychology. Understand the state of how person feels but let's say what does he pursue, does he want so it depends very much, but mostly it's about understanding as a people and because there are a lot of intellectual ones in Lithuania but they are very they don't understand what others are feeling saying why and so on, so it's a strange to observe but it's very important and of course to be sensitive not only to yourself but to others it's also not a feature, mostly. I think it should be more.

QUESTION 8

There have been recent reforms and structural changes in the higher education system of Lithuania. To what extent will these new reforms significantly impact the development of human-centric innovation ecosystems **now** and **in the future**? Have these reforms been impacted by the steady migration/emigration patterns in Lithuania?

DT08:

A question is which reforms do you mean? If, you speak about infrastructure it's an easy one I could, it could be exploited by the right person. Again it depends on people because if you will bring some very new equipment if you very don't know how to work with, which research can be done so why should you bring them, work on old one of course you have more less results from an advanced level of research, so regarding optimization, I think, so Lithuanian higher education system is very closed from my point of view and its very backward when you put, it's a questions and again it's a question how much money should public spend how much money university could do by lets say by taking in payments from students, from business and whatever, it's a question of balance but it's also a questions, let's say two things, in Lithuania higher education institutions they much depend on public money and I am not sure is it good or is it bad, I think it should change somehow to what extent, its also again a question and Lithuania is a very small country and the resources are very small in comparing with any other countries and so on and geographical position of Lithuania is not so feasible and again its more periphery and it will be like this in the nearest future. But I wanted to say that higher education system culture of higher education is still old but in contradiction business culture is very different and business culture is more likely to be like in US based on individual level, based on individual achievements the renumeration for individual achievements and a a lot of competition so you have like a clash of two cultures and that's why I think collaboration cooperation is not happening also but you should understand that these mindsets of like wild west in business is not isn't good also in Lithuanian businesses as well because, because also a small country, small resources so you should cooperate again so and there let's say in Europe there are clusters and so on what we seen in Lithuania, that clusters, cluster organizations are struggling to form to develop and so on so when we speak about the structural reforms in higher education of course teachers here I would agree that we need more teachers more good teachers and good teacher doesn't need to be a good researcher and so on but he or she should be should want, should be able to teach, which is also very much depends on personality and not everyone is able to do this. I do not believe in thing that you could learn how to be a good teacher, if you do not have this inside at least, a little bit if you have a little bit then you can develop but you cannot be just a good teacher everyone cannot be a good teacher I don't believe this. So, when we speak about teachers' training there should be a selection of course and you should check how people can how they would be able I am not sure that Lithuania has Lithuania has some good selections procedures processes because if you start from the beginning you should have good system to select, then good system to train then good system to place them and to give a renumerations they could live on and be proud of so its not only just 'we have a training programme for teachers' that's all… no its not happening so you should look throughout all the system and to be and all elements of the systems should be in place otherwise it will not work, otherwise we will spend the money and we will not have good results and innovation ecosystems as well. So, if we speak about optimization of universities, if you have a culture in business just as wild west culture, so then it's a question about a market of higher education. So, I would prefer my personal view, I would allow to be as much universities as they want to be here, but public money should be only be spent on the best results. So if university deliver the best so it can receive better funding but also I would allow university could have money from students from business from whatever, from foreign students and so because this pushes competition in the right direction and universities should not only compete here in Lithuania come on there are a lot of markets outside Lithuania but what I see is that universities administrations its very convenient how to say not to compete at global level so, very convenient because you always receive a public funding but I think you should be more open I don't say that in every field you should compete globally but you should choose some priorities you are good at and you should compete there otherwise it's also just a just doing as usual and doing as usual do not allow innovations to come out. So from this point of view and.. optimization is done as I understood because of decreasing students' numbers but the number of students should be. I think the number of students that comes to your study programmes should be responsibility of university and university should be allow to attract more foreigners and so on, so how university is successful in this, its how Lithuania want universities to be successful in this, its policy makers decision, I, I would think it would be good that university would have these performance indicators because lets talk about US so all culture was built on migrants, the best researchers migrants, the best movies migrants, so when we speak about talents talented people you should be open to them you should allow to go there freely and you should attract, and you should maintain them here also it's a lot of . But I don't think Lithuania has this attitude but it's because its trust issues I think first and second Lithuanians as I said they are very afraid or they have fear inside about different people and that's not helping of course let's say young people like my daughter's age or so they are more open minded they have a lot of friends across the world so they look differently and they have different attitudes but I encourage my daughter to go study abroad I don't want her to study here, because I think she will gain more there even the programme is not the best in the world but I think she will have a network she will have a different experience she will have a different view very different things that I think she is how to say be good at and for her it will create some benefits. So, I think Lithuania from higher education point should be more system itself should be more open more open more changing culture, I think MRU doing a lot in this direction. And I know of a very good example of a private university in Poland there in Poland Kozminski University which was established by former Professor of Warsaw university and this university is very successful on international scale. It was listed in financial times, when few of their programmes in financial times ratings as one of the best from tenth so, so and they attract a lot of foreign students so I think but they had very good attitude and very good strategies to do this and also very good network across the world so it helped them a lot but I think every university can do this. If they wanted, they have a strategy, they have action plan according to this and so on but ofcourse, they should be open.

QUESTION 9

How involved are businesses and the industrial sector in Lithuania in enhancing the higher education system? Which sectors are more active/ inactive with the system?

DT08:

So very difficult because I didn't check how much they active inactive you can check in from some things but I don't see the difference between business and industrial sector so I think universities try to attract business and industrial sector to be on board of study programs so it's a good thing. How much they are active, I think all law firms and consultancy firms are very active and all other industrial sectors depends on business entity I think, if they want to also on the network if you know, let's say if you know good some professors and he invites you to be on board, usually you would say 'ok you would like to board' if it's your friend at least some good acquaintance so its ok but to say how much they are active… So I can only speak about only on research and development activities because I work with this what I see that um business tries to cooperate with higher education institutions, not every practice is successful but if we look at the funding instruments and where it is outside I would say quite a lot, the question is about the quality of cooperation. Is it only just only for the tick just to have higher education on your R&D projects? Or is it only a tick to have on board on study programme of some business? what's inside you should look more deeply because its difficult to say just from numbers. I know that Vilnius university now have alumni club and they I think seventy-five thousand euros raised this money only, it's not very big number but it's a start. I know Thermo-fisher scientific cooperates a lot with Vilnius university giving them labs donating something and I think other business also donate something but to say what exactly I can't say I know that my friend is a director of zoology museum at Vilnius and she receive gifts like these I don't know how say in English, dead animals… furs, and they do not have procedure on how to accept this so there are very valuable ones but they don't how to say they didn't know how to put in accountancy, she stored this for about a year or more…its like you are receiving a sculpture which is very valuable and you just cannot put it nowhere so I think how to say it should not always be about the money, it should be ready for such donations also because if you want just refuse to take then but for zoology museum to have some experiments like some wild animals that is not in Lithuania. So, I think it's going, its going somewhere but I don't know about other universities, I think they also have some donations, but it was not how to say nobody reported so much, nobody counts this, so I think that if there would some system some system which allows this to do I think it would be good to know otherwise you should ask rectors of universities.

QUESTION 10

How can higher education inspire potential talented human capital to drive innovation and growth in Lithuania? Can this be achieved through a formal academic education offered by universities or vocational educational training offered by higher education institutions? What are the necessary components for such ecosystems?

DT08:

So it very I strongly believe that lets say the higher education should say first deliver some skills and knowledge in some specific area, so if its about vocational training I would say it's mostly practical skills for workforce it's not bad it's just for workforce, they are like bees who do the work but the ones who create something how to do this work? They are taught at universities usually so without strong knowledge I don't believe innovation could happen, what I see from my work with business when we consult them

I see that the most successful are the ones who have university degrees and who are, how to say and who have very good knowledge in this specific area they are taught in and they are fans of this area and they want to do more so these good innovations, I mean not incremental ones just to improve something which is also good it is not bad if we speak about high quality level so they cannot be done without this and I think higher education universities can deliver a lot. So, the question is how much talented people are happy within the university or within the college? So if you want to be the programmer it's enough for you to be in the college if you then want to get more then you can goo further, depends on you if you want to be something else and you go to university to get the knowledge and then to deliver more so it's also but without the good background of university I don't think we could have good innovations and I do know that Vilnius University Rector Prof. Žukauskas once ask business students 'what is the good innovation?' what's the… what's the… something like this and the main idea is that this innovations that is not on the market yet, it's somehow true but if we have in mind the example of the apple company all iPhones and so on so wasn't so much new but it was new in some features but for these features to develop the person had to be very, how to say, perfectionist, so because it was not enough for him to have a thing let's say just a coffee, he wanted to have very good coffee, he wanted to have a device with very good sound, screen and qualities and so on so he was a perfectionist so most of researchers are perfectionists good researchers, so it's my observation, because I also have a research project that ai manage and I gather here good researchers and I see how they work and they all are perfectionist all. All. It's not bad. In management you should be a little bit less perfectionist because you cannot manage that you should gather result in the end. You cannot improve anything until one hundred percent perfect thing. So, it's very difficult but I think that's why Steve Jobs suffered a lot. So, what I wanted to tell that without this good perfection perfect background you cannot do anything good. So, of very good quality. So, I think it's very important to have in higher education system very good researchers and very good lecturers or professors. It's so much important you can teach someone then how to lecture how to deliver lecture and so on how to conduct research but how to train people to do high quality research yea but is if they do have all in themselves, so that's why I think that lets say just funding body, the Research Council of Lithuania, have very good funding instruments to attract good researchers to Lithuania we have here good teams so I think here they are doing a lot. And Mostly I mean for fundamental research. Without fundamental research you cannot move forward. All other things come after wards. So higher education should do a lot in Lithuania. And there are a lot of efforts to deliver applied research to business it's good but it can be easily done from my point of view but if you do not have good fundamental research in your priority areas so you cannot do anything after ten or twenty years because we should not only think about research only in one year, two or even in three years we should think long terms and we should plans long terms and long term planning is not in Lithuania yet. In the whole public sector including higher education, including all research facilities. So, it's a pity, so it is like it is. And also regarding research and development not always the politicians should listen to business side because business is about now or at least in one year so they do not have foresight thinking they have, they do have strategy thinking how to develop the specific business area or a specific business but they definitely do not have foresight thinking for the future so and of course you should how to say take them into consideration because we can how to say create very good innovations and so on but there will be no business top take on all this and to move forward. But I think this side could be more easily promoted than research side, because research requires a lot of time resources, human capital and so on.

QUESTION 11

Human-centric innovation ecosystems are fundamentally built on the knowledge and commercial economy. Please explain the percentage of universities and higher educational institutions in Lithuania that are contributing to the development of each of these economies:

DT08:

Universities should be separated from Colleges. Colleges I think for commercial they can deliver… I don't know do they deliver? but they can and universities it's also I think about. So, all is it's for 'Other' and I don't speak about graduates, I speak about research and development activities current, for R&D. If we speak about graduates, I think both universities and colleges deliver about ninety percent. What I understand about innovation and commercial economy its not so much still.

The knowledge economy: Universities: 10%; Higher Educational Institutions: 0% (Research and Development)

The commercial economy Universities: 20%; Higher Educational Institutions: 20% (Research and Development)

QUESTION 12

Please describe whether higher education and a large stock of highly educated human capital (educational attainment) is correlated to the development of human-centric innovation ecosystems? Would having higher education training or qualification contribute more economic activities and wealth in Lithuania?

DT08:

Yea of course it is needed but again, it, it, it, cannot be just answer it's needed. Its, about how it is done so of course it is correlated but human-centric innovation ecosystem when you speak about this you speak more about societal challenges, I think and societal challenges should be agreed on within society so and what European Union gives at societal challenges it was it not necessarily reflects Lithuanian societal challenges. So, the question here is should Lithuanian Higher education system and Human-centric innovation ecosystems should deliver to Lithuania societal challenges to European societal, and global challenges how much Lithuania is affected by each level of challenges and then how we should design our higher education and innovation ecosystem so nobody thinks about this and policy makers I don't think they think in these steps, EU policy is much based on let's say on the majority of big countries of the big players in EU. So big players in the EU are very different from the small players and there is we should agree that there is a division between central and eastern Europe between south and northern Europe and central and western Europe so a lot of Europes and they are very different but now European Commission wants to how to say move further with innovations but Lithuania could align but how to do this can be a different way every time you cannot have different things to and to work and so on. So, its policy makers decision to think it through very well to have good advisors for this so of course for me it's very strange that every time Lithuania goes in line with EU policy. Trends and it's a pity because how to say, 'if a child is young don't know how to walk, he cannot run'. Its very easy to understand and for country goes the same. So, if you do not do your job at first stage you can cannot jump into third or fourth stage. And Lithuania is jumping and then suffer from results from the economy side when you if you look in innovation scoreboard you will see this so economic results are bad. So, for Lithuania it's very difficult to go with the European union when Lithuania wants more money from the structural funds and so on and does everything to get this money its ok but then you should think how you should use this money what directions what are priorities and so on. And Lithuania do a lot in R&D field and invest a lot and I do hope we somehow will have some very good results but not so much as we can.

QUESTION 1

Please explain how the curriculum of academic education and vocational educational training provided by higher education fundamentally contributes to talent development in Lithuania.

DT09:

Yes I believe it does contribute to some extent, yea it's a great to compare in higher education and vocational training so vocational training it is more talenting I would say not the high position jobs, its more targeting the services sector and some positions in the manufacturing sector, but it's really not about getting the professional, it about getting the professional in Lithuania, vocational education, vocational training is really lacking in coordination and currently it's really not contributing enough. Higher education does contribute to the talent development in a major extent but there is a ongoing dialogue or dispute that academic education is too stubborn to meet the needs of the actual labour market and private sector needs to constantly supply additional skills for the higher education graduates meaning that higher education does not really perform its function to the full extent so both do contribute, so summarizing vocational educational training much less and higher education quite a lot but there's a skills mismatch. With some extensions it (the curriculum of academic education) does not really match the expectations of the public businesses and of the public sector as well. It doesn't match, it does try to reflect it but the reflection goes too slow I believe they fail to adapt in such a good pace that it should be adapted.

QUESTION 2

Please choose the skills that the higher education policy of Lithuania deems **most common** or **least common** for human-centric innovation ecosystems:

DT09:

Motivation/drive: ***most common***
Leadership skills: ***least common***
Creativity skills: ***least common***
Risk taking/ showing initiative: ***least common***
Flexible and an adaptable attitude (Psychological): ***most common***
Industry-related skills through practical experience: ***most common***
Global mindset: ***least common***
Entrepreneurship skills: ***least common***
Decision-making skills: ***most common***
Strategic thinking: ***most common***
Communication skills: ***most common***
Collaborative skills: ***most common***
Analytical skills: ***least common***
Quantitative skills: ***least common***
Critical thinking/ Problem solving skills: ***least common***
Other skills ***Learning skills least common***

QUESTION 3

Please describe the infrastructure already in place in the higher education system that enhance the knowledge of population in various technological and non- technological fields of study? Please describe the basic, advanced teaching and research and development facilities that helps to form the talented human capital?

DT09:

Yes so of course this infrastructure in concentrated in the developed cities of Lithuania and there are various development level as well so most higher start of knowledge, of research infrastructure, knowledge concentrated in buildings. The point in Vilnius would be is of course Saulėtekis Valley, Sauletekis they have several infrastructures dedicated to promoting the technological and non-technological fields of study. One is the communication center this fancy building and the next there are two other buildings which one of which is dedicated to medicinal and bio-technological building and another is dedicated to physics and material science. So, both buildings serve sometimes but only occasionally but it is possibly as promotion of those particular fields of science that they are active at. They would both I would say technological, yes technological oriented and this communication center I would say its horizontal it not only technological it's various kind of events promotion of knowledge of higher education of various kind of things goes there. So there's another project being developed it's gonna be called the 'Museum of Science' it's going to be developed in Kaunas the other city but its gonna not be about science, well its gonna be science, not in a technological way. It's gonna be made for pupils of the primary education. There will be displayed, there will be displayed the achievements of scientific knowledge, just so to you know induce some kind of curiosity in the minds. There are other kind of structuring in Kaunas related to universities operating there I don't really right now remember anything in particular, maybe some open laboratories that you can visit. there *is also some museums that could also be related to some non-technological technological fields of studies in Klaipėda which is a marine city so we have some marine museums for example, or marine studies, some kind of open center. You can see something connected with the sea there. There is also in Panyvezys, which is fourth largest city in Lithuania we have this specialization for materials science and robotics I believe there is some kind of infrastructure there for promoting robotics which would be technological quite narrow field of study. They have this strategy to become kind of a robotic hub for some time already, it's not being happening so fast but they do have faculties, laboratories, clusters, and some things are going on there. That would be the main infrastructure I would say. So, yes all those all buildings that I describe, probably excluding this science museum would directly contribute to human capital development, because they are in connection with higher education institutions which are research institutions as well. They really attract, they really show, they really promote what is happening in those centers and they really show some high-end research infrastructure you know people can come in or future students, not just any kind of visitors. The future students can come and see how some particular huge microscope is working maybe on base on that you know he or she can develop curiosity and then become a future student so they directly contribute I would say. And not only added to that of course we have other universities that would organize various knowledge dissemination events of their research MRU as well, where they would invite somebody to give public lectures free lectures. In this case they would contribute to public knowledge.*

QUESTION 4

How can Lithuanian universities and higher education institutions be more effective in the engaging talented human capital (local and foreign talent) and simultaneously created a human-centric innovation ecosystem for aspiring entrepreneurs? Please describe what are the right kind of incentives in the Lithuanian system that allows human capital to pursue innovation

DT09:

Yes so this a good question and this question is at the very core of every university not so much as you have describe higher education institutions. We could consider higher education institutions, this term should have universities and colleges inside, so we usually called every type of institutions higher education institution and then we specify whether it's a college or university. So, these colleges they do participate in higher education processes, because the diploma is higher education, not the university but higher education but they have less infrastructure, they have less talent, teaching, teaching talent, less attractive study programmes and they do not perform research. If we say that the core of high quality studies is the research because from the research comes knowledge then further studies can be given to the students then colleges do not perform research, they do not create new knowledge basically, they only apply this knowledge to teaching so they are limited in the higher education systems. Universities, they really want to attract the best available students from national international and of course they want to let out of the studies talented entrepreneurs. So, they are lagging in all three steps. Part of very *good students from schools they would go to foreign universities which is fine, because maybe they can't find a particular field of study here. Because let's say neuroscience, there is no school in Lithuania, so they have to go abroad. The other aspect is attraction of talent they do attract some talent but to some extent because the country has to be very foreigner-friendly, it has to be offering good conditions, good weather conditions we could improve. We could really improve in both ways. We have some foreign talent the number is constantly increasing but compared to European Union average it's still way below. And the third thing you know is not just attracting but forging an entrepreneur after studies, universities were dormant, for ten years back nobody thought that a student should be an entrepreneurial spirit, an entrepreneurial spirit should be within the university, no an entrepreneur spirit should be a university and now they made this major change they did understand that university should prepare not only the set of knowledge skills, skills-apps, entrepreneurship, courage and many more skills that you have here and now they have very brave steps forward not just to teach something but just teach a student to be entrepreneur. Its increasing but it's even every institution has its own profile for example MRU they have a high profile of that but maybe they lack in other skills or in other things, for example Vilnius University they are very strong with the research, but the entrepreneurial spirit there is not as very good as MRU. So, it is not evenly distributed amongst the institutions but its present in every institution I would say. Universities in Lithuania are a combination of research-based and entrepreneurial-based. Combination yes I would still see this division because every university should probably go to a point where they are research, entrepreneurial university well-recognized in that but some of our universities are really kind of research focused and is not that focused on the outcomes of that so much.*

I would say that Lithuania is applying a majority of its instruments that there is on the menu. We try to attract to you know offer incentives for the researchers for the talents we have a promotion agency Work In Lithuania dedicated just to that attract the talents to high paid work places. Because now we are in the situation, actually it's a very good situation to be if you think short term, now Lithuania has more high paid vacancies to attract highly qualified humans resources so they just come and fill in everything would be solved, but you know there is also other issues involved it's hard to attract that talent that is already very hard in Lithuania and I believe that there are several things are you know in the reaches of this situation one is the overall image of the country. Image how do you perceived it for example... Yes because countries are kind of trying to create certain image, kind of a brand that would be attractive for example, Estonia, they are doing it quite right, Finland which is already doing it for forty years building this brand of really talented high paid jobs that. Other countries are trying they would promote good weather conditions or something. So, Lithuania has to think about still we do not know, we do not really agree, so what how can we describe the brand of Lithuania that it currently has. I don't know because there has been so many incentives and none is the final incentive. So we should have a brand probably and we are developing that, not STRATA, but the government they are developing that. The other thing is the living conditions so it's been improving in Lithuania we have performing very well the arrow in various indicators, still we are below European average in some points, I believe in five or ten years we will be several indicators above *average and then when you think then so I can go somewhere abroad to fill the vacancy abroad then we will look better but of course some of you know some incentives are needed to do that. And a its connected that high paid vacancies that are here, currently we have them, the more we have them, the more we can attract because it's not only in Lithuania we do the attraction, it's the brand of foreign companies that are here would also do this attraction. And all this system is working we have some free vacancies all foreigners come, all Vilnius come fill-in. I think it's a very good system that it's a self-turning wheel for pursuing the innovation because this workforce start migrating starts circulating the knowledge and its very preferable situation to be for the businesses because you can get somebody new, new set of skills and its very good for the worker because they can start having careers, acquiring new positions new knowledges. That's how the system should work and in Lithuania you know there are many incentives, attracting them and promoting high paid vacancies in Lithuania, offered stipends for the researchers, offer trans-location grants for the researchers, they are variousing but I think in Lithuania they are employing them.*

QUESTION 5

Recently Lithuania has moved up its place in its regional innovation activities. How has the higher education policy contributed to this advancement? Please comment on actual instances.

DT09:

I did not really make the calculations, but I know that one of the indicators that Lithuania is really moved up its place because of it's the number of higher education graduates. We still produce quite a lot of the percent of the population, quite a lot of a huge percent of the population is still graduating from universities and colleges. This number has been decreasing a little bit diminishing but still this percentage is very high in the European Union. So that's why you have a good indicator position because of that but on the other hand the indicators connected with the education policy that sags us down. It's the entrepreneurship, it's the talent, it's the education or research you know field collaboration with private sector with businesses. So, it's kinda we produce quite a lot of graduates, but they do not perform that well as they should so in this case education policy really contributes as a positive contribution on the other hand it contributes as a negative contribution. So, it's both. Negative that the output, output is high which is good of the education policy, but the quality is not that high as it should be. So, the graduates they are not really that entrepreneurial. Not every graduate takes the position that is required with higher education, they take the positions where less education is required and that is not a good indicator.

QUESTION 6

Are the present socio-economic conditions, industrial and sectorial environment of Lithuania harmonious for innovation ecosystem to thrive? Please comment on a few examples.

DT09:

Lithuania economy is dominated by of course by services and with some manufacturing as in most other countries. We are not really a manufacturing country or a services *country. But given the proportion of the manufacturing and it's a healthy proportion I think it's a about a twenty-five percent, which is above European average and a from that proportion the bigger part of the industrial ecosystem is considered nothing a lot. Still what they produced is based on not on innovation but on other factors that they can compete, maybe its labour, maybe it's… I don't know. They have good contracts because they know somebody, or they can really have other kind of leverages. So, I would say that only a small part of Lithuanian industrial systems is harmonious with our innovation, kind of small part. A part of manufacturing and a part of services industries as well. The recent success story is the financial technologies of course you have heard of that. It's been incentivized by some legal regulation not us simulating it with the grants of the money, something, just legal regulation it manages to bring some very innovative players in our ecosystem, which are in collaboration with our banks… I think it's intentional, but it worked out very well with very little resources because not financial resources were needed just legal resources, just the framework conditions not the financial incentives. So that a really good example that you could really build something and on the other hand we have been spending a lot of money you know incentivizing our industry to get more innovative and we are making slow progress with that. Still, still quite slow progress. But for most of the businesses I think that they have no other options just to become innovative in order to survive. Because I think the chance to compete on the cheaper human resources it's over. Lithuania it cannot be considered a cheap country anymore. Because the rates of the prices is not small. So yes, so those days are over. They will perish or they will survive through innovation.*

QUESTION 7

Several factors such as technology, capital and human capital contribute to innovation. What features of the human factor is responsible for innovation and economic growth in Lithuania?

DT09:

So, probably all the features that you are already that you did list in number 2:
Motivation/drive
Leadership skills
Creativity skills
Risk taking/ showing initiative
Flexible and an adaptable attitude (Psychological)
Industry-related skills through practical experience
Global mindset
Entrepreneurship skills
Decision-making skills
Strategic thinking
Communication skills
Collaborative skills
Analytical skills
Quantitative skills
Critical thinking/ Problem solving skills

They would be good contribution to innovation and economic growth, I think. There are also other features probably which we not call, in this case we would not call them skills but for example there is a researcher a Dutch researcher I believe or a Danish/Dutch I think Hofstede and he talked about as I have mentioned that you can classify the countries, communities probably, exactly and cultures, so in a cultural way skills are there probably some of the skills, some are more to the optic sense some are less, but especially those cultural dimensions of Hofstede, they are not, and they are not there and they could be a very serious positive factor for example what is the power dimension? That in northern countries anyone can challenge their superior if the superior proposes something stupid 'what are you doing' here still you have to have kinda this dimension. Another dimension that Estonians are doing quite fine with it's 'short-time' or 'long-time'. You can sacrifice something shorter in order to benefit two or three fault in the long-term, here 'still no' 'still no'. Lithuanians will think 'no'… 'I will eat a cake today but not have many cakes tomorrow'. kind of shortsighted… I am not trying apply to whole to the entire society, I would think the stronger expression of the positive, of you know positive end of this dimension would benefit for our innovation system and the economy as well. Yes, yes and another one and probably the most important is trust. It's not a dimension I believe by Hofstede but we lack trust. If we would have more trust with each and other, I would say the 'human factor' then the firms, companies would have more trust, Ministries. Trust with each other and then when you build trust from each and other then you build trust in organizations, then you build trust in sectors and then you go up. So, its lack of trust at every kind of the level. And yes we lack, within our ecosystem we lack this feature of trust, the distribution of ecosystem is done properly because of the lack of trust.

QUESTION 8

There have been recent reforms and structural changes in the higher education system of Lithuania. To what extent will these new reforms significantly impact the development of human-centric innovation ecosystems **now** and **in the future**? Have these reforms been impacted by the steady migration/emigration patterns in Lithuania?

DT09:

So, our higher education system has been in constant reform for many years. It's (the reform) already drastic because something loses itself is being under constant reforms. You know the higher education system received too much expectations, too much pressure, too much everything except for results that's probably. And it became fragmented, it became focused on some, I don't know, not on the core elements that it should have. So, the reason for the reform is that try to make a better conditions for the researchers, for the students, increasing their stipends and etc. And it tried to, it tried to make it less fragmented, we have a quite high number of institutions so its not enough if it's a good university, so it's very good to have fifty or a hundred universities in Lithuania if they are of a certain quality. If they are just pretending to be universities, then its bad because they take a part of resources and the output is nothing not the one we want to have. So, the reform tried to merge some institutions to make it bigger institutions to avoid duplication, to avoid those teachers that would go and teach in three universities, different universities, so maybe its better to teach them at one university, full-time not just part time, within three, because it's a common thing in Lithuania so it did not really achieve that, it did not really achieve that that merger so system remains quite fragmented. There are a lot of schools that would teach social sciences. There are schools that would teach technology, which is good, but then again how many of those schools we can afford, there are some issues. But on the other hand, it manage to bring additional resources for the researchers and additional resources for the students now every student will impact, will result in a little more funding for the institution, which is good because they are lacking of the resources, every researcher will earn more, a little bit more, every PhD student will receive, I think two or three times more you know for the PhD studies to attractive and competitive again. So, I think the reform did some very good things but those things are non-structural things it's just something on small and on outside but they did some positive things. The structural things probably impossible it's to make in Lithuania because higher education institutions are quite powerful political players, and it would block any kind of threats exposed to them. But on the other hand, you can see it's not revolution its evolution so maybe they will find a way to evolve because well maybe they can attract, they will find a way to attract more students from the outside, maybe they can attract more resources from the outside. Retaining students, well it depends really on the quality of the contents and the image of the institution you are offering. So, I think it is alright if a person goes to study abroad and then comes back to Lithuania its very good then, cause then you don't pay as the country for the education and maybe he can even get better somewhere abroad else and come here for a master or a PhD. On the other hand, if they will receive education abroad maybe they will stay there because they will be a match of the labour market in this case. For monetary attraction, it depends on the field of the study for example medicine is very attractive in Lithuania, extremely attractive, they cannot fit everybody who wants to study here. Some other field of studies they could be more attractive, I guess. Every field of studies have certain part of foreign students and places, I don't know more global exposure is good, but some a maybe some social and humanities they would be more, really more attractive for foreign students. That would be much better for the whole system.

QUESTION 9

How involved are businesses and the industrial sector in Lithuania in enhancing the higher education system? Which sectors are more active/ inactive with the system?

DT09:

So one is ICT and this is in contribution to salaries, to equipment to other kind of stuff within the higher education institutions, because it really much employ the output of the system. The other part but it is higher education institution, other thing is vocational training and within the vocational training the manufacturing sector they need those skills you know for a producing some kind of machineries and etc., and that's the vocational training so they are quite some machinery for them to learn how to perform that machinery in order for them when they finish their studies, they could be a match good fit for the work places. The other kind of businesses they are not that really kind of active but I would say every business sector that is considered to be innovative they are active, for example bio-technologies they are much smaller, photonics they are much smaller, but they are very innovative so those companies or small companies they really work with academia all the time. They are good at working at the system, they are small ICT, or to manufacturing which is fractional. When they work with academia it's for everything. Its knowledge transfer, its sharing of human resources, its initiating projects, commercialization, yes everything is there. For ICT its lacking they are not really pick up. The collaboration is only about to getting the new workforce and about nothing else. Almost nothing else. But for the manufacturing sector it is the same. It's not about research, it's not about the projects, it's not about something new.

QUESTION 10

How can higher education inspire potential talented human capital to drive innovation and growth in Lithuania? Can this be achieved through a formal academic education offered by universities or vocational educational training offered by higher education institutions? What are the necessary components for such ecosystems?

DT09:

So basically universities or higher education institutions they need to be attractive, they need to be attractive and they have to really be the guardians of this promise that if you spend three or four years in our system then you are accelerated in the labour market then you have this advantage compared to others. Now this advantage of in the labour market if it's not in specific skills as you know working with excels, I don't know, constructing a laser..., basically those skills they can be acquired not from the higher education institutions. Yes you will know something about management you will know something about history, basically all the higher education institutions, basically how to code, you don't need to go any university you can do this by yourself, so they eventually they will lose this competition with open courses with self-teaching, with mentoring exams etc. but on the other hand they haven't everything there, so if they keep the promise if they keep the curriculum good (relevant curriculum) then they can you know expect. Yes because, sometimes there is a diam, 'being at university you receive a huge amount of knowledge that is not really needed for you in your future workplace'. On the other hand, university says 'this is university, this is universal education and you need this knowledge that even if you not using it is a part of your universal understanding of how things work or how the world works.' In this case I am happy, but if they tell me about the world that is already thirty years old in the curriculum then I am not really happy but then if its brand new and they explain me the world as always brand new something and then those knowledge stays with me not really exposed to any particular in my routine in my job routine because its fine because they made a better understanding before the understanding.

QUESTION 11

Human-centric innovation ecosystems are fundamentally built on the knowledge and commercial economy. Please explain the percentage of universities and higher educational institutions in Lithuania that are contributing to the development of each of these economies:

DT09:

The knowledge economy: Universities: 80%; Higher Educational Institutions: 10%
The commercial economy Universities: 20%; Higher Educational Institutions: 90%

QUESTION 12

Please describe whether higher education and a large stock of highly educated human capital (educational attainment) is correlated to the development of human-centric innovation ecosystems? Would having higher education training or qualification contribute more economic activities and wealth in Lithuania?

DT09:

It is well. Those skills that you again have for the question number two, when you started it somehow, it's related to the development of human-centric innovation ecosystems. So those skills some of them are really exposed at higher education institutions some of the skills are not exposed but we understand that they should be. I don't think that it is born I think it is the environment you acquire some kind of skills not from the higher education institutions in this case yes. I would say that usually people would acquire majority of the skills needed for human-centric innovation ecosystems not from higher education institutions usually in some stance. Is it good? No. I think that they should acquire the majority of skills needed for human-centric innovation ecosystems from the higher education institutions and that would make them much more relevant for the innovation and the economy for the both. Right now, I would say the bigger part comes from the higher education institutions, it comes from your family friends from your working environment. The Lithuanian economy is growing, steadily growing so somehow, we create more output more something, every year is more and more is created, so in the global competition. We are not isolated system. So it means that people living in Lithuania and living abroad paying taxes here they create more so maybe they have more every year in the total combination pool of skills is more of something compared to the previous year so it could create more wealth and its good I think it's alright. And it also says that even if our higher education institutions are honour their calling, still the total amount of skills required for economic output is increasing I believe so then it's good. I can only imagine and speculate on what will be only if our higher education institutions would be much more relevant so probably, we would see growth, even faster, more better and even more sustainable without this component we are growing but with this component we would grow much more. The components that contribute to these growths are the networks and international exposure we acquire skills from being parts of projects that consists of various kinds of countries. We try to manufacture something and export it for many more countries than previously and then you have to learn. Learn by the skills etc., etc. in services and manufacturing government sector as well we are competing with other governments regarding policies trying to come with something new. So, all this contributes for the whole society yes, learning by applying the skills and the output is economic growth. Not really only through higher education.

QUESTION 1

Please explain how the curriculum of academic education and vocational educational training provided by higher education fundamentally contributes to talent development in Lithuania.

DT10:

Talking about PhD studies I think that a, the main factor which serve for talent development is that we have not so much students and there is all studies, the process of studies is a based on individual work. With supervisor, with teachers with whom you have lectures and afterwards we have to pass exams and so on. So individual work is I think the key factor for talent development. But of course, maybe talking about, about didactic you know of, of the programme. Didactic is the methods we used for, for helping students to develop their you know PhD. So I would say methods continue to be very old and they have to be re-thinked very much and this, am you know if to think that PhD students have to be ready to work with innovations um, I would say curriculum, curriculum is not oriented to that. Curriculum is oriented for research development and research development yes is part of innovation but research when it is not the same to know how to make good research how to organize, how to conduct good research according to you know all requirements of the methodology and how to make the same research in, in a in a project for example in which the main aim or the main goal is to develop innovations. So, it is not an equal, equal things. And to apply research knowledge, research not knowledge, research qualifications I would say for innovations, I would say for today so far not everyone student would be ready to do this and it is not, I am not talking about one particular university, I would thinking all Lithuanian universities are more less the same. So I would say curriculum as it has many individual work it is ok it is good for talent development for being ready to how to say to think to, to, to developed thinking or mindset which is very important for innovations, but the curriculum itself is not oriented to innovations and should be much more oriented. I am working with bachelor and master degree students also and I would say yes those students has much less individual work with the teachers because they are mainly are studying in lectures and only when they develop their course paper or when they develop their diploma paper they have more individual contact with teachers but so far I would think universities of course I don't I couldn't say about all universities because when we talk about bachelor and master, we have much more people involved in that and I would say about our university, yes we try to talk about innovations but I think it is very important to have special courses about innovations and to help for young people to, to develop innovation mindset because it is not the same, innovations is not often to have a lot of knowledge often you need more courage than knowledge and innovations is that you need more outbox thinking and studies is that you need more inbox thinking because studies is learning to follow some kind of knowledge and methods and so on and so on and innovation is that you go outside of what you know and studies is learning, learning to know something and innovations is I would say learning, learning what you don't know so these are completely different approaches I would say and the not everyone student even the best with the best grades I would say after finishing university they not necessary are ready to work in with innovations. I think so.

QUESTION 2

Please choose the skills that the higher education policy of Lithuania deems **most common** or **least common** for human-centric innovation ecosystems:

DT10:

Motivation/drive: **most common**
Leadership skills: **least common**
Creativity skills: **most common**
Risk taking/ showing initiative: **least common**
Flexible and an adaptable attitude (Psychological): **most common**
Industry-related skills through practical experience: **most common**
Global mindset: **most common**
Entrepreneurship skills: **most common**
Decision-making skills: **least common**
Strategic thinking: **least common**
Communication skills: **most common**
Collaborative skills: **most common**
Analytical skills: **least common**
Quantitative skills: **least common**
Critical thinking/ Problem solving skills: **most common**
Other skills: **independent mindset, positive attitude**

QUESTION 3

Please describe the infrastructure already in place in the higher education system that enhance the knowledge of population in various technological and non- technological fields of study? Please describe the basic, advanced teaching and research and development facilities that helps to form the talented human capital?

DT10:

I would say in Lithuania we have for today in general in Lithuania we have many infrastructures. If we talk about labs like you know physical entity and there are so many different labs in different fields, (connected to higher education, yes) and each university has labs for studies labs for research and some of them are for both studies and research some divided and so on and it was like a dream I would say more than ten years ago because when we travel somewhere abroad we saw those nice labs you know in western European countries and we was dreaming to have in Lithuania and when we already have them of course it is a big problem to have people working in those labs and I would say that maybe in big cities like in Vilnius, Kaunas there is no such big lack of people but in smaller cities like in Klaipėda really young talented people we are lacking of them because it is very attractive for young people to study to work and to live in Vilnius in Kaunas and not in Klaipėda or smaller cities somewhere Šiauliai, Panevėžys and so on but another thing is having in mind that Lithuania is not a big country and to travel two or three hundred kilometers is not a problem for today even you no have your own car you can travel by bus by train you can connect online and so on. What we lack most of all we lack cooperation and teamwork I would say we lack teamwork in each institution we lack teamwork between, among institutions and yea it is, it is the main I would say problem in Lithuania because in general thinking in general we are moving more and more towards account big science and yes if you want to win projects like HORIZON you have to have really strong and big teams and sometimes even for big universities to collect strong team is very difficult working because you need to have not only people together you need to have people working in the same field together so I think teamwork is much more important than infrastructure itself and even I would say it could be less infrastructure but more teamworking and maybe our infrastructure in recent fifteen years I would say Lithuanian government, government encouraged big projects for so called development of valleys and we have five valleys in Lithuania it was it was European structural, structural funds project and a those valley they have I would say a lot of infrastructure and the infrastructure itself when it was, when it was bought before that it was not too much thoughted it has to be connected as you know, as, as networks and each university buy what concrete university thought that he will need for their scientific research development. But I would say that we need to buy maybe to buy one valley project for the whole Lithuania and somebody would have being responsible to coordinate why in concrete institution we are having such type not another type of infrastructure and to what kind of people it would be connected you know and so on. So infrastructure is not, not ready to be used in you know in network and, and when infrastructure is not ready to physically is not ready for working in network people in their mind think very much are driven by environment you know and when environment is not driven towards networking mindset people don't thinking in that way. The environment is not based on lack of trust, I wouldn't say, I wouldn't say, it is based maybe more on, on you know human weakness because it is easier to work alone you need less time you need less contacts list, talking less communication, ok maybe two or three of us we think that it is team, it is not team you need twenty people and I think more to have a strong team and, and of course you need it is time consuming it is energy consuming and it is often easier to, and to avoid it is very human.

QUESTION 4

How can Lithuanian universities and higher education institutions be more effective in the engaging talented human capital (local and foreign talent) and simultaneously created a human-centric innovation ecosystem for aspiring entrepreneurs? Please describe what are the right kind of incentives in the Lithuanian system that allows human capital to pursue innovation.

DT10:

Very difficult question, very difficult question. You know have you read a book by I do not remember the author of the book. It is 'Geography of Talents', a very interesting book and yea Geography of Talents and a the author of the book at the time we have translation from Lithuanian language all the time is trying to find out an answer, ' why in certain time in certain places appeared you know to be, to be talented people, to work with talented people to live talented people'. And I think the main feeling that in each country is very different history, in a, in a each field is very different history what fits for musicians will not necessarily fit for engineers and then so on. So it is really very difficult to to say some kind of general you know like one size fits all explanation, but I think that um thinking from the perspectives of this book I think that a that a being attractive for country or for university for talented people we have to be somehow different than others in order they would recognize they would recognize you among other you know people among other places, among other universities and so on and so on. And I think that Lithuania in general maybe we are trying, living almost thirty years of independence, we are trying too much to be similar to something else and maybe we are not brave enough to be,to be different maybe we not need to be different in all things to be different or to do the same things in different way, you have to be quite brave for today and you always have to take kind of risk doing like this or acting this so I think that Lithuania maybe for today is not recognized by young talented people having some kind of you know hidden seed for some kind of very attractive difference because of which they would choose Lithuania, more people would choose Lithuania and because for talent yes you need a, it is not enough that one or two person would choose your country, you have to attract somehow critical mass of people and yes we have some I would say nice case studies case stories so far we cannot say they we have critical mass for that, so I couldn't say nothing much concrete because they are many, you know many how to say trials you know to do something to be attractive for young talented people some nice initiatives and so on but it is not enough it seems. For example I remember it was maybe I don't know five or more years ago when we had one of Ministers who a was very fascinated with Israel as a country for innovations you know I do know this book about Israel as the country of innovations I would recommend to read it and really their systems of a in a country of innovations is completely different from any one of the other European country yea and they are completely different to my point of view not because you know of how to say um Jewish mentality not only because of that. They are different because they have really different ex-factor I would say compare to any other country in the world and our one of Ministers he said when he was minister it was Kreivys I think, he said 'yes we have to follow Israel because Israel is very successful in innovations…' and he initiated some, some documents on government level you know to follow the system of Israel but so far we don't have success so and often we hear ok let's another Minister or Prime Minister, says 'ok, we see great success somewhere in Singapore... let's try to do something similar to them and we see success in Switzerland let's try to do something similar to them…'. But it is not a case to succeed. You can by bringing to country the good and best experience from other countries in the world you can, you can um succeed to be better tomorrow than you are today, but you cannot succeed to be the best. To be the best you need to invent something different. So, I think we have to wait for that in Lithuania.

QUESTION 5

Recently Lithuania has moved up its place in its regional innovation activities. How has the higher education policy contributed to this advancement? Please comment on actual instances.

DT10:

I would say for, in Lithuania we have in general we have ambivalent situation, because, um, yes it is um strong narrative from government and from Seimas that it should be, it should be given big attention and serious attention to regions, but so far I would say as for today as living in a region, we don't have region policy. We have document which says um try to define what it is region and what kind of um not achievements but what kind of institutions, what kind of activities should be developed in order to have the status of the region here in Lithuania. But it is not the policy I would say because for university for development how to say for certain region policy for university first of all, the State should have, real region policy and especially we living in the region, we feel lack of region policy very much. Because almost everyday somebody could have a different opinion, what is region or what is not region and if we need university in region or if we don't need university in region. If university in region should be with very high scientific achievements or if university in region should serve um pay more attention to serve needs of the region, I mean I mean needs of business, needs of social sector and so on and so on. So um especially when you go to the level of a of a funding initiatives related to regional policy it is very difficult to get um to get money to get funding for that because you know we don't have region policy we don't have image of university in the region not maybe not necessarily we need so called region university but university in the region. What does it mean for Lithuania, and of course as university in the region we try to, to suggest our you know opinion, our, our our to create some kind of model how university in the region should work and it should be evaluated, but it is, it is very difficult to find common language between university and government or Ministry of Education, Science and Sports, in Vilnius, because Ministry and government they want to have you know, everywhere kind of Vilnius University but it is impossible, it is impossible and to have university who is thirty thousand students here in Klaipėda is mission impossible because we don't have so much people living here at all. So, I would say first of all should be very strong policy for region development and afterwards we can develop model of university in the region. And now what we are doing we are a you know in constant pilot study, I would say we trying to discover what does it mean to be university in region. Yea It is it is. And university could contribute to region development very a lot I have even read some kind of um studies which tell that um scientific studies as research those results of those studies tells that when you create knowledge in a in the same you know how to say region in the same place where they could be applied a it is you can get bigger effort knowledge for economy. And that is very really important and interesting that is really I would say fundamental reason why we should have university in region because yes if you have strong business company this strong company could have relationship with any university in the world because online you know communication live communication by organizing visits and so on and so and it is it is not mission impossible for any business company but to have such a strong business companies in region is not easy also and I would say a majority of a business companies and especially social, social partners they need university in region because for them it is maybe too expensive or too difficult to be connected directly to universities abroad they like to be connected university to foreigner university they like very much when they have this mediation of university in this you know connection but university helps to a to, to develop connection and, and um, Lithuania talking in general, Lithuania as you know is among if we we talk in terms of innovation scoreboard yes, Lithuania is among Moderate Innovators. Moderate Innovators and in recent five or seven, maybe seven years we, we get so called higher status from, from bad innovators or low innovators to moderate innovators. But I have read some studies that impact of innovations for economies is still remains quite low and the question is why? And I think that there are of course many reasons, but I think that maybe one of the main reasons would be human relationships and human capital. Yes, lack, lack of human capital and a, and a, lack of not only people itself lack of population but lack of communication I would say. And I would say that a for example, when you look to rankings criteria of rankings companies which is giving for us kind of points you know one more company one more rankings, methodologies, started to be, started to count for example publications of universities in cooperation with business company and not with any business company. Some points you get with a you know cooperation when you develop publication with company abroad and different points you get when you develop publication with company in your geographical area and I think it is indicator that it is important criteria for innovation development, in general. There are so many nice research studies about, about um university connection to geographical area in developing in innovations. There are very interesting research data about this phenomena. Yes, but essential point is very strong and very clear region policy, I think is key.

QUESTION 6

Are the present socio-economic conditions, industrial and sectorial environment of Lithuania harmonious for innovation ecosystem to thrive? Please comment on a few examples.

DT10:

I think that the first thing what is important to admit that a all these mentioned how to say elements they live their own life a so and you have to put so many energy, to, to, to convince you know industry or, I don't know… you know it is a lot of imitation of collaboration and you know collaboration often starts and ends with some nice meetings with good coffee and yea chocolates and so on. So it is, it is, you know really maybe we are too young as a country to have very harmonious system in this way and each and each I would say field each institution would put so much efforts you know to create ourselves as modern organizations and so on, today, um in Lithuania in general you know a each institutions you know never the less universities, municipality or it is I don't know business entity or some other you know unit. You know we have so much so much goals tasks and um and it is really very difficult to fulfill everything for your institution and to develop cooperation yes it is important because some goals you cannot achieve without that without cooperation but how to develop cooperation you know in a high quality that is a problem because a there are so many you know spontaneous things and so a lot depends on human relationships you know when you can call and you can say 'hi remember me we have worked, we have met, we had a project and so on and so on and it is easier when you know people and other people know you and it is easier when you have no contact at all before you know you have to to suggest something very, very interesting or important or fruitful for another organization and so on, so I think that in cooperation and seeking so called harmonious you know system a we need to go long way. We need really to go long way but maybe it is mission impossible maybe we don't need to think that all institutions should be in relationships of kind of very harmonious you know a thing because if you want to to to be successful in innovations you maybe don't need so much harmonious you need um something unusual something a little bit coarse a little bit you know spontaneous things and then so on and so on. So I couldn't say that seeking harmonious is maybe the only one or the best way of for creating ecosystem because ecosystem to my point of view and to my understanding is completely different phenomena from structure and for so many for so many years in Lithuania we our efforts to create structures different structures and a and a now we see that those structures lack connections so innovation ecosystems is the concept which could help to connect structures to my point of view and a another, talking in these terms another very interesting thing is that a Lithuania when we look at innovation scoreboard as I talked earlier we are among the Moderate Innovators and we are somewhere you know at the end of the spectrum but when we, when we talk about um um certain, how to say certain measurements for example Lithuania is among a seven or eight to among ten in general talking leading countries in Europe if you talk about innovations environment for innovation, but why we are at the end when we talk about results of innovation. So, and I think that it is phenomena those two, this gap between results and innovation, innovation environment. We have this gap because a in innovation environment there is not enough connection among people among structures among well you know, different elements and um that is the reason why the results of innovation are only Moderate. It is my personal opinion. My personal analytical insight. Maybe I am wrong but um, but um but it could be, it could be true. I think so.

QUESTION 7

Several factors such as technology, capital and human capital contribute to innovation. What features of the human factor is responsible for innovation and economic growth in Lithuania?

DT10:

I think that um most of all important for innovation mindset is independent, independent thinking because a looking at those factors which are a listed in the question number two they all are important but they are more you know I would say when you want to create to create kind of a effective product you have to, you have to have competence you have to have strategical thinking and so on and so on, when we are taking about and you have to fit to certain framework, but when we talk about innovations often you have to go outside of framework and, and I think that um a often like a you know high qualification or very good competencies they are an obstacle for innovations because, a because you know are too much too much deep in a certain you know fixed you know in a certain framework and innovations is about I think daring to think independently, independently of policy independently of of other frameworks even independently of research paradigm, paradigmas which um which um tells that oh no you cannot find bacteria in a stomach, but you know the story about haploid bacteria in a stomach was discovered by, by one of a doctor when nobody when the prevailing paradigm in a science was that it couldn't exist you know and if he would be how to say very very a strategical thinking thinker and very a you know how to say organized to be in a framework of certain scientific community maybe for today we would never know about haploid bacteria and we would never discovered you know um method to, to heal people having problems with stomach because of haploid bacteria. So, he said but 'no but I found this this h-kind of bacteria in a stomach and it is bacteria and I will prove that.' So, innovations is often going not togethers with others innovation you know is going in an opposite way and that is a not so much about harmony or about strategy or about you know or I don't know what else um but creativity, creativity is very important. A leadership I don't know, maybe it is important but a when the person want to to a develop a leadership it is a danger that I think he or she will never be innovative because um if you have a goal of leadership you will never be innovative I think so. Because a being a leader you need to have a followers. It easier to have followers when you are in a certain framework and you set yourself in a certain framework. But when you want to start from zero you know and when you say that you want to a, when you declare something completely new a to to gather followers is very difficult and a, it could not be the aim of leadership when we talk about innovations. The leaderships is are not an aim it is like manifestation, only afterwards, at the end like a reward you know for everything you have done at the end maybe but leadership in nowadays society is often what people wants right now and today, they don't want to be um waste time to be recognized as leaders somewhere in the at the some settled day lives so it is it is. So, you, you know there is no rules when we talk about innovations. I think each innovations is more less different case and it is not a framework it is not a rule it is not a um it is not a something what can be easily created or recognized.

QUESTION 8

There have been recent reforms and structural changes in the higher education system of Lithuania. To what extent will these new reforms significantly impact the development of human-centric innovation ecosystems **now** and **in the future**? Have these reforms been impacted by the steady migration/emigration patterns in Lithuania?

DT10:

You know those reforms, if you talk about now, those reforms have impact only missing hours but not impact on innovation in the future maybe, how who can know but for today a today a I couldn't say that I see very, very significant changes because yes reforms they inspired I would say thinking about changes and um in each university we have some changes related with unifying the small departments into bigger ones and then faculties merging faculties and then doing things like that but um I think it was um too short time, too short time and people accepted those reforms as very mechanical you know thing ok they say if you want we can live under one roof but so far they continue to live to their, their previous life and so on. So I think that a mm, I think that um those reforms to some extent it was good thing that it was encouraged universities to think what kind of universities they want to be what a kind of a mmm, changes they would like to do ah of course there were some sometimes too much pressure to do certain things and not certain things but this pressure it is good that it was not a how to say it was not crossed the line of university autonomy what is really very important and call I would say element, when we talk about the university as phenomena, university autonomy but you know when you think about reforms which says that you have to earn as much as possible money from business and um and um you know to transfer, transferring knowledge to society in general and to business in particular um to some extent you always lose very important very important element of university how to say phenomena you lose so called independently yes you need to fit somehow to expectations and to needs of you know those people who own money to those companies who own and pay for research. It doesn't mean that we do something unethical or scientifically nonsense I don't have in mind things like that but I have in mind more things like you know when you are thinking about things like a scientist it is one trend what you would like to do as a scientist as a real scientist but when you think if those your thoughts and those you know um possible products is um iis um s need if for this your thoughts is need from business side you understand especially from social sciences and humanities no business don't care about that and what does it mean if we don't to use science anymore, real science. So I think the main and of course many people if you don't get funding directly from budget you somehow change your thinking track more and more adjusting to what business need a because you have how to say a possibility that you will earn money and I like this very much this joke that if a, if a science development model was based on business needs when Galileo was living maybe never ever we would have theories he did have, so I think I think it is you know the reform um somehow put too much emphasis on science business cooperation and not enough of us thinked how how much really government will by financing schemes you know assure that universities will develop so called will have possibilities to develop so called real science and that is really very important. And as a woman I would say that I am very fascinated in in a Virginia Wolfe ah she is known as one of the first woman writers with great emphasis on woman world and a sometimes it is called the first feminists you know a woman writer but a erm in one book it is called I don't know I have read in Lithuanian (language), so in my mind I have Lithuanian title of the book but in English (language) it should be a "Own Room", and in this book she is writing, she wrote in the beginning of the twentieth century and she is writing, ' nobody… for nobody it is interesting what are you thinking and nobody ask you to write a book..' so I was thinking, ' oh my God, she was writing at the beginning one hundred years ago…' and then you know then me as a social scientist. I am thinking about ideas I would like to develop I could completely accept what is written in this book you know nobody cares too much because you have to adjust your thinking to others needs so. And it is really nice book especially, to read for a woman who want to go choose to go a way of science and especially if you are not working in a technologies where there is more direct connections maybe with businesses. So, I would say the reform should have two streams you know one stream is so called to ensure possibilities and environment for real science and to define what for Lithuania as a country, what kind of ambitions for real science we would have. And um and a another stream is a um in which cases, in which circumstances and in which fields maybe we are much more oriented to business needs. And it would be much more clear those things I would think such reform could be much more successful. And of course um government and Ministry they say 'it's up to universities to decided what they want to do and to define their strengths and weakness, challenges and possibilities and so on and so on.' To some extent it is true but I think it is not enough guidelines because you know universities in Lithuania. Yes, we do have cooperation but we do continue to having competition and the environment is that you have to compete because of students because of resources from the funding agencies and a and um a you know I think that um that because of very limited resources. It is not enough for university itself to decide. We have to have much more a clear general guidances from Ministry of Education or government I don't know from what because the strong universities yes maybe they have to define and when they define what else is left for other universities so I would say um governmental and a Ministry policy is very important in this in this case and um it should it should not it's really an art. Policy is an art you cannot restrict universities' autonomy but you cannot leave everything for freestyle you know.

QUESTION 9

How involved are businesses and the industrial sector in Lithuania in enhancing the higher education system? Which sectors are more active/ inactive with the system?

DT10:

Yes, I would say business and industrial sector they are involved in so called say all mannered they give some money for students' scholarships they give some, some small money for, for small scale you know research but if a you want to think about bigger research project you have to succeed to find at least eighty percent of a funding you know from a from certain agencies and so on. Yes in Lithuania we have so called MITA and other agencies which encourage projects in particular for business and science cooperation for business and university cooperation and that is good but often those project you know are too much procedures when you have to implement the project are too much bureaucratic and um you know when you try once you don't want so much to try second time because too much too much control too much bureaucracy and even in a projects so called innovation projects so much bureaucracy so much restrictions so much you need to waste your time for explanations why you do this or that and so on. There is no spirit of of a investigation no spirit of experimentation and a I think a those procedures especially for business partners for them too long too difficult too complex and so on and so on. So I would say intention yes it is but we need much a completely different system because yes business if um if you talk about bigger projects with several million litas with several hundred thousand litas business would like that those would be project at least fifty or sixty or eighty percent funded by agency you know and they can make their partial input so called and they are happy to do this but the procedures are killing you know killing the whole idea the whole connections and so on and sometimes we are joking… yea they are killing. And yes of course um sector working with high technologies they are um you know having much more need to cooperate with universities in completely different way and they, they need much more cooperation in scientific in real scientific research, but other especially small business with the small and medium business um those who are not involve in high technologies they often need very small fragmented research which would be often conducted by students during their practice and so on and so on. And it is always you know always a question, how to how to say how to define this cooperation when students go to practice and they do this teacher supervision kind of investigation with the science business cooperation or not and so on and so on. So, I would say it should be it should be change the system very very very a lot. Yes business, even here in region business understand has understanding that cooperation with universities is very important and they do their best to but I would say according to the old model and it is very difficult to start to work on on um on different you know model. And often you know those fundings, those fundings schemes are sometimes very strange percent they give twenty thousand euros for the science business cooperation project and it is for any kind of project it is not enough and you know for the scientist they say 'ok we don't want to a if we only do what is paid for those money it will be very you know simple results and we want to do more because we want to you know have good image and recognition in business sector and often they do twice more than it is paid you know and ofcourse it is good if you think about reputation of university and so on but when you think about young people motivation to continue to work at university it is not supported. And of course here in university see you know we as administrators is seeing such situations often we are looking for um eternal resources to encourage those people ok you want to do much more we try to compensate with them somehow this you know efforts and time and and so on but it is not easy you know to find internal resources in addition and and so on and so on. So when we talk about another example could be it was in Lithuania and continue to be I think three years ago started we started to have initiative for so called industrial PhD studies. Industrial it means that it is the same PhD studies but you do a you develop your idea together with concrete business company and business company they get some additional money to support the student in their you know setting for the research. And we did big meeting invited business representatives you know from different business and we are scientists from university and we made you know big meeting and workshop to analyze those requirements and to understand who and when and how could apply to this you know funding to get funding under the roof of industrial PhD studies. So and the conclusion was yes we have students who would like to study. We have professors who could be supervisors but requirements for business companies to fit are unrealistic. They have to have certain infrastructure, they have to have certain experience in you know R&D development and for small and medium companies to have R&D infrastructure and development projects, yes they are doing something by their own you know internal initiatives but it is not you know real those projects. and so and of course you have in a such industrial PhD studies you have to have a supervisor from university and not supervisor but consultant from the company and when we started who it could be and so on it is almost mission impossible to find such people you know how to say to fit those requirements. And you know the silly thing is at the end requirements for you know filling application businesspeople say it is too difficult maybe you can fill this thing fast and we started to think this thing oh the theater. And They are not going to do it you know because we nor them wanted this. And we think ok our PhD students even for today for those studying in technologies, especially in technologies they are already doing their research already in business company without this crazy programme you know and because they couldn't conduct research you know from background initially they could conduct research somewhere in vacuum you know somehow they need concrete company one or two or three. And They do this without any you know fitting to those requirements. So yes, nice initiatives but I don't know when the people are setting requirements they should have a feeling of real situations. They should have you know just very simple feeling if businesspeople really will sit down to the table to fill something you know they ask to fill they have to be realistic. And you know for university it is very difficult to convince business that they have that they will have real very very how to say big added value, because you know cannot in PhD in PhD work to develop product that would already be commercialized. And for business you know to look at least ten years ahead and to wait for something it is too much you know it is too much.

QUESTION 10

How can higher education inspire potential talented human capital to drive innovation and growth in Lithuania? Can this be achieved through a formal academic education offered by universities or vocational educational training offered by higher education institutions? What are the necessary components for such ecosystems?

DT10:

I think university if very important because um universities when they when they fulfill their fundamental role that they give for students fundamental education fundamental thinking a the people can be very you know have very good background and can be standing on this background this they can be very creative and they can be very sensitive to context and so on and so on but the problem is that you know society and especially business they say 'ugh we do not care about this your mission for fundamental education we want you fulfil our needs'. And their needs in not necessarily what is fundamental education and you know sometimes we have ridiculous situation when they say 'ok we want university to prepare engineers in in a very narrow field for example for working with a wood cutting'. Is it role of university? I don't know. I doubt very a lot. So it is under balance really and business completely is confused what is difference between college and university and I think college should be institution which really is oriented towards business needs. But university I think should be oriented to what not business needs but to what I would say to business future. And a um universities should offer something what is the future of the business. Ah help them to think about their you know future development future trends and so on and so on. It is really more analytical really than researched based thing and um as now I think this could be done by colleges when we will have model of higher education as the as um the many other European countries when colleges are not faculties but under roof of universities. And when we have completely autonomous institutions colleges and universities it is really difficult to you know to I think it would be difficult to develop innovation ecosystem because when we have you know fragmentation in higher education system and colleges they have their own you know aims and universities have their own yes do we cooperate on some initiatives on some projects but we do not have common strategies we do not have you know common, common, how to say common narrative and that's not important and I think in Lithuania especially when we have very huge decreased in population in recent ten years and still continue to have emigration and want to attract more young talented people from foreigner countries to come to study and later to work and so on we have to have very clear system of higher education and I can imagine that for young people from somewhere in Africa or in India to you know to explore studies system here in Lithuania and to understand that it is higher education at university higher education in non-university what is the difference between that I think it is too complicated. And often it is too complicated even for ourselves. It is getting more and more complicated even when compete for resources especially for financial for financial resources. So I don't know I think that um a higher education systems should be somehow if somebody would come back to the question of higher education system reform the most wise decision would be to unify colleges and universities and first of all because of limited human resources and that would be what would make that I think could make preconditions to talk about so called human capital. Resources start to be capitalized resources are not only resources they start to be capitalize because resources to my understanding is not equal to capital. Resources to be you know transformed into capital. We need something initially you know inputs and transformations for that. So, I think in Lithuania the only one way is to have unified higher education system.

QUESTION 11

Human-centric innovation ecosystems are fundamentally built on the knowledge and commercial economy. Please explain the percentage of universities and higher educational institutions in Lithuania that are contributing to the development of each of these economies:

DT10:

The knowledge economy: Universities:20 %; Higher Educational Institutions: 5%

The commercial economy Universities:30 %; Higher Educational Institutions: 10%

QUESTION 12

Please describe whether higher education and a large stock of highly educated human capital (educational attainment) is correlated to the development of human-centric innovation ecosystems? Would having higher education training or qualification contribute more economic activities and wealth in Lithuania?

DT10:

Um definitely is correlated for sure. I couldn't imagine innovation development of innovation ecosystem without highly educated human ahh capital, but I would say highly educated human capital if we are talking about just highly educated population or highly educated human capital. Because, I would say maybe not everybody would become from population would become how to say I can imagine the capital is something a what a what already brings so called added value and um. As I said for sure they are interlinked and higher education and innovation ecosystem they are interlinked very a lot, very a lot but of course it depends on very a lot on content of education and and outputs of education if we if we have you know we have to have move completely different I would say education model because we are paying too much attention on just giving knowledge and a not enough attention on learning how to how to work with those knowledge transforming into maybe great amount of it into innovative products and other things like that commercial you know and so on and so on. So I think that a as I said if we would have unified higher education system um we would really have clear stream those people who are research oriented and fundamentally oriented learning and those who are practice oriented and it is better to learn them to work together while they are studying and not expect that one when they finish studies they will learn by themselves it is not true. So, I would say um to um now I see that young people um they see situation in society they often want to be knowing almost everything when they know almost everything it appears that they know almost nothing you know quite deep. People are not how to say people want to to um how this word in English you know insurance or assurance. Education they see kind of insurance for the future I would learn a little bit of this of that of that I will see what will be in the future and I think that at university young people should learn that it is safe and good thing to be focused on a on a concrete field not specialty but field and know how to cooperate with other people in you know what are competencies to know about competencies of of people with different education for example in the same field but different education I mean university education and college education and so on and so on. So, I would say in Lithuania yes we are very proud to have one of the highest a how to say, result, not result, how to say achievement in Europe talking about how much young how much people in general compare to general population are those with higher educations. We are very with high results in this field but so far, we are not as good in innovations as for example other countries. So not only number of education, quality of education is very, very important and I think innovations is often nothing new nothing to deal with completely new things. Innovations in many cases is new quality of the same things of rarely known things and a and to understand people these very you know thing these very sensitives things is not easy is not only a knowledge of matter it is a matter of knowledge it is a matter you know of of um mindset in general and a and a this different mentality often you know, people have to change in their mentality I would say in often cases

QUESTION 1

Please explain how the curriculum of academic education and vocational educational training provided by higher education fundamentally contributes to talent development in Lithuania.

DT11:

Curriculum is designed based on the needs of the labour market that are identified during the extensive discussions with social partners from the public sector, NGOs, and business.

Curriculum is constantly modified according to the feedback provided by the students, alumni network and employers (or social partners).

Currently universities are trying to make their study programs international, interdisciplinary and oriented towards the development of skills that are critical in the age of digital economy (e.g. emotional intelligence, creativity, communication, analyzing and managing data, etc.). These skills are developed by integrating modern teaching and learning methods (e.g. action based learning, deliberate practice, etc.) into the curricula as well as by using distance, blended or hybrid learning technology to make the knowledge acquisition available to various social groups.

QUESTION 2

Please choose the skills that the higher education policy of Lithuania deems **most common** or **least common** for human-centric innovation ecosystems:

DT11:

Motivation/drive: ***most common***
Leadership skills: ***most common***
Creativity skills: ***least common***
Risk taking/ showing initiative: ***least common***
Flexible and an adaptable attitude (Psychological): ***least common***
Industry-related skills through practical experience: ***most common***
Global mindset: ***least common***
Entrepreneurship skills: ***most common***

Decision-making skills: ***most common***
Strategic thinking: ***least common***
Communication skills: ***most common***
Collaborative skills: ***most common***
Analytical skills: ***most common***
Quantitative skills: ***most common***
Critical thinking/ Problem solving skills: ***least common***
Other skills ____

QUESTION 3

Please describe the infrastructure already in place in the higher education system that enhance the knowledge of population in various technological and non- technological fields of study? Please describe the basic, advanced teaching and research and development facilities that helps to form the talented human capital?

DT11:

The most widely used infrastructure to enhance the knowledge of population include: university libraries; commercial learning courses for the social partners; distance learning (though the latter is more available for the students of the university than for the broader community; Lithuanian MOOCs are still not very common); consulting projects where universities are offering their research services and resources to help the public sector and business to solve some important problems and gain additional know-how.

QUESTION 4

How can Lithuanian universities and higher education institutions be more effective in the engaging talented human capital (local and foreign talent) and simultaneously created a human-centric innovation ecosystem for aspiring entrepreneurs? Please describe what are the right kind of incentives in the Lithuanian system that allows human capital to pursue innovation.

DT11:

N/A (I think this question is similar to the question No 10, so some answers are provided there).

QUESTION 5

Recently Lithuania has moved up its place in its regional innovation activities. How has the higher education policy contributed to this advancement? Please comment on actual instances.

DT11:

The higher ranks in regional innovation activities were fostered by the EU funding that are extensively used by universities and their social partners, and actually are the main source of income for some businesses in Lithuania (e.g. IT sector).

Another factor is merging of the universities due to the strong competition in the market. It forces higher education institutions to seek the new forms of organisational management and study process organisation in order to improve the quality of their services.

QUESTION 6

Are the present socio-economic conditions, industrial and sectorial environment of Lithuania harmonious for innovation ecosystem to thrive? Please comment on a few examples.

DT11:

N/A (the question requires competence in the field of economic politics).

QUESTION 7

Several factors such as technology, capital and human capital contribute to innovation. What features of the human factor is responsible for innovation and economic growth in Lithuania?

DT11:

N/A (the question is not clear enough and I think it requires some competence in the field of psychology).

QUESTION 8

There have been recent reforms and structural changes in the higher education system of Lithuania. To what extent will these new reforms significantly impact the development of human-centric innovation ecosystems **now** and **in the future**? Have these reforms been impacted by the steady migration/emigration patterns in Lithuania?

DT11:

The reforms in higher education has been mainly impacted by the competition in higher education system and more opportunities to study abroad. So, higher education institutions now compete not only within the boundaries of Lithuania, but also on the international level. Also, a huge decrease in the quality of studies and research was noticed during the last 10-15 years, that also had an impact to the recent reforms. The positive impact of these reforms are that the universities are forced to change themselves in order to improve the products/services their provide, and this certainly affects the human-centric innovation ecosystems bringing closer together all the players.

QUESTION 9

How involved are businesses and the industrial sector in Lithuania in enhancing the higher education system? Which sectors are more active/ inactive with the system?

DT11:

Businesses and the industrial sector in Lithuania are more and more actively involved in the processes of higher education system. The main processes they participate is teaching (practitioners coming to share their knowledge with the students) and research (when enterprises provide commercial research project proposals for the higher education institutions). However, in my opinion the most active players in higher education are from the IT and financial sector.

QUESTION 10

How can higher education inspire potential talented human capital to drive innovation and growth in Lithuania? Can this be achieved through a formal academic education offered by universities or vocational educational training offered by higher education institutions? What are the necessary components for such ecosystems?

DT11:

Higher education inspires innovation through the innovative teaching and learning methods, and through the example of being innovative itself. If the students would see what innovations and how have happened at their own university during their 2-3 years of studies, they would become more risk-taking, creative, and change prone themselves. All these things are necessesary for the innovations to happen. Not only curricula is important, but also innovations that happen at the university itself.

QUESTION 11

Human-centric innovation ecosystems are fundamentally built on the knowledge and commercial economy. Please explain the percentage of universities and higher educational institutions in Lithuania that are contributing to the development of each of these economies:

DT11:

The knowledge economy.

The commercial economy – *I would say the majority of players in the market of higher education in Lithuania are still contributing to the commercial economy since the study programmes and the teaching/learning methods are more oriented towards what is needed right now in the labour market without little emphasis of what will be needed in the future. Research is also more oriented towards current needs and current problem solving meanwhile some conceptual problems get little attention because of the funding schemes of the research.*

QUESTION 12

Please describe whether higher education and a large stock of highly educated human capital (educational attainment) is correlated to the development of human-centric innovation ecosystems? Would having higher education training or qualification contribute more economic activities and wealth in Lithuania?

DT11:

Having higher education training and qualification is always important, but the features of national character and history also play an important role in human-centric innovation ecosystem (i.e. innovation ecosystem in the US is different that innovation system in Lithuania, but both countries can be equally innovative). So, it is important to have that cultural aspect in mind because it helps to understand what elements of the innovation theory will and what will not work in practice within different political, economical, social and cultural contexts.

MYKOLAS ROMERIS UNIVERSITY

Keisha LaRaine Ingram

THE IMPACT OF THE HIGHER EDUCATION POLICY ON THE DEVELOPMENT OF HUMAN-CENTRIC INNOVATION ECOSYSTEMS IN LITHUANIA

Summary of the Doctoral Dissertation
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The doctoral dissertation is available at Martynas Mažvydas National Library of Lithuania (Gedimino avenue 51, Vilnius), Klaipėda University Library (K.donelaičio a. 3, Klaipėda), Mykolas Romeris University Library (Ateities st. 20, Vilnius), Šiauliai University Library (Vytauto st. 84, Šiauliai), Vytautas Magnus University library (K. Donelaičio st. 52, Kaunas).

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INTRODUCTION

Thematic relevance of the dissertation. Progressive economies all share a common element to quality innovation: talented, human capital. In countries where innovation occurs at a moderate pace, the assumption is that education does not necessarily render better economic benefits (Jucevičius, 2004). However, collaborative platforms between universities, governments and industries that generate the commercialization of knowledge and skills for innovation (Lowe, and Marriott, 2006), could potentially work better when a strategic, human-centric approach is applied. Therefore the creation of human-centric innovation ecosystems is crucial as human-centric is the core of innovation and when channeled through higher education learning, a curricula developed *with* innovation in mind results in human capital that are problem-solvers (Weisberg, 2006; Sternberg; 2009; Isaksen, Dorval and Treffinger, 2010; Proctor, 2018). A systematic critical literature analysis has highlighted several problems relevant for management sciences:

- The traditional approach to innovation by the higher education sector is inclined to train and educate the human-resources for innovation without understanding role of the problem-solving aspects of innovation entails iteration, empathy and an interdisciplinary approach to the creativity process (Isaksen, Dorval, Treffinger, 2010). These traits, equivalent to human-centered design, when applied to achieve innovation enables total involvement of the end-users of innovation in the problem-solving process (Roser et al, 2009; Smorodinskaya et al., 2017; Luthans, Youssef and Rawski, 2011; Proctor, 2018). As such, the human resources tend to view innovation in an abstract sense where it created for the people and *not with the people* that it should impact on. This leads to higher education being remote and inertial to innovation when it comes to human resources development for problem-solving aspect of it (Buchori and Malik 2004; den Ouden, 2011; Naqshbandi, 2017; von Stamm, 2011; den Ouden, 2011; Choudhary, 2017);
- Problem-solving is the attribute that defines quality innovation and innovation ecosystems (Luthans, Youssef and Rawski, 2011; Proctor, 2018). The university setting could ideally be the starting point for human-centric innovation ecosystems as it consists of the perfect environment to incubate opportunities to establish human resources stakeholder cooperative ecosystems in addition to offering formal education and vocation training directly related to innovation (Jongbloed, Enders and Salerno, 2008; OECD, 2017). Yet as potential conveners and collaborators for quality ecosystems, the higher educator sector greatest

impact to nations through innovation is the large quantity of human resources it generates annually which leads to how the policy that support this trend demonstrates that talented human capital from higher education systems does lead to quality innovation outputs (European Commission, 2003; Laredo et al., 2007; Ramirez-Corcoles and Manzaneque-Lizano, 2015; Zaharia et. al., 2016; Pedro et al., 2019; Chang et. al., 2019);

– Opportunities to apply ecosystems theories such as business ecosystems, entrepreneurial ecosystems, innovation ecosystems and knowledge-based ecosystems to expand the scope of the higher education sector's contribution to innovation is significant (Iansiti and Levien, 2004; Moore, 1993:1996; Pralad, 2005; van der Borgh et. al, 2012). However, the advent of the knowledge society have increased the importance of integrating the human-centered design for value capture from innovation considering the number of human-centric activities linked to it (Moore, 1993:1996; Buchori and Malik 2004; den Ouden, 2011; Naqshbandi, 2017; von Stamm, 2011; den Ouden, 2011; Choudhary, 2017). The higher education sector is no exception to this. This dissertation will generate new knowledge on how human-centric innovation ecosystems as a resource in the higher education sector, can strategically capture value for all stakeholders and beneficiaries of the ecosystem.

Level of research of the scientific problem. The dissertation is based on the human-centered approach to innovation in the context of knowledge society era. Quality human capital for innovation is conventionally trained and developed through the formal systems of the higher education sector, promulgated by the supporting internal and external conditions of human-centric innovation ecosystems. Application of human-centric innovation ecosystems is a theme that has been insufficiently explored however is evidenced by the features of the knowledge society. The term "human-centric innovation" is predominantly linked and explored in smart technologies, artificial intelligence and robotics fields, with human-centric in the management field of marketing pertaining to several terms such as "customer-centric, customer-focused, human-centered or people-focused" which are all human centric names due to the object of the product offerings. Human-centric innovation does exists and have emanated from eminent global think-tanks, organizations and companies such as the Global Innovation Index (GII) (Cornell University, INSEAD, and WIPO, 2014), IBM (2020), Fujitsu (2014) and the human-centered design as the strategy for achieving value capture in innovation in the knowledge society. As a strategic resource for human-centric innovation, human-centric innovation ecosystems through the human factor achieves the implementation and developmental aspects of it (Alpkan, et al. 2010; Mahsud, Yukl, and Prussia, 2011; Mariz-Perez, et al. 2012; Prajogo and Oke, 2016; Kianto, Sáenz and Aramburu, 2017). The role and social value of human capital for enterprise or institutions success is acknowledged in research conducted on advanced economies that have benefited and are the pacesetters for innovation (Laužikas and Miliūtė, 2020a). This is crucial for increasing the intellectual capacity of the human resources for regional development of nations (Neverauskienė and Gruževskis, 2009; Laužikas and Miliūtė, 2020a & 2020b; Szara and Ślusarczyk 2020). Research on human capital development have assessed the various the investments possibilities and integration of human capital into the labor market for national development. This revealed that while conditions at the regional level are not created for adults who seek to get occupation or requalification, it is crucial that investments for qualification or re-qualifications is allocated to the improvement of the human resources for innovation (Rodríguez-Pose and Vilalta-Bufí, 2005; Neverauskienė and Gruževskis, 2009; Sverdlova, 2014; Laskowska and Dańska-Borsiak, 2016; Aleknavičiūtė, Skvarciany and Survilaitė, 2016; Prakapavičiūtė and Korsakienė, 2016; Kottaridi, Louloudi, and Karkalakos, 2019; Laužikas and Miliūtė, 2020a & 2020b; Szara and Ślusarczyk 2020; Capsada-Munsech and Valiente, 2020; Delaney, 2020). Moreover, the concept of human capital is not adequately reflected by the personal qualities (attributes) of individuals, rather through the personal qualities (general competence) in the qualification structure of employees have increased (Heckman and Rubenstein, 2001; Heckman and Carneiro, 2003; Heckman, 2007; Heckman, 2008; Neverauskienė and Gruževskis, 2009; APA, 2018; Holmberg-Wright and Hribar, 2016; Alva, 2019; Laužikas and Miliūtė, 2020a & 2020b; Szara and Ślusarczyk 2020). A number of studies conducted on the higher education policy in innovation have addressed the interface between the higher education sector to the competitiveness and development of economies, not many have analyzed the impact of the policy on the development of human-centric innovation ecosystems. The impact of the higher education policy is very significant and in terms of innovation ecosystems, many researchers have investigated it as concepts of knowledge transfer and knowledge resource (Frankort, 2013; Schofield, 2013; Belitski and Heron, 2017; O'Reilly et. al 2019; Appio et al, 2019), university-industry cooperation (Schaeffer et. al, 2018; Ranga et al, 2017; Markkula and Kune, 2015; Jin-fu, 2010; Mascarenhas et al, 2018) entrepreneurships (Portuguez Castro, et al, 2019; Belitski and Heron, 2017; Bischoff, 2018; Carvalho, et al 2010; Brush, 2014) smart specialization (Romano et al, 2014; Jucevičius et al, 2016; Lopes et al, 2018; Lopes et al, 2020; Santos and Caseiro, 2015; Nieth et al, 2018; Schiuma and Carlucci, 2018), entrepreneurial universities (Guerrero et al, 2016; Schiuma and Carlucci, 2018; Secundo et al 2019; Markkula and Kune, 2015; Romano et al, 2014), open innovations (Carayannis and Campbell, 2011; Schiuma and Carlucci, 2018), social innovations (Romano et al, 2014; Markkula and Kune, 2015; Schaeffer et. al, 2018; Appio et al, 2019) and as a dynamic capabilities resource (Heaton, Siegel and Teece, 2019).

Human-centric innovation ecosystems is a strategic resource that could improve innovation and higher education outcomes, dualistically. The EU higher education sector in itself have consistently undergone many major reforms for the last three decades to address both issues (Nokkala, 2007; Corbett 2011; Hoffman and Holzhuter, 2012; Enders and Westerheijden, 2011; Lipnicka and Verhoeven; 2014; Jongbloed, Enders and Salerno, 2008; OECD, 2017; European Commission, 2018j; European Commission, 2019). Due to the skills mismatch leading to low productivity levels in labor, cyclic fluctuations in the labor market and regional innovation development, this misallocation has consistently led to the reduction of productivity gains from the human capital (Stoll, 2005; Galgóczi and Leschke 2016; McGuinness, Konstantinos and Redmond, 2017; WEF, 2019). At the planning stage of policy, the higher education should expand to include strategies that incentivize the outputs of cooperation activities that collectively address the managerial challenges of skills mismatch and talent development. Currently structural funds address this however through a formal ecosystem framework at the national policy planning stage for the higher education sector, could collectively generate human-centric initiatives to address talent development and skills mismatch challenges issues. Harmonious ecosystem environment is dependent on integrating managerial strategic targets for survival and value generation. The large networks of the higher education sector already have incentives and tools in place to support such environments for increasing the sector's contribution to innovation (Mason, 2009; Holmes and Mayhew, 2015; Delteil, and Kirov, 2016; Houston, et al 2016; Camilleri and Camilleri, 2016; Dewi and Suharti, 2018; Editor, 2018; Capsada-Munsech and Valiente, 2020). However, qualitative tools within an ecosystem framework could enhance the tangible outcomes of the higher education sector contribution to innovation in the knowledge and commercial economies. This would be useful for evaluating the true level of skills mismatch from the sector.

The value framework of the internal and external environmental networks of ecosystems is crucial for success through strong cooperation activities and alliances that strengthens it (Iansiti and Levien, 2004). This is the same for the higher education sector where research supporting this have claimed greater satisfaction levels on the outcomes and value of the outputs generated. Moreover assessing the innovative development of an industrial enterprises entails research on how the perceived risks and threats that affect the innovative activity could impede potential success (Penrose, 1959; Schultz, 1960; Schultz, 1961; Romer, 1986; Lucas, 1988; Barro, 1990; Teece et al., 1997; Heckman and Rubenstein, 2001; Heckman and Carneiro, 2003; Kamath, 2007; Al-Alawi et al., 2007; Heckman, 2007; Heckman, 2008; Ramírez-Córcoles and Gordillo, 2014; Mahoney and Kor, 2015; Pedro et al., 2019; Chukurna et al, 2020). Applying this to human-centric innovation ecosystems in the higher education sector, greater contribution to innovative success comes from strong cooperation, trust and sustainable solutions within an ecosystem framework. Governance and management of human-centric innovation ecosystems entails the New Public Governance (NPG) model research and theory framework incorporated with the modern organizational practices of the innovation-driven private sector. This could generate new knowledge on innovation ecosystems that adopt the human-centered approach and contribute to the fields of New Institutional (NI) and Resources Dependency Theories (RDT) in management sciences.

Scientific problem. What are the theoretical principles for human-centric innovation ecosystems development and how should the impact of the higher education policy be evaluated.

Dissertation research object is evaluate the impact of the higher education policy on human-centric innovation ecosystems.

Dissertation research aim. To empirically evaluate the higher education policy impact on human-centric innovation ecosystems. The proposed suggestions developed from the evaluation would support the management and strategic use of human-centric innovation ecosystems to strengthen the competitiveness of higher education sector.

Dissertation research objectives formulated to achieve the aim of the dissertation are:

5. To critically analyse literature on ecosystems, human capital, higher education systems and develop a conceptual framework of the ecosystem.
6. To conduct an empirical research to assess the relevance of the human-centric innovation ecosystems framework developed using Lithuania as an experimental case;
7. To designate the position of human-centric innovation ecosystems in the higher education sector from the main findings and its application in the management and planning of institutions and resources.
8. The use of human-centric innovation ecosystems as a resource for strategy development in the decision-making and planning processes for the higher education sector from the main insights of the empirical research findings.

Dissertation research methods. Systematic, critical review of scientific literature and articles. Document analysis on national cases of EU Member States policy on higher education and innovation outcomes using the New Public Governance perspectives in addition to New Public Management and New Public Policy theories. Further on in the analysis, it was necessary to evaluate ecosystems, human capital and institutions within the higher education sector according to the New Institutional and Resources Dependency Theories as resources and institutions interconnected according to the objectives set for innovation and ecosystems' development. A conceptual theoretical framework was developed for human-centric innovation ecosystems to identify the stakeholders and beneficiaries and their role, processes of how the ecosystem should work at each level and the value creation captured. In order to test if the developed theoretical framework is correct and valid as a strategic resource for the higher education sector, it was necessary to conduct a qualitative case study and get insights from Experts with scientific and practical knowledge in the field. Prior to the data collection process, unstructured observations were done on the higher education environment. The following steps were then applied for collecting data in the field: (a) formalizing interviews with the experts; (b) case study on the Republic of Lithuania (c) constant comparison process, data saturation, coding and extraction of the themes using Nvivo (2019) to assess the qualitative dimensions for human-centric innovation ecosystems development according to the Expert's responses. The next step was to further evaluate from the findings, the impact of the higher education policy according to the strategic needs of higher education sector. This was done through inductive analysis on the findings from the research.

Scientific novelty of the dissertation. The novelty is determined by the aim and objectives of the scientific research. In the course of developing research, the dissertation will significantly supplement knowledge to the field strategic management and planning of management sciences in the following ways:

6. The concept of human-centric innovation ecosystems is defined according to how the ecosystem is developed using the human-centered attributes of the human factor to achieve innovation skills useful to create quality innovation, through utilization of the formal higher education skills and training attained.

7. After conducting a critical review of scientific literature on ecosystems, human capital, higher education systems, a conceptual framework of human-centric innovation ecosystem was developed. The constructed framework permitted evaluation of value creation in the ecosystem at all levels for the stakeholders and beneficiaries of the higher education sector.
8. Relevance of human-centric innovation ecosystems is emphasized according to how it used as a strategic resource for the higher education sector. Focus areas for effective utilization of human-centric innovation ecosystems in the higher education sector are assessed according to the insights from the Experts:
   3.7. Strengthening of collaborative networks with stakeholders and beneficiaries to address smart specialization and skills mismatched should be oriented towards new practice and learn or innovate and research degree programs in higher education institutions.
   3.8. Align higher education institutions study programs to the labor market through collectively affiliating the mission, objectives functions of the ecosystem according to each stakeholder and beneficiaries' needs strengthens the performance of higher education sector, structure and functions both in quality and quantity.
   3.9. The evaluation of non-higher educational factors relative to human capital development for contribution to the knowledge and commercial economy, would be monitored by the quality assurance indicators developed for the ecosystem.
   3.10. The significance of the socio-economic, industry, academia and sectorial stakeholder environment in human-centric innovation ecosystems be monitored by the quality assurance indicators to measure how those factors support the ecosystem's survival.
   3.11. Tools and resources developed to measure the performance, outcomes, processes and impacts on the development of the ecosystem should be done as a ratio to the inputs.
   3.12. Provide a comprehensive approach to support management teams in the higher education sector in the process of analysis and decision-making of the ecosystems strategy to increase the competitive advantage of the sector.
9. The position of human-centric innovation ecosystems is conceptually at the strategic planning phase of policy for the higher education sector.
10. Human-centric innovation ecosystems is set as a strategic goal in line with higher education institutions mission and vision to innovation.

Defended statements.

- Applying human-centric innovation ecosystems at the planning stage of policy for the higher education sector effects cooperation networks through the strategies developed to collectively address the challenges and issues of talent development in the sector.
- The problem of generating a harmonious ecosystem environment in the higher education sector is to integrate human-centric innovation ecosystems in each in-

stitutions according to the managerial targets set by policy; currently existing incentives in place to support such environments are formalized cluster networks in the biotechnologies, nanotechnologies and fintech sectors that are hardly applicable to the large networks of the higher education sector.
- Using human-centric innovation ecosystems would make visible the sector's input and future performance as a ratio of the outcomes; there is a scarcity of qualitative tools to measure the tangible outcomes of the higher education sector contribution to innovation in the knowledge and commercial economies within an ecosystem framework.
- The value of human-centric innovation ecosystems is identified from the levels of inputs of the ecosystem to the knowledge and commercial economy; the quality assurance indicators set by the higher education sector for monitoring the ecosystem would disclose this.

Main findings of the dissertation research. In the course of the research conducted, the following significant findings have been achieved:
- Human-centric innovation ecosystems are embedded in a network of actors in higher education sector. Its suggested position is at the planning stage of policy development due to the strategic nature of the ecosystems to support the managerial functions, vision and mission of the higher education sector for the development of human capital for innovation.
- The case study of Lithuania revealed that policy related to education and training, lead stakeholders and beneficiaries to proactively choose methods concurrent and supportive of innovation ecosystem development. Therefore, the impact of policy at the planning stage of human-centric innovation ecosystems development is evaluated according to the kind of solutions formulated to strengthen the collaborative networks with stakeholders and beneficiaries of the ecosystem.
- Technically oriented higher education institutions that have stronger and closer cooperation with its stakeholders and beneficiaries in businesses and industry within human-centric innovation ecosystem network have a high smart specialization and entrepreneurship profile. Research-oriented higher education institutions that cooperate closely with partners in HORIZON2020 projects, participate in competitive funding to support scientific and research activities leading to innovation have a high research profile. These instances indicate stronger partnerships and cooperation and strengthens the higher education sector's competitive advantage.
- The attributes of the human capital derived from the internal and external environments for human-centric innovation ecosystems in HEIs, are higher in entrepreneurships, being different innovative and collaborative. Within human-centric innovation ecosystems', quality assurance indicators monitor the qualitative inputs, processes, results, outputs and outcomes on the attributes of the human capital for innovation.
- The significance of the socio-economic, industry, academia and sectorial stakeholder environment in human-centric innovation ecosystems permit the formulation of quality assurance indicators to measure the ecosystem's survival.

The suggested tools and resources for monitoring of the quality assurance are:

6. Quality of human capital produced.
7. Incentives for talent development.
8. Greater cooperation ties among key actors (stakeholders and beneficiaries).
9. Institutions in the higher education sector's strategic goals.
10. Institutions functions (role) in higher education sector to innovation value creation.

- Most progressive institutions in the higher education sector have stronger cooperation ties, an internal and external environment aligned to its vision and mission, centrality of innovation in its activities, quality human capital and talent. The findings indicate that strategic monitoring of the quality assurance indicators evaluate the ecosystems' competitive advantage status through outcomes and outputs generated. This shows that the features and attributes of ecosystem have taken into account quality rather than quantity as well.
- Greater cooperation strengthens the higher education sectors' position to the knowledge and commercial economies. Through human-centric innovation ecosystems, the higher education sector contributes to the continuous development of these economies through the quality of the human capital produced and talent developed through its systems. Both knowledge and commercial economies requires human resources, first, to create the technology and digitization platforms for instant access to knowledge, then secondly develop the tools for its commercialization. The quality assurance indicators of human-centric innovation ecosystems evaluate the strategies for integrating more practical learning and research into studies also as a ratio of inputs to processes, outputs and outcomes in the knowledge and commercial economies.
- Higher education institutions in Lithuania contribute to both knowledge and commercial economies however positioning human-centric innovation ecosystems into the functions would enable systemic quality evaluation of inputs into the commercial and knowledge economies.
- Higher education sector's systems of learning, practice and research aligned closer to all stakeholders and beneficiaries involved particularly for the expectations on the outcomes of higher education attainment. Human-centric innovation ecosystems ensures that institutions forming its network align teaching methods that are relevant and inclined to the knowledge society, beneficial for stakeholders and actors and ensures that quality and quantity of outputs are measurable. Strategic partners developed through these collaborative structures and relations have greater importance and presence in policy development for the higher education sector. Utilization of human capital and talent as resource tools and strengthened collaborations across institutions results in greater resource optimization in human-centric innovation ecosystems.

Practical value of the dissertation research findings. The comprehensive framework of human-centric innovation ecosystems is significant for the higher education sector due to the following reasons:

- Human-centric innovation ecosystems is a strategic resource in management sciences for monitoring quality ecosystems that create innovation aligned with the objectives, missions and functions of its stakeholders and beneficiaries. The ecosystem was evaluated qualitatively according to how it served the purposes of the higher education sector as a strategic resource tool for strategy development to capture value in innovation. This new and significant for management science.
- The conceptual theoretical framework developed for human-centric innovation ecosystems is relevant and correct as it is suitable for assessing research on human-centered type innovation through the human capital possessing higher education. This is new knowledge generated on innovation ecosystems features that adopt the human-centered approach to human capital development in the higher education sector.
- The research additionally designated the true position of human-centric innovation ecosystems in the higher education sector. This is new and useful as the practical benefits are the management science approach utilized to develop better strategies for quality collaborative ecosystems leading to new synergies, greater optimization of resources and improvement of the higher education sector's general performance in addressing issues with all its valued stakeholders and beneficiaries of the ecosystem's network.

Implications of the scientific problem. The main implications of the impact of the higher education policy on the development of human-centric innovation ecosystems are:
- Cultural and socio-economic (macro-environment). The socio-economic and cultural environment also determine whether human-centric innovation ecosystems harmoniously develop considering the factors, actors and funding to support it as a strategic resource for the higher education sector.
- Institutional (eso- and meso-environment). The institutional implication originates from possible weak *inter*- and *intra*-cooperation between institutions impede the ecosystem's development. The overall internal and external institutional environment, resources, technology and infrastructure needed to support its functions should be considered as well.
- Skills development (micro-environment). Human-centered features such as trust, communication, organizational and institutional culture to innovation are several barriers to human-centric innovation ecosystems development in the higher education institutions.
- Individual (talent). At the individual level, human-centered features such as skills development, aptitude and an inherent motivation for innovation.

Structure and organization. The dissertation is structured according to the formulated aims and objectives of the dissertation. Part one consists of a critical and overview on literature developed on ecosystems, human capital development, higher education systems and governance which are significant for developing the theoretical framework of human-centric innovation ecosystem for the empirical research. Part two consists of the rationale of the methodology for the research, methods and data collection instruments. Part three consists empirical research and evaluation of the practical applicability of the findings according to the impact analysis of human-centric innovation ecosystems development. Figure 1 provides the structure of the dissertation.

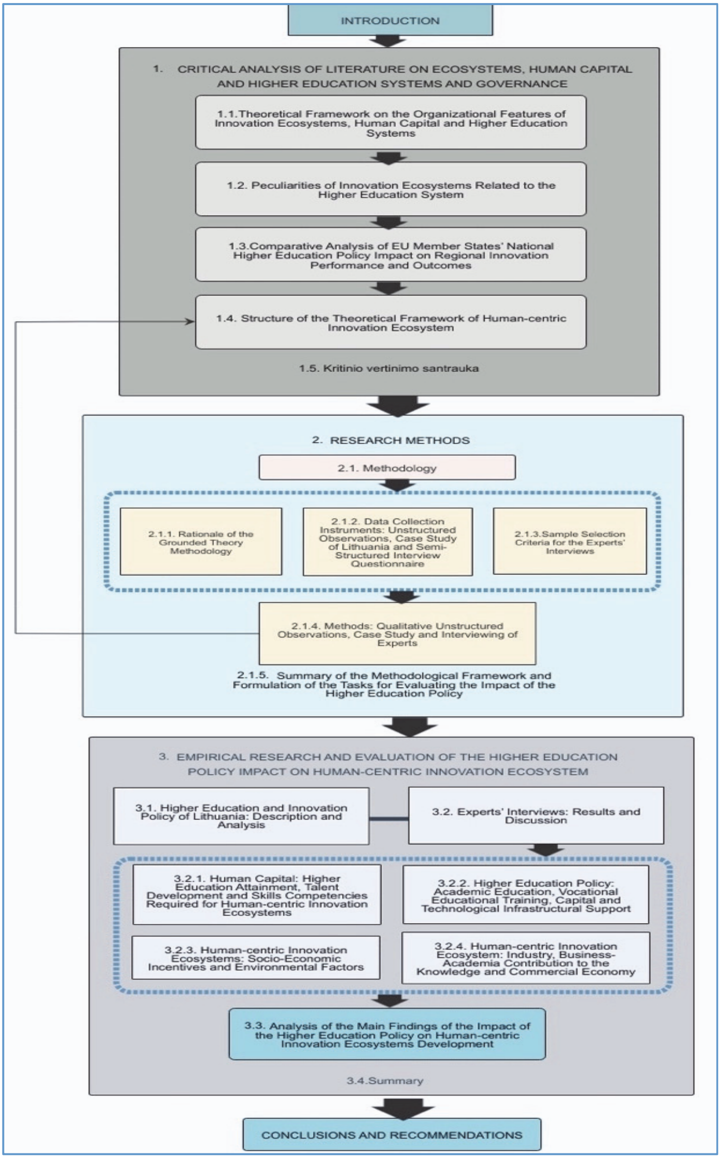

Figure 1. *Structure of the Dissertation*
Source: Developed by the Author

Keywords: Ecosystems, Higher Education, Education Policy, Innovation, Human-centric Innovation.

OVERVIEW OF THE CRITICAL ANALYSIS OF LITERATURE ON ECOSYSTEMS, HUMAN CAPITAL AND HIGHER EDUCATION SYSTEMS AND GOVERNANCE

Innovation ecosystems, human capital and the peculiarities of human-centered *type* higher education institutions are disruptive terminologies that enhance the social and economic value of the novelty of human-centric innovation ecosystems. Innovation ecosystems in scientific literature have evolved from business to entrepreneurial innovation ecosystem model which are not the same as human-centric innovation ecosystems though they share a common actor, the human factor. Human-centric innovation anthropocentrically describes innovation that improves the quality of life for humans. Human-centric innovation ecosystems are the networks that permits the creativity process with humans involved. Analogizing these ecosystems through New Institutional theory, Resource Dependency Theory and Isomorphism Institutionalism uncovers the key features for the human factor necessary for human-centric innovation ecosystems. The role of human factor in human-centric innovation ecosystems thus requires an education policy that fosters the nurtured and educated skills capacities of individuals. The cognitive abilities of the human capital such as individual personality traits, a global mind-set, creativity, critical thinking, problem-solving, analytical and decision-making skills, as well optimism, empathy and motivation highlights the economic and social value of human capital development attained through lifelong learning education. Linking these human-centered attributes, human capital, is indeed related to quality innovation ecosystems. In addition to the aggregate of abilities garnered as well as the basic competencies acquired from the *natural* surrounding environment of a human being's life proves the aggregation of this invaluable 'capital'.

The analysis further indicated the need to consider the models of higher education system as generated through the national education policy during the empirical research. This is requisite in order to understand the development and management of human-centric innovation ecosystems, the ecosystem's limitations and benefits, the traits of the human capital linked to quality innovation outputs, the external and internal network environment of the higher education sector as well as the ecosystem's position relative to these models of higher education systems. Moreover, the assertion that though higher education policies could influence the prospective development of human-centric innovation ecosystems, higher education institutions would benefit from the evaluation on the managerial issues of such ecosystems holistically. This leads to greater strategic perceptiveness on how the human-centered aspect of innovation progresses in ecosystems and the depth of cooperation with the other stakeholders that are specific to enable HEIs ecosystems to contribute to quality innovation through the talented human capital. The comparative analysis revealed key important limitations of the critical analysis conducted. Using the theoretical rationale developed, the significance of reviewing actual cases of higher education policy systems that impact human-centric innovation ecosystems development, the position of policy to the interdisciplinary framework of management of the innovation and innovation ecosystems is identified.

The analysis further focused on the challenges of the EU that relate to policy-making systems governance strategic approach to innovation to the higher education sector. From the comparative analysis, the higher education sector of each national case was assessed according to the authentic contexts and associative interdisciplinary collaborative activities of each stakeholder or institutions responsible for contributing to developing quality innovation ecosystems leading to innovation. The analysis additionally provided knowledge building on the associative meanings behind the implications of policy that results from gradual development of human resources through the higher education sector's internal and external environments. This could serve as a suggested approach to gain insights on the strategic background of regional innovation linked to the higher education sector. The comprehensive analysis provided more effective and evidence based strategic planning and management of education and innovation-based ecosystems having a positive impact on the competitiveness of human-centric innovation ecosystems for higher education institutions.

The analysis conducted on the correlation of how the higher education policy impacts human-centric innovation ecosystems was not entirely comprehensive and lead to an inductive research. At the regional level, analysis of the types of ecosystems that is linked to the human-centered attributes of the problem-solving process from higher education systems to innovation ecosystems was achieved through the comparative assessment of EU Member States. This was done according to each categories of innovation performance outputs used as the initial sample. The evaluation was further broken down from the macro-, eso-, meso-, micro- to the level of the human factor in order to distinguish the novelty of human-centric innovation ecosystems networks as managerial resources in strategic management systems.

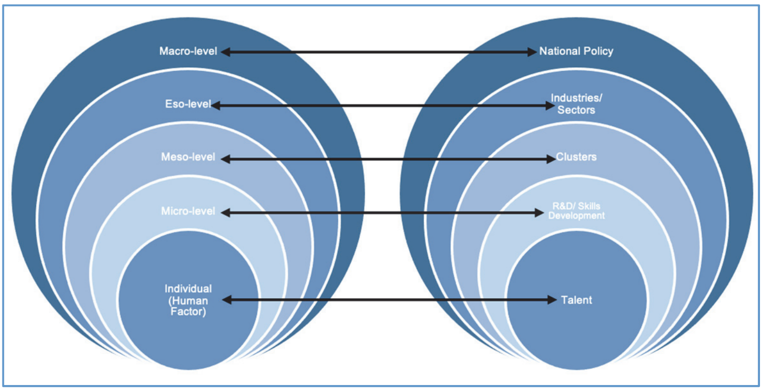

Figure 2. *The Value of Innovation Modelled as Human-Centric Innovation Ecosystems at each Level*

Source: Created by the Author according to DiMaggio and Pfeffer and Salancik, 1978; Powell, 1983; Powell and DiMaggio, 1991; Moore, 1993; Teece, 2007; Zott and Amitt, 2010; Nambisan and Sawhney, 2011; Mitleton-Kelly; 2003; Moore 1993; Iansiti and Levien, 2004

As seen in Figure 2 the interaction and matching the value of innovation at each level translates to the fundamental conceptual framework for the human-centric innovation ecosystems. The theoretical conceptual framework developed describes most important features of the human capital, the internal and external environments of HEIs impacts, all actors including stakeholders and beneficiaries as well as non-higher educational social and economic factors which strategically enhances its contribution to the knowledge and commercial economy. The strategic value created from this ecosystem through the collaborative activities, investments into the development of the human resources through higher education, skills development as well as training to enhance human-centered attributes necessary for innovation. According to the critical analysis of literature, the conceptual framework should operate on two-fold basis where skills and knowledge transference occurs simultaneously.

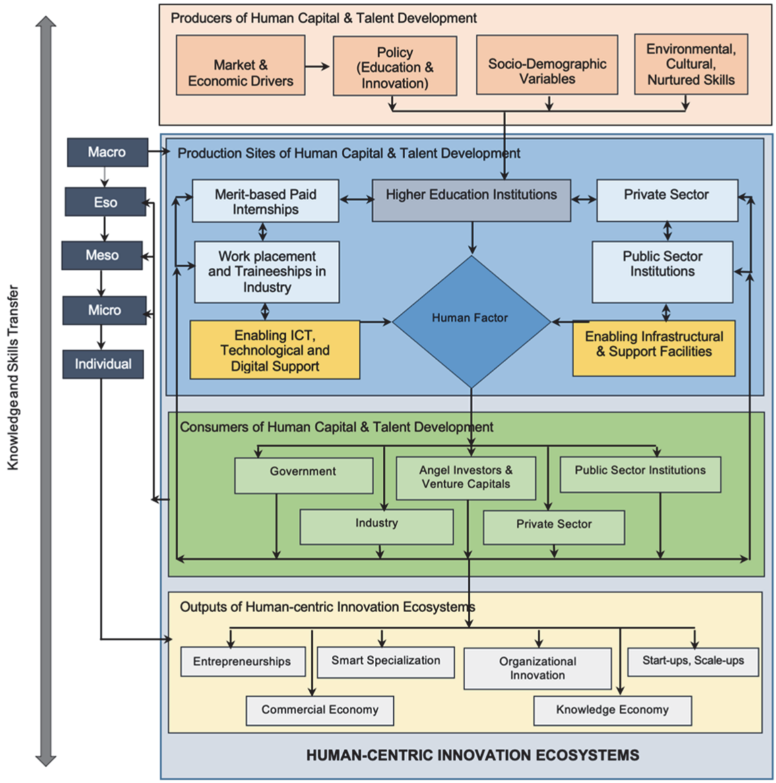

Figure 3. *Theoretical Framework of Human-centric Innovation Ecosystems*

Source: Created by the Author according to Penrose, 1959; DiMaggio and Pfeffer and Salancik, 1978; Powell, 1983; Powell and DiMaggio, 1991; Moore, 1993; Teece et al., 1997; Mitleton-Kelly; 2003; Iansiti and Levien, 2004; Al-Alawi et al., 2007; Teece, 2007; Zott and Amitt, 2010; Nambisan and Sawhney, 2011; Mahoney and Kor, 2015; Alva, 2019.

The theoretical conceptual framework of Figure 3 is described according to its features: *Levels, Actors, Processes, Role of each Actor* and *the Value Creation at each Level.* This is outlined in Table 1 below:

Table 1. *Features and Description of the Framework of Human-centric Innovation Ecosystem*

Features of the Framework	Description
Levels	Macro, Eso, Meso, Micro, Individual
Stakeholders and Beneficiaries	Government, Industry, Angel Investors and Venture Capitals, Public Sector Institutions, Private Sector, Human Factor, Higher Education Sector;
Processes	a) Enabling ICT, Technological and Digital Support Infrastructure; b) Enabling Infrastructural Support; c) Policy (Education and Innovation); d) Market and Economic Drivers; e) Socio-Demographic Variables; f) Environmental, Cultural, Nurtured Skills;
Role of each Actor	1) *Producers of Human Capital Development:* Policy (Education and Innovation); 2) *Production Sites of Human Capital and Talent Development:* Higher Education Institutions in cooperation with the Private Sector, Public Sector Institutions, Merit-based Paid Internships, Work Placements and Traineeships in the Industry, through the support of Enabling ICT, Technological and Digital support Infrastructure and other Enabling Infrastructural and Support Facilities; 3) *Consumers of Human Capital and Talent Development:* Government, Angel Investors and Venture Capitals, Public Sector Institutions, Industry, Private Sector; 4) *Outputs of Human-centric Innovation Ecosystems*: Entrepreneurships, Smart Specialization; Organizational Innovation, Start-ups, Scale-ups, Knowledge Economy, Commercial Economy;

Features of the Framework	Description
Value Creation at each Level	***Macro:*** Social, Economic, Improved quality of life and society; Greater commercialization of research results, Knowledge economy; Human-centered solutions, Attraction and retention of quality human capital; Focused innovation-led activities, Smart specialization, Start-up and scale-up economy, Entrepreneurship; ***Eso:*** Improved industry and sectorial collaborative activities, Strategized industry-led innovation networks; ***Meso:*** Diverse, human-centered innovation ecosystems, Easier transfer of knowledge and skills for greater coordination, Greater collaboration; ***Micro:*** Trustful, Openness Collaboration, Increased diversity of innovation activities, Greater use of actualized skillset, Training and knowledge skills developed according to market and economic drivers, Inclusivity, Greater satisfaction in the quality of the human capital, Increased competitiveness of the Higher Education sector; Quality ecosystems ***Individual:*** Inspired and creative human resources, Improved social and economic quality of life, Quality higher education qualification, Skills- and knowledge-oriented, Problem-solver, Citizenship, Trusting, Open, Entrepreneurial-minded, Motivated, Leader, Shows initiative, Flexible and an adaptable attitude (Psychological), Industry-related skills through practical experience; Global mind-set; Willing to take decision and responsibility; Strategic thinker; Good communicator; Collaborator; Analytic, Quantitative thinker; Risk-oriented

Source: Developed by the Author according to Penrose, 1959; DiMaggio and Pfeffer and Salancik, 1978; Powell, 1983; Powell and DiMaggio, 1991; Moore, 1993; Teece et al., 1997; Mitleton-Kelly; 2003; Al-Alawi et al., 2007; Teece, 2007; Zott and Amitt, 2010; Nambisan and Sawhney, 2011; Mahoney and Kor, 2015; Iansiti and Levien, 2004; Alva, 2019;

The value creation of human-centric innovation ecosystems theoretical framework is initially outlined at the *Individual* level are structured according to how the human factor is developed to drive and be the creator of innovation. At the individual level, the value creation of the framework is illustrated according to the benefits attained through pursuing higher education studies or training and the associative incentives from human-centric innovation ecosystems. At the *Micro* level the value creation of the conceptual framework is illustrated according to the benefits construed for all the actors of the framework. At the *Meso*, level the value creation of the conceptual framework is illustrated according to the benefits developed through active cooperation, greater and appropriate use of the knowledge, skillsets developed and training through the higher education system that match the actualities and demands of the market's needs. At the *Eso* level the value creation of the conceptual framework is illustrated according to the benefits construed for the actors within that level, that is the Government, Ministry policy makers, stakeholders and beneficiaries of the ecosystem. The *Macro* level relates to the outputs of the conceptual framework of human-centric innovation ecosystems as well as the benefits for all actors of the ecosystem.

OVERVIEW OF THE RESEARCH METHODS AND METHODOLOGICAL FRAMEWORK

The applied methodology, the grounded theory (GT) was chosen with the sole purpose of extracting the theory from the data evaluated to assess the impacts of the higher education policy on the development of human-centric innovation ecosystems. The epistemology used was Chicago interactionism, which was adopted for the methodological positioning, with pragmatism chosen as the philosophical stance. By integrating the philosophical, selected methodology, research methods and instrument, consistency was maintained in a systematic manner for the research. Symbolic interactionalism was useful to analyze the data generated from grounded theory research as it is rooted in pragmatism.

Data collection instruments for the research consisted of unstructured observations, case study and semi-structured interview questionnaire. The instruments were appropriate as they were complementary to the other chosen qualitative methods used in the empirical research. The unstructured observations, as a pilot study method, was essential for rich data capture during the initial stage of the research. The case study method provided further exploration and understanding to the pilot study on complex issues surrounding the higher education sector management and development of the human factor for human-centric innovation ecosystems.

Additional data for the research was collected through interviews with Experts from September 2019 to October 2019 in the Republic of Lithuania. The questionnaire developed for the interviews was structured in parallel to the developed theoretical conceptual framework of human-centric innovation ecosystems and the concepts and structure of the theoretical background analyzed. Eleven experts formed the sample and represented all spheres relevant to the research environment Lithuania. The method for choosing the Experts was by snowball sampling method in conjunction with purposive sampling.

Theoretical sampling after the interviewing of the Experts, permitted the conceptual density process to analyze how well all the data collected had achieved saturation level. Conceptual density occurs when all the responses are the same and no new information has emerged during the interviews. This justified the selection of eleven experts for the research as a larger sample could have led to difficulties identifying key areas and themes from the data collected.

The next step of the research was analysis of the data collected from the interviews using the coding process. Open, axial and thematic coding was applied to extract data from the Experts' responses for the qualitative analysis of the thematic categories derived. This enabled the key focus areas from the findings for evaluation of human-centric innovation ecosystem development.

Furthermore, the integrated qualitative evaluation assessed whether the findings from the empirical research are correct and relevant to the conceptual framework developed for human-centric innovation ecosystems. Therefore, the findings from Experts semi-structured interviews and case study on the Republic of Lithuania were evaluated to gain insights on how human-centric innovation ecosystems develop, its usefulness and how it is strategized as a resource to improve the internal institutional environment of the higher education sector. The evaluation of the higher education policy impact on the development of human-centric innovation ecosystems was investigated to address the management issues of:

(1) The strategic management of human-centric innovation ecosystems and the recommended qualitative indicators of human-centered attributes as well as the associative implications to the ecosystem in the higher education sector.
(2) The correlation identified between talent development and innovation in the areas of the knowledge and commercial economies;
(3) Identifying the designation of human-centric innovation ecosystems in higher education sector;
(4) Assessing and identifying the most important features of the human capial developed from the internal and external environments HEIs. The role of stakeholders, actors, non-higher educational factors of human-centric innovation ecosystems relation to human capital development and contribution to the knowledge and commercial economy;
(5) Estimating the significance of the socio-economic, industry, academia and sectorial stakeholder environment in human-centric innovation ecosystems.

OVERVIEW OF THE EMPIRICAL RESEARCH AND EVALUATION OF THE HIGHER EDUCATION POLICY IMPACT ON HUMAN-CENTRIC INNOVATION ECOSYSTEM

The case study findings revealed that Lithuania still remains one of the leading EU Member States for higher education attainment. The case study findings also indicate that activities that directly connects the Lithuanian higher education sector with industry and business is evidenced by the expansion of the creative industries sector at the international level. Though the case study revealed that significant investments to broaden these networks and infrastructure of the higher education sector, humancentric innovation ecosystems could provide guidelines for enhancing greater strategic utilization of these resources by the Ministry of the Economy and Innovation and the Ministry of Education, Science and Sports. Consequently, prospective opportunities that create added value for the society would result.

According to the conceptual framework of human-centric innovation ecosystems, higher education institutions could contribute more by collaborating with businesses and with each other, rather than being just only the source for graduates. This would be achieved through knowledge transference, dissemination of research results and governing on how knowledge is used and acquired for the benefit of society. From the conceptual framework, entrepreneurships, talent, the tertiary education (higher education) or the research sector, should collaborate with the private sector businesses as well. Moreover, as entrepreneurships is an indicator measuring innovation rankings, the case study revealed that the graduates from the Lithuania higher education sector are not entrepreneurial. This leads to graduates employed in jobs that do not required higher education qualifications. This affects the innovation indicators for Lithuania.

A human-centric innovation ecosystem works well when the higher education qualifications attained are relevant to business needs. From the students' side investing three or four years in the system to gain an advantage in the labor market is useful when the qualifications attained are pertinent to business innovations or operations. The conceptual framework thus indicates that strategic planning and monitoring of higher education programs lessens the probability of online or self-taught teaching programs to overtake on-campus, traditional higher education learning methods in the sector. These programs usually offer shorter timespan for learning and training, more relevant to the industrial and business sector labor market needs and self-regulating. The developed model would propose guidelines for a blended approach to incorporate this learning alternative to traditional learning methods.

In acknowledging the human-centered approach to education operating as part of digital ecosystems networks, development of customized study programs grants better transition of the future workforce into their work environment. For Lithuania, the demand for those customized education programs are more majors in the robotics, ICTs and other digitalized, technologically related educational field areas. Thus, the higher education sector could reorient its strategic activities to contribute to Industry 4.0 ecosystems development plan in Lithuania through human-centric innovation ecosystems that futuristically forge symbiotic relations as a 'Solution Providers' to innovation. This would be achieved through continuous collaborative activities that contribute to the development of the Digital Technologies sector. As a key stakeholder, the study revealed that the higher education sector could proactively provide degree programs at both the master and bachelor level that are innovation-based, listed as part of the 'Solution-Providers' initiatives of the Industry 4.0 Plan. The study further revealed that the list of academic higher education institutions differentiates from those institutions that are involved in innovation-led ('Solution-Providers' activities). This is achieved through applied research (capital and technology) and traineeships and apprenticeship activities (talent).

From the findings mapped onto the conceptual framework of human-centric innovation ecosystems, its physical layout would consist of other tangible infrastructural entities such Science Parks, Research, Innovation and Development centers (competence centers), laboratories and testing centers, etc. The findings further revealed its intangible infrastructure such as technology, ICT services, digital technologies and the talent from higher education sector, expert services providers as well as other cluster-based human resources and associations. A symbiotic relationship then results between 'Solution-providers' (implementers of the ecosystem) and 'Consumers' (institutions that benefit from the ecosystem). According to the conceptual framework, this would be the 'Production Sites' and 'Producers' of human-centric innovation ecosystems. The common element, similar to human-centric innovation ecosystems conceptual framework, between the ‘Solution-providers’ and the ‘Consumers’ is talent. Furthermore, the case study proved that with greater unification of activities between the Ministry of Education, Science and Sports and the Ministry of Innovation and Economy, to broaden innovation potential the proposed ecosystem would work base on the strategies proposed from the conceptual model. As stakeholder and beneficiary, both ministries could set the criteria regarding the type of State-owned resources both tangible and intangible required for elevating and increasing the level of innovation-led activities in Lithuania through talent, technology, smart specialization and capital infrastructure that would be the ‘Outputs’ of the conceptual framework of human-centric innovation ecosystems. By broadening Lithuania’s innovation potential, the current policy is built on the premise that innovation would be a circular activity that leads to a wide range of opportunities. According to the layout of the conceptual framework of human-centric innovation ecosystems, this should be a unified, close-networked cooperative, systems consisting of all the mentioned actors, stakeholders and beneficiaries regulated under the education and innovation policy of Lithuania. This increases the higher education sector’s innovation potential to address existing skills mismatch and shortages linked to quality innovation ecosystem development.

The case study of Lithuania and the experts feedback further provide insights on institutions on strategy development, however more efforts could lead to stronger partnerships and cooperation to address the issues in the higher education sector. Figure 4 summarizes how this process works:

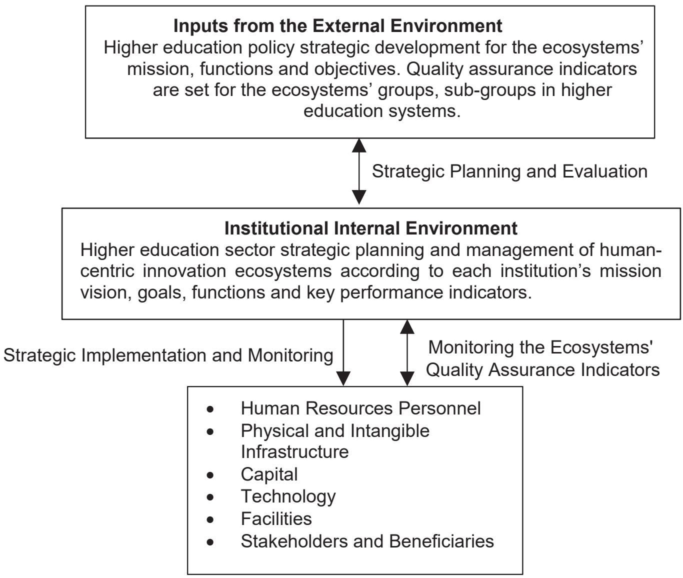

Figure 4. *Strategy Development through Human-centric Innovation Ecosystems. Source: Created by the Author*

A general approach for aligning higher education institutions study programs to the labor market is supporting cooperation with stakeholders and beneficiaries through collectively affiliating the mission, objectives functions of the ecosystem according to each stakeholder and beneficiaries' needs. This strengthens the performance of higher education sector, structure and functions both in quality and quantity. The attributes of the human capital derived from the internal and external environments for human-centric innovation ecosystems in HEIs, are higher in entrepreneurships, being different innovative and collaborative. Within human-centric innovation ecosystems' networks of stakeholders, actors, non-higher educational factors relative to human capital development for contribution to the knowledge and commercial economy, quality assurance indicators could monitor the qualitative inputs, processes, results, outputs and outcomes. Using Pearson's correlation, the Figure below indicates a major linear relation exist between the ecosystem's contribution to the knowledge and commercial economy, and as such quality assurance indicators should be formulated for the ecosystem to consistently monitor this.

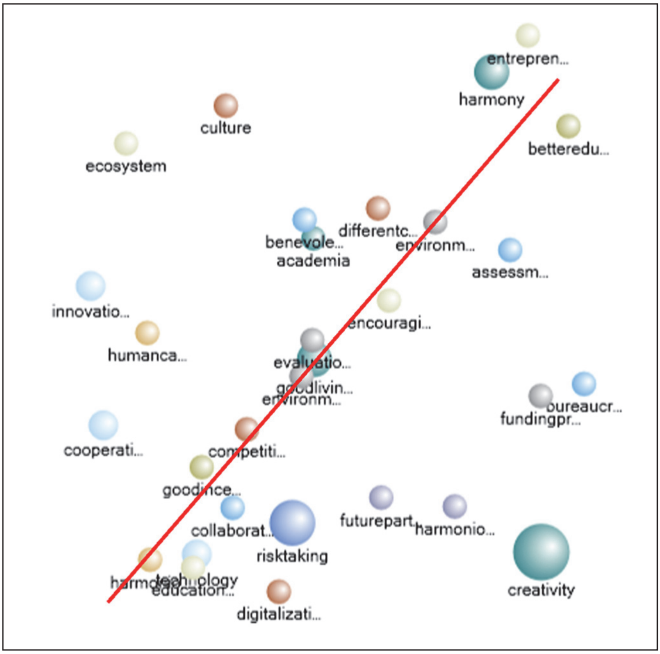

Figure 5. *Correlation between Human-Centric Innovation Ecosystems Qualitative Outputs and Outcomes to the Knowledge and Commercial Economies. Source: Developed by the Author*

The significance of the socio-economic, industry, academia and sectorial stakeholder environment in human-centric innovation ecosystems from the case assessment and the experts' responses could permit quality assurance indicators to measure how those factors support the ecosystem's survival. Using the Pearson correlation, a relation exists ranging from approximately 0.5 to 1. Quality assurance indicators should be formulated to monitor this environment in the ecosystem as well. These tools and resources that measure the performance, outcomes, processes and impacts on the development of the ecosystem should be done as a ratio to the inputs.

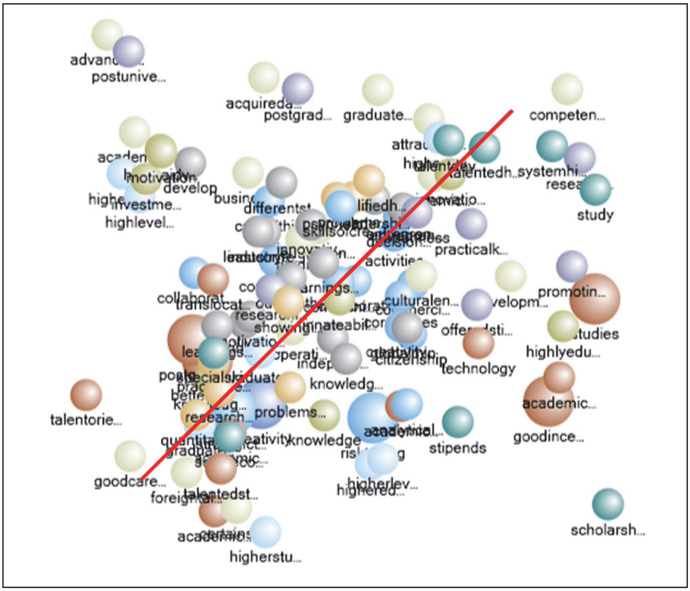

Figure 6. *Correlation of the External Environment to the Survival of the Ecosystem.*
Source: Created by the Author

The empirical research fulfilled the aim for evaluating the impact of the higher education policy according to the theoretical conceptual framework developed for human-centric innovation ecosystems. It also validated that the theoretical conceptual framework developed for human-centric innovation ecosystems is relevant and correct. Furthermore, the suggested conceptual framework is suitable for assessing research on human-centered type ecosystem development through the human capital possessing higher education qualifications. The results obtained in the investigation, such as qualitative insights on the thematic concepts and categories that indicate quality ecosystems development, are complementary for all stakeholders and beneficiaries. This can be used for generating new knowledge about innovation ecosystems features that adopt the human-centered approach. Human-centric innovation ecosystems could be treated as a strategic tool in management sciences for understanding and monitoring quality ecosystems that create value from innovation with its stakeholders and beneficiaries of the ecosystem.

The results obtained provided a better understanding of the attributes required for ecosystem development. This evaluated according to inherent features of the talented human factor, perceived as the initiator of human-centered innovation through qualifications skills attained, is new and significant for management science. The research also provided an understanding on the objectives and functions of all actors, the network structure of human-centric innovation ecosystems and assists the higher education sector to identify and its contribution as well as concentrate on its most important benefits and limitations. The results of empirical research are also new and useful for institutions in the higher education sectors.

Conceptual framework of human-centric innovation ecosystem.

1. Human-centric innovation ecosystems is a strategic resource to address the managerial challenges and issues of talent development for innovation in the higher education sector. Its framework, composition and features enable focused-driven strategic design and decision making to result according to the role and functions of institutions in the higher education sector. Capturing on the cognitive abilities, skills and attributes of the human factor, the framework developed enables its development for innovation.
2. Concurringly the conceptual framework developed for human-centric innovation ecosystems value capture at all levels for each actor, stakeholders and beneficiaries of the ecosystem. This is structured according to the level and ratio of the human factor in innovation to the motivation and value of the abilities acquired. As a human-centered structured ecosystem, it is recognized that talent and motivation for innovation is shaped according the environmental culture, supporting incentives technology and infrastructural facilities as well as the approach of all agents of the ecosystem to innovation. From the most important features, internal and external institutional environmental factors and socio-economic conditions from the scientific literature, this resides on the value of cooperation between all agents for the ecosystem to flourish and achieve the strategic goals set for the higher education.
3. For value capture at each level, the conceptual framework entails strong integrative, collaborative structures between each actor and institutions of the ecosystem, which fosters its adaptability, flexibility, ease of transference of resources as well as increasing the ecosystem's efficiency as a resilient strategic resource. Moderately this results in a great degree of resources dependency between actors and institutions within the ecosystem to enable optimization, greater concentration and reallocation of resources for human capital and talent development.
4. Technological and digitalization platforms affect the technology transference within the ecosystem. Therefore, policy should ensure that through the stakeholders' relations and cooperative links, stakeholder transactional costs is reduced to access these resources for talent and human capital development. One approach to counter this would be strategic management of the technological and digital transference within the ecosystem. According to the framework structure, aligning the ecosystem according to each economic level could be problematic in terms of the differing resources available at each level and its estimated outputs and outcomes. This is alleviated by horizontally aligning key resources and platforms across the ecosystem which enables ease of their transference and greater utilization between all actors.
5. The literature review on human-centric innovation ecosystems necessitates its consideration at the decision-making level of the higher education policy for higher education institutions. Due to the nature of the ecosystems structure,

greater insights at policy levels on the approach to human capital and talent development through higher education institutions from aggregate results generated through the quality assurance indicators tools of the ecosystem. This in turn converts to strategic intangible solutions for innovation and greater identification of long-term objectives specific to the overall needs of the ecosystem.

Human-centric innovation ecosystem and the higher education sector.

1. A harmonious ecosystem environment is generated across the massive networks of institutions and actors of the higher education sector. Incentives that supports such environments typically work well in smaller networks and clusters however a tailored approach to the vast network of the higher educator sector, using human-centric innovation ecosystems would potentially foster this. Though the empirical findings indicate that internal actors of higher education institutions as well as other stakeholders and beneficiaries are generally aware of their role to foster a harmonious environment for innovation development, they generally do not take into account the benefits of its practical application within an internal institutional environment.
2. Human-centric innovation ecosystems from the empirical findings, is that as a strategic resource, it creates value from innovation due to the shared functions, shared use of resources, technology and platforms for talent and human capital development as a managerial resource for innovation. The significance is further reiterated from the current outputs and outcomes of the features of the human capital developed for innovation. The empirical findings indicate that the current status of human capital base on skills and features developed is not conducive for quality innovation.
3. The quality assurance indicators developed for monitoring and assessing the inputs, processes, outputs and outcomes of human-centric innovation ecosystems ensures that if human capital and talent development fall short of the set objectives and mission of the ecosystem, intervening corrective initiatives would be applied concurrently to ensure that they meet the criterion set.
4. The findings further indicate that though higher education institutions operate in relatively competitive environments that lack trust and openness, they would not take into account the potential underestimated benefits derived within the ecosystem's network. However, the ecosystem could permit higher education institutions to benefit from underestimated benefits that would grant a comparative advantage that enhances their institutional profile.
5. The empirical findings validate that the network structure of human-centric innovation ecosystems assists the higher education sector to qualitatively identify its contribution levels to quality innovation as well as areas of concentration to develop on as well as its limitations within the ecosystem.

Designation of human-centric innovation ecosystem.

1. According to the structure of the framework, human-centric innovation ecosystem is conceptually designated at the planning phase of policy for the higher

education sector. Human capital and talent developed within the ecosystem ensures skills gratification and simultaneously improve cooperation networks that contributed to this. As producers of human capital and talent development, the policy including other intangible and tangible inputs determines the role and functions of the higher education sector as well as the opportunities set for human-centric innovation ecosystems implementation, at the institutional level, as a strategic goal in line with their mission and vision to innovation.

2. Human-centric innovation ecosystems strategically enhance the reputation and value of the higher education sector as well as its future performance and contributions to innovation within the knowledge and commercial economies. Selection of methods strategically concurrent and favorable to the sector's internal functions as well as to the ecosystem's overall framework. The ecosystem will designate the position and benchmark levels for setting of the internal strategic design for human capital and talent development in the higher education sector. Incorporation of the results achieved is added into the overall framework of the ecosystem to improve the general outlook of the higher education sector depending on the results attained.
3. As a strategic resource for the management and planning processes for the higher education sector, human-centric innovation ecosystem enables higher education institutions to collectively affiliate with its key stakeholders its vision, mission and objectives for human capital development through improved communications systems. This strengthens its performance and garner greater support simultaneously from other actors of the ecosystem to the higher education sector in fulfilling its functions in society through stronger cooperation networks.
4. Quality assurance indicators tools developed for monitoring the non-higher education factors relative to human capital development in human-centric innovation ecosystems evaluate the processes and outcomes for the higher education sector's internal planning and allocation of resources in the future.

Use of human-centric innovation ecosystem in strategic planning and policy.

1. The quality assurance indicators developed for human-centric innovation ecosystems monitors the input levels developed from the strategic design planned for cooperation activities between the higher education sector and its stakeholders. The value creation is generated from the inputs to the knowledge and commercial economies. The quality of the solutions generated to strengthen collaborative networks with the ecosystems' stakeholders and beneficiaries support new practice and learn or innovate and research degree programs in higher education institutions which also create value for these economies.
2. From the empirical findings, the attributes of the human capital derived from the internal and external environment of human-centric innovation ecosystem are higher in entrepreneurships, being different, innovative and collaborative. These attributes achieve the practical application of smart specialization through higher education. Moreover, skills mismatch and non-manifestation of talent for

innovation is addressed through collaborative planning with the stakeholders and beneficiaries to enhance skills compatibility and talent flow to industry. The main factor dependent on its success is good communication systems in the ecosystem. The findings indicated that communication and trust lead to significant functional results and longevity of the ecosystem network. Human-centric innovation ecosystems enable greater focused-based development of human capital and talent development through better utilization of resources in the ecosystem.

3. Within human-centric innovation ecosystems, policy regulating the ecosystems' development is evaluated according to the kind of solutions developed to address the challenges in the higher education sector. The level of *inter-* and *intra-*cooperation, internal and external institutional environment and available resources, technology and infrastructure.
4. Through enhance cooperation ties, institutions of the higher education sector attain a competitive advantage through human-centric innovation ecosystem. Resolution of the challenges and issues relating to skills mismatch and non-manifestation of talent for a competitive advantage in innovation, however, is contingent of this. Comparatively, a competitive advantage is indicative of the quality generated by the sector through the ecosystem for inputs to innovation.
5. Human-centric innovation ecosystem framework enables greater use of managerial resources for improvement of the performance of the higher education sector to its stakeholders and beneficiaries. Practical applicability of human-centric innovation ecosystems is based on its use as a strategic resource for strengthening cooperation within the ecosystem itself. This enables the higher education sector to address issues and challenges through strengthened cooperation activities, optimization of its key resources and funding to achieve this.

Main Suggestions:

1. For value capture of human-centric innovation ecosystems, it is proposed that the ecosystem framework serve as a strategic resource input for innovation strategy development and implementation.

Recommendations to Scientists for Future Research:

1. In order to investigate the application of human-centric innovation ecosystems for the innovative potential of entities and institutions as an input resource, more research on assessing the practical processes, outputs and outcomes of the ecosystem for the formulation of strategy development.
2. More research to assess the impact of other actors such as regulatory accelerators and sandboxes on the development of engagement within human-centric innovation ecosystem framework.
3. In order to assess the application of human-centric innovation ecosystems in the higher education sector, more quantitative research on the managerial phases involved to utilize the ecosystem as a strategic resource to address challenges and issues in the sector as well as revealing insights from the quality assurance indicators developed for the monitoring process.

Recommendations for Stakeholders and Beneficiaries:

1. For stakeholders and beneficiaries, a formal systemic role appropriation implemented into the ecosystem's framework in order to acquire accurate and comprehensive perspectives on each actor's contribution to the ecosystem.
2. Implement a set of formal quality assurance tools to evaluate the outcomes and outputs of the ecosystem.
3. Knowledgeable and experienced human resources (personnel) should form a core part of the ecosystem's framework to develop its strategic insights, management and coordination of its activities.
4. Experts that have knowledge to access points for human capital development should form a core part of the ecosystem.
5. In order to achieve talent for innovation, implement more graduate program internships and placements through funding mechanisms to recruit outstanding talent in higher education programs aligned to the enterprise mission, vision and goals.
6. Multidisciplinary engagement and interaction with the higher education sector in the ecosystems through cooperation and partnerships that fosters joint allocation of resources for innovation.
7. Alternate tuition programs or scholarship schemes for promising, outstanding talent sponsored during the study years at higher education institutions on a semester-base performance evaluation system. Upon graduation talent is evaluated according to education or technical performance outcomes for future employment.

Recommendations for the Higher Education Sector:

1. For human-centric innovation ecosystem in the higher education sector, higher education institutions that are technically oriented should coordinate study programs as mechanisms for sandbox- or incubator-led innovation outcomes to achieve skills compatibility with the industrial sector.
2. For human-centric innovation ecosystems, those institutions that are research-oriented, study programs should be coordinated through accelerator mechanism schemes for knowledge development and correct alignment of its transference to industry knowledge acquisition and utilization. This enables enhanced commercialization of research results from the higher education sector.
3. Study placements to outstanding trained human-capital should not be solely offered on an academic or technical criterion; rather as part of future placements with progressive enterprises that are stakeholders with HEIs in human-centric innovation ecosystems.

Recommendations for Governmental Ministries:

1. In order to ensure that the ecosystem operates effectively, educate the stakeholders, beneficiaries and actors about the functions, vision and mission of human-centric innovation ecosystem. Procedural, regulatory and legal frameworks should be implemented to the ecosystem to manage its functions and activities.
2. Experienced personnel should be recruited to human-centric innovation ecosystem to develop and execute solutions needed to address the issues faced by the higher education sector and mitigate future challenges that may arise. For human-centric innovation ecosystems, implement open recruitment systems in higher education institutions for the best, outstanding and talented individuals that have an interest to be trained and contribute to quality innovation outputs and outcomes. Open recruitment systems should consist of attractive incentives for talent to pursue innovation.
3. Quality assurance performance indicators should be developed in order to regulate and assess human-centric innovation ecosystems functions and objectives as well as its quality outcomes and outputs.

DISSEMINATION OF THE RESEARCH FINDINGS

The results of this dissertation research include: (A) Publications in research journals and conference proceedings and (B) Conference presentations.

(A) Publications in research journals and conference proceedings:

- Chukurna, O.; Niekrasova, L.; Dobrianska, N.; Izmaylov, Ya.; Shkrabak, I.; Ingram, K. Formation of methodical foundations for assessing the innovative development potential of an industrial enterprise = Формування методичних засад оцінки потенціалу інноваційного розвитку промислового підприємства = Формирование методических основ оценки потенциала инновационного развития промышленного предприятия // Науковий вісник = Naukovyi visnyk Natsionalnoho Hirnychoho Universytetu : peer-reviewed journal. Dnipropetrovsk: State Higher Educational Institution «National Mining University». ISSN 2071-2227. eISSN 2223-2362. 2020, no. 4 (178), p. 146-151. [Academic Search Complete; VINITI] [CiteScore: 1,50, SNIP: 0,911, SJR: 0,345, kvartilis: Q2 (2019, Scopus Sources)] [M.kr.: S 003].
- Ingram, Keisha LaRaine. Power and culture in human-centric innovation ecosystems // Journal of management and training for industries. Kitakyushu: Institute of Industrial Applications Engineers. ISSN 2188-8728. eISSN 2188-2274. 2019, vol. 6, no. 2, p. 1-16. DOI: 10.12792/JMTI.6.2.1. [ProQuest Central; Business Source Premier; Ingenta Connect; Business Source Complete] [M.kr.: S 003].
- Baležentis, Alvydas; Ingram, Keisha Laraine. Development of human-centric innovation ecosystems theories = Į žmogų orientuotų humanocentrinių inovacijų ekosistemų plėtros teorijos // Socialinių mokslų studijos: mokslo darbai = Societal studies: research papers. Vilnius: Mykolo Romerio universitetas. ISSN 2029-2236. eISSN 2029-2244. 2017, t. 9, Nr. 1, p. 56-64. [SocINDEX with Full Text] [M.kr.: S 003].
- Ingram, Keisha Laraine. Attracting and retaining talented professionals in the Baltic States = Gabių profesionalų pritraukimas ir išlaikymas Baltijos valstybėse // Socialinių mokslų studijos: mokslo darbai = Societal studies: research papers. Vilnius: Mykolo Romerio universitetas. ISSN 2029-2236. eISSN 2029-2244. 2016, t. 8, Nr. 2, p. 224-232. DOI: 10.13165/SMS-16-8-2-05. [ProQuest Central; SocINDEX with Full Text] [M.kr.: S 003].

(B) Conference presentations:

- Sudnickas, Tadas; Ingram, Keisha Laraine. The value framework of sustainable connectivity in business ecosystems // International security in the frame of modern global challenges 2019: collection of research papers / Mykolas Romeris University, Kyiv National Economic University named after Vadym Hetman. Vilnius; Kyiv: Mykolo Romerio universitetas, 2019. ISBN 9789955199625. eISBN 9789955199632. p. 89-92. [M.kr.: S 003].
- Ingram, Keisha LaRaine. Human-centric innovation ecosystems // Social transformations in contemporary society: proceedings of annual international conference for young researchers. Vilnius: Mykolo Romerio universitetas. eISSN 2345-0126. 2018, t. 6, p. 66-77. [DOAJ] [M.kr.: S 003].

- Ingram, Keisha Laraine. Human-centric innovation ecosystems theories // International scientific conference for young researchers „Social transformations in contemporary society 2018“: abstract book, 7-8 June, 2018, Vilnius-Net / Mykolas Romeris University; Doctoral candidates' association. Vilnius: Mykolo Romerio universitetas. eISSN 2424-5631. 2018, 2018, p. 21-22. [M.kr.: S 003].

Other publications. List of scientific publications not related to the dissertation results. (A) Publications in research journals and conference proceedings, (B) Conference presentations and (C) Peer-reviewed articles from conference proceedings that appear in Web of Science and/or Scopus DB:

(A) Publications in research journals and conference proceedings

- Ingram, Keisha Laraine. Intellectual property protection for brand Jamaica's creative industries // Socialinės technologijos: mokslo darbai = Social technologies: research papers. Vilnius: Mykolo Romerio universitetas. ISSN 2029-7564. 2014, [Nr.] 4(1), p. 151-167. DOI: 10.13165/ST-14-4-1-10. [DOAJ; Academic Search Research and Developement (EBSCO)] [M.kr.: S 003]

(B) Conference presentations:

- Ingram, Keisha Laraine. Internet connectivity and the cloud // Social technologies'15: Development of social technologies in the complex world: E-health: conference abstracts, September 24-25, 2015 [Elektroninis išteklius] / Mykolas Romeris University. Vilnius: Mykolas Romeris University, 2015. ISBN 9789955197577. p. 19. [M.kr.: S 003]
- Ingram, Keisha Laraine. Generating online equity for Brand Jamaica through intellectual property administration // SOCIN 2013: Social technologies'13. Development of social technologies in the complex world: special focus on e-health: conference abstracts: 10-11 October 2013 [Elektroninis išteklius] / Mykolas Romeris University. Vilnius: Mykolas Romeris University, 2013. ISBN 9789955195870. P. 29-30. [M.kr.: S 003]
- Ingram, Keisha Laraine. Sustainable Connectivity and One Asia Community // One Asia Convention, Seoul 2019: proceedings. 5-6 August 2019, Lotte Hotel Seoul (Sogongdong) / Konkuk University. Seoul: One Asia Foundation. 2019, p. 120-126. [M.kr.: S 003]

(C) Peer-reviewed articles from conference proceedings that appear in Web of Science and/or Scopus DB:

- Nitsenko, Vitalii; Kotenko, Sergiy; Hanzhurenko, Iryna; Ingram, Keisha Laraine. Determination of Weight Coefficients for Stochastic and Fuzzy Risks for Multimodal Transportation // Journal of physics: conference series: The 2nd Joint International Conference on Emerging Computing Technology and Sports (JICETS) 2019 25-27 November 2019, Bandung, Indonesia. Bristol: Institute of Physics Publishing Ltd. ISSN 1742-6588. eISSN 1742-6596. 2020, vol. 1529, 032007, p. 2-8. DOI: 10.1088/1742-6596/1529/3/032007. [Conference Proceedings Citation Index - Science (Web of Science)] [CiteScore: 0,51, SNIP: 0,454, SJR: 0,221, kvartilis: Q4 (2018, Scopus Sources)] [M.kr.: S 003]

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AUKŠTOJO MOKSLO POLITIKOS ĮTAKA Į ŽMOGŲ ORIENTUOTŲ INOVACIJŲ EKOSISTEMŲ PLĖTRAI LIETUVOJE

Daktaro disertacijos santrauka
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Mokslo daktaro disertacija rengta 2016–2020 metais Mykolo Romerio universitete pagal Vytauto Didžiojo universitetui su Klaipėdos universitetu, Mykolo Romerio universitetu ir Šiaulių universitetu Lietuvos Respublikos švietimo, mokslo ir sporto ministro 2019 m. vasario 22 d. įsakymu Nr. V-160 suteiktą doktorantūros teisę.

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AUKŠTOJO MOKSLO POLITIKOS ĮTAKA Į ŽMOGŲ ORIENTUOTŲ INOVACIJŲ EKOSISTEMŲ PLĖTRAI LIETUVOJE

ĮVADAS

Disertacijos temos aktualumas. Visas ekonomiškai pažangias valstybes vienija bendras inovacijas užtikrinantis elementas: talentingi žmogiškieji ištekliai. Šalyse, kur inovacijos diegiamos vidutiniu tempu, daroma prielaida, kad švietimas nebūtinai prisideda prie didesnės ekonominės naudos kūrimo (Jucevičius, 2004). Tačiau universitetų, vyriausybių ir pramonės bendradarbiavimo platformos, užtikrinančios žinių ir gebėjimų komercializavimą inovacijų diegimui (Lowe ir Marriott, 2006), potencialiai galėtų veikti geriau, jei būtų taikomas strateginis į žmogų orientuotas požiūris. Taigi, į žmogų orientuotų inovacijų ekosistemų kūrimas yra būtinas, kadangi toks požiūris yra esminis, kai orientacija į žmogų sudaro inovacijų pagrindą, o kryptingos aukštojo mokslo programos, sukurtos atsižvelgiant į inovacijas, sudaro prielaidas probelmų sprendimų paieškoms į inovacijas orientuoto žmogiškojo kapitalo ugdymui (Weisberg, 2006; Sternberg, 2009; Isaksen, Dorval ir Treffinger, 2010; Proctor, 2018). Sisteminga kritinė literatūros analizė išryškino keletą vadybos mokslui aktualių problemų:

- Tradiciškai aukštojo mokslo sektoriuje vyrauja požiūris akcentuojantis būtinybę ugdyti bei kelti žmogiškųjų išteklių kvalifikaciją inovacijų srityje, tačiau stokojama probleminių sprendimų paieškos aspektų ir jų svarbos atsižvelgiant į inovacijas supratimo, kas pasireiškia kūrybiškumo procesų iteracijos, empatijos bei tarpdisciplininiuose požiūriuose (Isaksen, Dorval, Treffinger, 2010). Tokie bruožai, tolygūs į žmogų orientuotam požiūriui, pritaikyti inovacijoms įgalinti, leidžia jų galutiniams vartotojams visiškai įsitraukti į problemų sprendimo procesą (Roser ir kiti, 2009; Smorodinskaya ir kiti, 2017; Luthans, Youssef ir Rawski, 2011; Proctor, 2018). Iš esmės žmogiškieji ištekliai yra linkę į inovacijas žiūrėti abstrakčiai, kai inovacijos kuriamos žmonėms, bet ne kartu su tais, kam jos turėtų turėti įtakos. Tai nulemia ir aukštojo mokslo nusišalinimą nuo inovacijų bei inertiškumą joms, ypač kalbant apie žmogiškųjų išteklių rengimą problemų sprendimų paieškoms (Buchori ir Malik, 2004; den Ouden, 2011; Naqshbandi, 2017; von Stamm, 2011; Choudhary, 2017);
- Problemų sprendimas yra svarbus inovacijų kokybę bei inovacijų ekosistemas apibūdinantis požymis (Luthans, Youssef ir Rawski, 2011; Proctor, 2018). Esant idealioms sąlygoms universitetų reglamentavimas galėtų tapti atspirties tašku kuriant į žmogų orientuotas inovacijų ekosistemas, kadangi jose sukuriama puiki aplinka, kai be formalaus švietimo ir į inovacijas nukreptų papildomų mokymų, gali būti skatinama galimybė steigti žmogiškųjų išteklių ugdymu suinteresuotųjų šalių bendradarbiavimo ekosistemas (Jongbloed, Enders ir Salerno, 2008; OECD,

2017). Visgi, kaip potencialus kokybės ekosistemų iniciatorius ir bendrakūrėjas, aukštojo mokslo sektorius didžiausią poveikį šalies inovacijoms daro kasmet išleisdamas didelį žmogiškųjų išteklių kiekį, taigi svarbu, kad šią tendenciją palaikanti politika užtikrintų, kad aukštojo mokslo sistemoje parengtas talentingas žmogiškasis kapitalas prisidėtų prie kokybiškų inovacijų bei rezultatų (Europos Komisija, 2003; Laredo ir kiti, 2007; Ramirez-Corcoles ir Manzaneque-Lizano, 2015; Zaharia ir kiti, 2016; Pedro ir kiti, 2019; Chang ir kiti, 2019);

– Galimybės pritaikyti ekosistemų teorijas, tokias kaip verslo ekosistemų, verslumo ekosistemų, inovacijų ekosistemų ir žiniomis grindžiamų ekosistemų (*ang. business ecosystems, entrepreneurial ecosystems, innovation ecosystems and knowledge-based ecosystems*) teorijas, yra reikšmingos, siekiant padidinti aukštojo mokslo sektoriaus indėlį į inovacijas (Iansiti ir Levien, 2004; Moore, 1993: 1996; Pralad, 2005; van der Borgh ir kiti, 2012). Tačiau, žinių visuomenės sąlygomis išaugo į žmogų orientuoto požiūrio integracijos svarba, siekiant užtikrinti inovacijų vertę, atsižvelgiant į kitas susijusių veiklų, nukreiptų į žmones, skaičių (Moore, 1993: 1996; Buchori ir Malik 2004; den Ouden, 2011; Naqshbandi, 2017; von Stamm, 2011; den Ouden, 2011; Choudhary, 2017). Aukštojo mokslo sektorius nėra išimtis. Ši disertacija skirta naujų žinių apie tai, kaip į žmogų orientuotos inovacijų ekosistemos, kaip aukštojo mokslo sektoriaus priemonė, gali strategiškai užtikrinti vertę visoms suinteresuotoms šalims ir ekosistemų naudos gavėjams, sukūrimą.

Mokslinės problemos ištirtumas. Disertacija grindžiama į žmogų orientuotu požiūriu į inovacijas žinių visuomenės eros kontekste. Kokybiškas žmogiškasis kapitalas inovacijoms tradiciškai ugdomas ir plėtojamas formaliose aukštojo mokslo sektoriaus sistemose, kurias nulemia palaikančios vidinės ir išorinės į žmogų orientuotų inovacijų ekosistemų sąlygos. Į žmogų orientuotų inovacijų ekosistemų taikymas yra nepakankamai ištirta tema, tačiau jos svarbą pagrindžia esminiai žinių visuomenės bruožai. Terminas „į žmogų orientuota inovacija“ dažniausia yra susijęs ir nagrinėjamas išmaniųjų technologijų, dirbtinio intelekto ir robotikos srityse, o į žmogų orientuotas požiūris rinkodaros vadybos srityje yra susijęs su keletu terminų, tokių kaip „į vartotoją orientuotas, į klientą orientuotas, į žmogų orientuotas arba sutelktas į žmones“, kurie visi yra į žmogų orientuoti pavadinimai, susiję su produkto pasiūlos objektu. Į žmogų orientuota inovacija vertinama žymių pasaulinių mokslinių tyrimų centrų, organizacijų ir įmonių, taikant tokius rodiklius kaip pasaulinis inovacijų indeksas (GII-Global Innovation Index) (Kornelio universitetas, INSEAD ir WIPO; 2014, IBM ,2020, Fujitsu ,2014) bei į žmogų orientuotas požiūris, kuris taikomas kaip strategija, skirta, kad žinių visuomenėje būtų sukurta vertė. Į žmogų orientuotos inovacijų ekosistemos per žmogiškąjį veiksnį veikia kaip į žmogų orientuotų inovacijų strateginė priemonė ir užtikrina jų įgyvendinimo bei plėtojimo aspektus (Alpkan ir kiti, 2010; Mahsudas, Yukl ir Prussia, 2011; Mariz-Perez ir kiti, 2012; Prajogo ir Oke, 2016; Kianto, Sáenz ir Aramburu, 2017). Žmogiškojo kapitalo vaidmuo ir socialinė vertė įmonių ar institucijų sėkmei nustatyta atlikus tyrimus pažangios ekonomikos sąlygomis, kur gaunama nauda ir skatinamos inovacijas (Laužikas ir Miliūtė, 2020). Šis aspektas yra esminis didinant žmogiškųjų išteklių intelektinį pajėgumą šalių regionei plėtrai (Neverauskienė ir Gruževskis, 2009; Laužikas ir Miliūtė, 2020a; Laužikas ir Miliūtė, 2020b; Szara ir Ślusarczyk, 2020). Žmogiškojo kapitalo plėtros tyrimai įvertino įvairias investicijų galimybes ir žmogiškojo kapitalo integraciją į darbo rinką nacionalinei plėtrai užtikrinti ir atskleidė, kad nors regioniniu lygmeniu stokojama sąlygų suaugusiesiems, norintiems įsidarbinti ar persikvalifikuoti, yra būtina, kad investicijos kvalifikacijai ar perkvalifikavimui atsižvelgtų į žmogiškųjų išteklių tobulinimą inovacijoms užtikrinti (Rodríguez-Pose ir Vilalta-Bufí, 2005; Neverauskienė ir Gruževskis, 2009; Sverdlova, 2014; Laskowska ir Dańska-Borsiak, 2016; Aleknavičiūtė, Skvarciany ir Survilaitė, 2016; Prakapavičiūtė ir Korsakienė, 2016; Kottaridi, Louloudi ir Karkalakos, 2019; Laužikas ir Miliūtė, 2020a; Laužikas ir Miliūtė, 2020b; Szara ir Ślusarczyk 2020; Capsada-Munsech ir Valiente, 2020; Delaney, 2020). Be to, žmogiškojo kapitalo sąvoka nėra tinkamai perteikta individų asmeninių savybių (charakteristikų) prasme, o yra apsiribota asmeninių savybių (bendrosios kompetencijos) stiprinimu darbuotojų kvalifikacijos struktūroje (Heckman ir Rubenstein, 2001; Heckman ir Carneiro, 2003; Heckman, 2007; Heckman, 2008; Neverauskienė ir Gruževskis, 2009; APA, 2018; Holmberg-Wright ir Hribar, 2016; Alva, 2019; Laužikas ir Miliūtė, 2020a; Laužikas ir Miliūtė, 2020b; Szara ir Ślusarczyk 2020). Eilė tyrimų, atliktų aukštojo mokslo politikos tematika inovacijų srityje, nustatė aukštojo mokslo sektoriaus sąsają su konkurencingumu ir ekonomikos plėtra, tačiau yra stokojama politikos poveikio į žmogų orientuotų inovacijų ekosistemų plėtrai vertinimo. Aukštojo mokslo politikos poveikis yra labai reikšmingas, ir kalbant apie inovacijų ekosistemas, daugelis tyrėjų jį nagrinėjo žinių perdavimo ir žinių šaltinių užtikrinimo kontekste (Frankort, 2013; Schofield, 2013; Belitski ir Heron, 2017; O›Reilly ir kiti, 2019; Appio ir kiti, 2019), universitetų ir pramonės bendradarbiavimo (Schaeffer ir kiti, 2018; Ranga ir kiti, 2017; Markkula ir Kune, 2015; Jin-fu, 2010; Mascarenhas ir kiti, 2018) verslumo (Portuguez Castro ir kiti, 2019; Belitski ir Heron, 2017; Bischoff, 2018; Carvalho ir kiti, 2010; Brush, 2014) išmaniosios specializacijos (Romano ir kiti, 2014; Jucevičius ir kiti, 2016; Lopes ir kiti, 2018; Lopes ir kiti, 2020; Santos ir Caseiro, 2015; Nieth ir kiti, 2018; Schiuma ir Carlucci, 2018), verslumo universitetų (Guerrero ir kiti, 2016; Schiuma ir Carlucci, 2018; Secundo ir kiti, 2019; Markkula ir Kune, 2015; Romano ir kiti , 2014), atvirų naujovių (Carayannis ir Campbell, 2011; Schiuma ir Carlucci, 2018), socialinės naujovės (Romano ir kiti, 2014;Markkula ir Kune, 2015;Schaeffer ir kiti, 2018; Appio ir kiti, 2019), dinaminių pajėgumų prielaidų kontekste (Heaton, Siegel and Teece, 2019).

Į žmogų orientuotų inovacijų ekosistemos yra strateginė priemonė, kuri galėtų pagerinti kaip inovacijų, taip ir aukštojo mokslo rezultatus. ES aukštojo mokslo sektorius per pastaruosius tris dešimtmečius nuolat buvo reformuojamas abiem klausimams spręsti (Nokkala, 2007; Corbett, 2011; Hoffman ir Holzhuter, 2012; Enders ir Westerheijden, 2011; Lipnicka ir Verhoeven, 2014; Jongbloed, Enders ir Salerno, 2008; EBPO, 2017; Europos Komisija, 2018; Europos Komisija, 2019). Dėl gebėjimų neatitikimo, lėmusio žemą darbo našumą, bei dėl ciklinių darbo rinkos svyravimų ir regioninės inovacijų plėtros, šis netinkamas paskirstymas lėmė nuolatinį žmogiškojo kapitalo veiklos rezultatų mažėjimą (Stoll, 2005; Galgóczi ir Leschke, 2016; McGuinness, Konstantinos ir Redmond, 2017; WEF, 2019). Politikos planavimo etape aukštasis mokslas turėtų apimti strategijas, kuriomis būtų skatinami bendradarbiavimo veiklų rezultatai, bendrai sprendžiantys gabumų neatitikimų vadybos ir talentų ugdymo uždavinius. Šiuo metu struktūriniai fondai sprendžia šias problemas, tačiau į žmogų orientuotų inovacijų ekosistemų suinteresuotosios šalys ir naudos gavėjai galėtų bendrai sukurti į žmogų orientuotas iniciatyvas sprendžiant talentų ugdymo ir gebėjimų nesuderinamumo problemas. Harmoninga ekosistemos aplinka priklauso nuo valdymo strateginių tikslų, skirtų išlikimui ir vertės kūrimui, integravimo. Platūs aukštojo mokslo tinklai jau turi paskatų ir priemonių tokioms aplinkoms remti, siekiant padidinti sektoriaus indėlį į inovacijas (Mason, Williams ir Cranmer, 2009; Holmsas ir Mayhew, 2015; Delteil ir Kirov, 2016; Hiuston ir kiti, 2016; Camilleri ir Camilleri, 2016; Dewi ir Suharti, 2018; Editor, 2018; Capsada-Munsech ir Valiente, 2020). Tačiau kokybiškos priemonės, taikomos ekosistemų struktūros rėmuose, galėtų padidinti apčiuopiamus aukštojo mokslo sektoriaus indėlio į inovacijas žinių ir komercinėje ekonomikoje rezultatus. Tai būtų naudinga vertinant tikrąjį gebėjimų neatitikimo lygį šiame sektoriuje.

Ekosistemų tinklų vidaus ir išorės aplinkos nulemta vertybių sistema yra labai svarbi užtikrinant sėkmę bendradarbiavimo ir jį stiprinančių sąjungų dėka (Iansiti ir Levien, 2004). Tai pasakytina ir apie aukštojo mokslo sektorių, kur atlikti moksliniai tyrimai nustatė didesnį pasitenkinimo laipsnį rezultatais ir sukurta verte. Be to, vertinant inovacijų plėtrą pramonės įmonėse reikia ištirti, kaip suvokiama rizika ir grėsmės, darančios poveikį inovacinei veiklai, kas galėtų trukdyti pasiekti geriausią reultatą (Penrose, 1959; Schultz, 1960; Schultz, 1961; Romer, 1986; Lucas, 1988; Barro, 1990; Teece ir kit, 1997; Heckman ir Rubenstein, 2001; Heckman ir Carneiro, 2003; Kamath, 2007; Al-Alawi ir kiti, 2007; Heckman, 2007; Heckman, 2008; Ramírez-Córcoles ir Gordillo, 2014; Mahoney ir Kor, 2015; Pedro ir kiti, 2019; Chukurna ir kiti, 2020). Taikant į žmogų orientuotų inovacijų ekosistemų principus aukštojo mokslo sektoriuje, galima teigti, kad didesnį indėlį į inovacijų sėkmę įneša tvirtas bendradarbiavimas, pasitikėjimas ir tvarūs sprendimai ekosistemų struktūros rėmuose. Į žmogų orientuotų inovacijų ekosistemų valdymas ir vadyba turėtų apimti naujus viešojo valdymo modelio mokslinius tyrimus ir teorinės sistemos kūrimą, atsižvelgiant į šiuolaikinę į inovacijas orientuoto privataus sektoriaus organizacijų praktiką. Tokie tyrimai įgalina naujų žinių apie inovacijų ekosistemas kūrimą, kai yra pritaikomas į žmogų orientuotas požiūris, ir taip prisidedama prie naujų institucinių ir išteklių priklausomybės teorijų (*New Institutional and Resources Dependency Theories*) vadybos mokslo srityje.

Mokslinė problema. Kokie yra į žmogų orientuotų inovacijų ekosistemų plėtros teoriniai principai ir kaip turėtų būti vertinamas aukštojo mokslo politikos poveikis.

Disertacijos tyrimo objektas yra įvertinti aukštojo mokslo politikos poveikį į žmogų orientuotoms inovacijų ekosistemoms.

Disertacijos tikslas. Empiriškai įvertinti aukštojo mokslo politikos poveikį į žmogų orientuotoms inovacijų ekosistemoms. Vertinimo metu bus parengti pasiūlymai, kuriais būtų remiamasi į žmogų orientuotų inovacijų ekosistemų valdymas ir strateginis taikymas, siekiant sustiprinti aukštojo mokslo sektoriaus konkurencingumą.

Disertacijos uždaviniai, suformuluoti disertacijos tikslui pasiekti:

1. Kritiškai išanalizuoti literatūrą apie ekosistemas, žmogiškąjį kapitalą, aukštojo mokslo sistemas ir sukurti konceptualų ekosistemos modelį.
2. Atlikti empirinius tyrimus, siekiant įvertinti į žmogų orientuotos inovacijų ekosistemos, sukurtos naudojant Lietuvą kaip eksperimentinį atvejį, svarbą;
3. Nustatyti į žmogų orientuotų inovacijų ekosistemų aukštojo mokslo sektoriuje galimybes remiantis pagrindinėmis išvadomis ir jų pritaikymu valdant ir planuojant institucijas ir išteklius;
4. Remiantis pagrindinėmis empirinių tyrimų išvadų įžvalgomis pasiūlyti naudoti į žmogų orientuotų inovacijų ekosistemas kaip strategijos kūrimo šaltinį priimant sprendimus ir planuojant procesus aukštojo mokslo sektoriuje.

Disertacijoje taikomi tyrimo metodai. Sisteminė, kritinė mokslinės literatūros ir straipsnių apžvalga. ES valstybių narių nacionalinių dokumentų apie politiką dėl aukštojo mokslo ir inovacijų rezultatų, pagrįstų naujojo viešojo valdymo, naujosios viešosios vadybos ir naujosios viešosios politikos teorijų perspektyvoje (*New Public Governance, New Public Management, New Public Policy*), atvejų apžvalga. Be to, atliekant analizę būtina įvertinti aukštojo mokslo sektoriaus ekosistemas, žmogiškąjį kapitalą ir institucijas pagal naujas institucines ir išteklių priklausomybės teorijas (*New Institutional and Resources Dependency Theories*), kadangi ištekliai ir institucijos yra apjungtos tarpusavyje pagal nustatytus inovacijų ir ekosistemų plėtros tikslus. Buvo sukurtas teorinis modelis, skirtas į žmogų orientuotoms inovacijų ekosistemoms, siekiant nustatyti suinteresuotas šalis, naudos gavėjus bei jų vaidmenį ir procesus, apibūdinančius, kaip ekosistema turėtų veikti kiekviename lygmenyje, siekiant užtikrinti vertės kūrimą. Siekiant patikrinti, ar sukurtas teorinis modelis yra teisingas ir tinkamas taikymui kaip strateginė aukštojo mokslo sektoriaus priemonė, būtina atlikti kokybinį atvejo tyrimą ir gauti įžvalgų iš ekspertų, turinčių mokslo ir praktinių žinių šioje srityje. Prieš renkant duomenis atlikti nestruktūrizuoti stebėjimai aukštojo mokslo aplinkoje. Tada buvo taikomi šie duomenų rinkimo metodai šioje srityje: a) pokalbių su ekspertais formalizavimas; b) Lietuvos Respublikos atvejo tyrimas; c) nuolatinis duomenų lyginimo procesas, duomenų rinkimas, kodavimas ir atranka naudojant Nvivo (2019), siekiant įvertinti kokybinius į žmogų orientuotų inovacijų ekosistemų plėtojimo aspektus pagal ekspertų atsakymus. Kitas žingsnis yra vertinti rezultatus, aukštojo mokslo politikos poveikį atsižvelgiant į strateginius aukštojo mokslo sektoriaus poreikius. Tai buvo padaryta atliekant indukcinę tyrimo rezultatų analizę.

Disertacijos mokslinis naujumas. Naujumą nulemia mokslinių tyrimų tikslas ir uždaviniai. Atliekant mokslinius tyrimus, disertacija žymiai praturtina žinias strateginio valdymo ir planavimo bei vadybos mokslo srityje šiais būdais:

1. Į žmogų orientuotų inovacijų ekosistemų koncepcija apibrėžiama pagal tai, kaip ekosistema plėtojama naudojant į žmogų orientuotus požymius, kad būtų pasiekti gebėjimai, naudingi kokybiškoms inovacijoms kurti, naudojant taikomus formaliojo aukštojo mokslo metodus ir mokymus.

2. Atlikus kritinę mokslinės literatūros apie ekosistemas, žmogiškąjį kapitalą, aukštojo mokslo sistemas apžvalgą, buvo sukurta į žmogų orientuotos inovacijų ekosistemos konceptualus modelis. Sukurtas modelis leidžia įvertinti vertės kūrimą suinteresuotosioms šalims ir aukštojo mokslo sektoriaus naudos gavėjams ekosistemoje visais lygmenimis.
3. Į žmones orientuotų inovacijų ekosistemų aktualumas pabrėžiamas atsižvelgiant į tai, kad jos naudojamos kaip strateginė aukštojo mokslo sektoriaus priemonė. Į žmogų orientuotų aukštojo mokslo sektoriaus inovacijų ekosistemų veiksmingo panaudojimo tikslinės sritys vertinamos atsižvelgiant į ekspertų įžvalgas:
   3.1. Bendradarbiavimo tinklų su suinteresuotomis šalimis ir naudos gavėjais stiprinimas siekiant spręsti išmaniosios specializacijos ir gebėjimų neatitikimų problemas, kai viskas turėtų būti orientuota į naują praktiką, mokymus arba inovatyvius mokslinių tyrimų studijų programas aukštojo mokslo institucijose.
   3.2. Suderinti aukštojo mokslo institucijų studijų programas ir darbo rinkos poreikius kolektyviai remiant ekosistemos misiją ir funkcijų tikslus pagal kiekvieno iš suinteresuotųjų šalių ir naudos gavėjų poreikius, kas stiprintų aukštojo mokslo sektoriaus rezultatus, struktūrą ir funkcijas tiek kokybine, tiek kiekybine prasme.
   3.3. Neaukštojo mokslo veiksnių, susijusių su žmogiškojo kapitalo plėtojimu, siekiant prisidėti prie žinių ir komercinės ekonomikos rezultatų, vertinimas būtų stebimas pagal parengtus ekosistemos kokybės užtikrinimo rodiklius.
   3.4. Socialinės ir ekonominės, pramonės, akademinės bendruomenės ir įvairių suinteresuotųjų subjektų sektorių aplinkos svaba į žmogų orientuotoms inovacijų ekosistemoms turi būti vertinama kokybės užtikrinimo rodikliais, siekiant nustatyti, kaip šie veiksniai padeda ekosistemoms išlikti.
   3.5. Priemonės ir ištekliai, sukurti siekiant įvertinti veiklą, procesus ir poveikį ekosistemų plėtrai, turėtų būti naudojami priklausomai nuo gaunamų rezultatų.
   3.6. Kompleksinis požiūris į paramą aukštojo mokslo sektoriaus valdymo grupėms analizuojant ir priimant sprendimus ekosistemų strategijoje didina sektoriaus konkurencinį pranašumą.
4. Konceptualiai į žmogų orientuotų inovacijų ekosistemų padėtis yra nustatyta strateginio aukštojo mokslo sektoriaus politikos planavimo etape.
5. Į žmogų orientuotos inovacijų ekosistemos yra strateginis tikslas, atitinkantis inovacijas remiančių aukštojo mokslo institucijų misiją ir viziją.

Ginamieji teiginiai.

– Į žmogų orientuotų inovacijų ekosistemų taikymas aukštojo mokslo sektoriaus politikos planavimo etape veikia per bendradarbiavimo tinklus naudojant strategijas, parengtas siekiant kolektyviai spręsti šio sektoriaus talentų ugdymo problemas ir iššūkius.
– Harmoningos ekosistemos aplinkos kūrimo aukštojo mokslo sektoriuje problema yra į žmogų orientuotų inovacijų ekosistemų integravimas kiekvienoje ins-

titucijoje pagal politikos nustatytus valdymo tikslus; dabartinės tokios aplinkos rėmimo paskatos įgauna klasterių tinklų biotechnologijų, nanotechnologijų ir finansinių technologijų sektoriuose pavidalą, kuris yra sunkiai pritaikomas stambiems aukštojo mokslo sektoriaus tinklams.

- Naudojant į žmogų orientuotas inovacijų ekosistemas sektoriaus indėlis ir būsimi veiklos rezultatai būtų vertinami priklausomai nuo gaunamų rezultatų; šiuo atveju trūksta kokybinių priemonių, skirtų įvertinti apčiuopiamus aukštojo mokslo sektoriaus indėlio į inovacijas žinių ir komercinės ekonomikos sąlygomis aspektus inovacijų ekosistemų dėka.
- Į žmogų orientuotų inovacijų ekosistemų vertė nustatoma pagal ekosistemos indėlio lygį į žinių ir komercinę ekonomiką; tai atskleistų aukštojo mokslo sektoriaus nustatyti kokybės užtikrinimo rodikliai, skirti ekosistemai stebėti.

Disertacijos tyrimų pagrindinės išvados. Atlikus tyrimą buvo padarytos šios esminės išvados:

- Į žmogų orientuotos inovacijų ekosistemos turi būti įtrauktos į aukštojo mokslo sektoriaus dalyvių tinklą. Dėl strateginio ekosistemų pobūdžio siūloma tai daryti politikos kūrimo etape siekiant remti aukštojo mokslo sektoriaus valdymo funkcijas, viziją ir misiją plėtojant žmogiškąjį kapitalą inovacijų srityje.
- Lietuvos atvejo analizė atskleidė, kad su švietimu ir mokymais susijusi politika didina suinteresuotųjų šalių ir naudos gavėjų iniciatyvą rinktis inovacijų ekosistemos plėtojimo rėmimo metodus. Taigi, planavimo etape politikos poveikis į žmogų orientuotų inovacijų ekosistemų plėtrai yra vertinamas pagal tai, kokio pobūdžio sprendimai yra suformuluoti stiprinant ekosistemų suinteresuotųjų šalių ir naudos gavėjų bendradarbiavimo tinklus.
- Techniškai orientuotos aukštojo mokslo institucijos, puoselėjančios glaudų bendradarbiavimą su suinteresuotomis šalimis ir naudos gavėjais verslo ir pramonės srityse į žmogų orientuotų inovacijų ekosistemų tinkluose, išsiskiria pažangios specializacijos ir verslumo profiliu. Į mokslinius tyrimus orientuotos aukštojo mokslo institucijos, glaudžiai bendradarbiaujančios su partneriais įgyvendinant programos "HORIZONTAS 2020" projektus, konkurencingai rungiasi dėl finansavimo, skirto mokslinių tyrimų veiklai, skatinančiai inovacijas, turi gerus mokslinių tyrimų rezultatus. Šie atvejai parodo, kad glaudi partnerystė ir bendradarbiavimas didina aukštojo mokslo sektoriaus konkurencinį pranašumą.
- Žmogiškojo kapitalo charakteristikos, nulemtos į žmogų orientuotų aukštojo mokslo įstaigų inovacijų ekosistemų vidaus ir išorės aplinkos, išsiskiria geresnėmis savybėmis verslumo srityje, kuris grindžiamas išskirtiniu požiūriu į inovacijas ir bendradarbiavimą. Į žmogų orientuotų inovacijų ekosistemų kokybės užtikrinimo rodikliais vertinami pradiniai kokybiniai duomenys, procesai, rezultatai ir kitos į inovacijas orientuoto žmogiškojo kapitalo charakteristikos. Socialinės ir ekonominės, pramonės, akademinės bendruomenės ir įvairių sektorių suinteresuotųjų šalių aplinkos svarba į žmogų orientuotų inovacijų ekosistemose leidžia parengti kokybės užtikrinimo rodiklius ekosistemos gyvybingumui įvertinti.

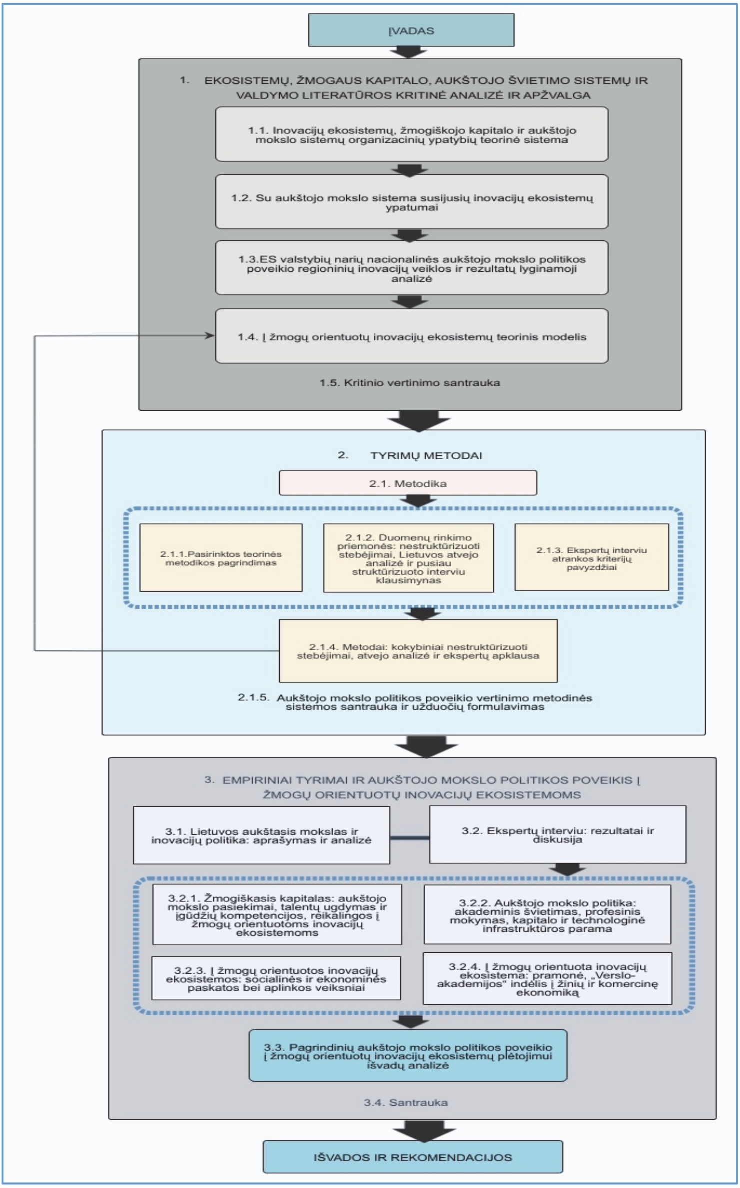
Siūlomos kokybės užtikrinimo stebėsenos priemonės ir ištekliai:
1. Pagaminto *žmogiškojo kapitalo kokybė.*
2. Paskatos talentų ugdymui.
3. Glaudesni pagrindinių dalyvių (suinteresuotųjų šalių ir naudos gavėjų) bendradarbiavimo ryšiai.
4. Aukštojo mokslo sektoriaus institucijų strateginiai tikslai.
5. Aukštojo mokslo sektoriaus institucijų funkcijos (vaidmuo) kuriant inovacijų vertę.
   - Dauguma pažangių aukštojo mokslo sektoriaus institucijų turi glaudžius bendradarbiavimo ryšius, vidaus ir išorės aplinka atitinka jų viziją ir misiją, išryškina inovacijų svarbą veikloje, ugdo kokybišką žmogiškąjį kapitalą ir pritraukia talentus. Išvados atskleidžia, kad strateginis kokybės užtikrinimo rodiklių stebėjimas vertina ekosistemų konkurencinio pranašumo būklę pagal gaunamus rezultatus. Tai parodo, kad ekosistemų bruožai ir požymiai atsižvelgia labiau į kokybę, o ne į kiekybę.
   - Glaudus bendradarbiavimas stiprina aukštojo mokslo sektorių pozicijas žinių ir komercinės ekonomikos sąlygomis. Naudodamasis į žmogų orientuotomis inovacijų ekosistemomis, aukštojo mokslo sektorius prisideda prie nuolatinės šių ekonomikų plėtros užtikrindamas žmogiškojo kapitalo ir sistemos viduje ugdomo talento kokybę. Tiek žinių, tiek komercinei ekonomikai reikalingi žmogiškieji ištekliai, visų pirma, norint sukurti technologijas ir skaitmenines platformas, kad būtų įgalintas greitas žinių pasiekiamumas ir, antra, sukurti įrankius jų komercializavimui. Į žmogų orientuotų inovacijų ekosistemų kokybės užtikrinimo rodikliai vertina praktinio mokymosi ir mokslinių tyrimų integravimo į studijas strategijas kaip žinių ir komercinės ekonomikos indėlio į procesus ir rezultatų santykį.
   - Lietuvos aukštojo mokslo institucijos prisideda tiek prie žinių, tiek prie komercinės ekonomikos, tačiau į žmones orientuotų inovacijų ekosistemų funkcijų nustatymas leistų sistemiškai įvertinti indėlį į komercinę ir žinių ekonomiką.
   - Aukštojo mokslo sektoriaus mokymosi, praktikos ir mokslinių tyrimų sistemos yra labiau suderintos su visomis suinteresuotosiomis šalimis ir naudos gavėjais, ypač atsižvelgiant į lūkesčius dėl aukštojo mokslo rezultatų. Į žmogų orientuotos inovacijų ekosistemos užtikrina, kad jos tinklą formuojančios institucijos suderintų mokymo metodus, kurie yra aktualūs ir paiso žinių visuomenės reikalavimus, naudingi suinteresuotosioms šalims ir dalyviams, ir užtikrina, kad būtų galima įvertinti rezultatų kokybę ir kiekybę. Strateginiai partneriai, atsiradę šių bendradarbiavimo struktūrų ir santykių dėka, turi didesnę reikšmę ir dalyvavimą plėtojant aukštojo mokslo sektoriaus politiką. Žmogiškojo kapitalo ir talentų, įrankių ir sustiprinto bendradarbiavimo tarp institucijų panaudojimas lemia didesnį į žmogų orientuotų inovacijų ekosistemų išteklių optimizavimą.

Disertacijos tyrimų išvadų praktinė vertė. Kompleksinis į žmogų orientuotų inovacijų ekosistemų modelis yra aktualus aukštojo mokslo sektoriui dėl šių priežasčių:
- Į žmogų orientuotos inovacijų ekosistemos yra strateginė valdybos mokslo priemonė užtikrinanti ekosistemų kokybę, kur kuriamos inovacijos suderintos su

suinteresuotųjų šalių ir naudos gavėjų tikslais, misijomis ir funkcijomis. Ekosistema buvo vertinama kokybiškai pagal tai, kaip ji padėjo aukštojo mokslo sektoriui pasiekti tikslus, taigi, kaip strateginė plėtros priemonė, skirta inovacijų vertei užtikrinti. Tai nauja ir svarbu vadybos mokslui.
– Sukurtas į žmogų orientuotų inovacijų ekosistemų teorinis modelis yra svarbus ir aktualus, nes yra tinkamas vertinant mokslinius tyrimus, susijusius su į žmogų orientuotomis inovacijomis, pasitelkiant aukštąjį m turintį žmogiškąjį kapitalą. Tai naujos žinios apie inovacijų ekosistemų ypatybes, kuriose taikomas į žmogiškąjį kapitalą orientuotas požiūris ugdant žmogiškąjį kapitalą aukštojo mokslo sektoriuje.
– Tyrimai papildomai atskleidė dabartinę į žmogaus orientuotų inovacijų ekosistemų padėtį aukštojo mokslo sektoriuje. Tai naujas ir naudingas požiūris, nes kuriami naudingi praktiškai vadybos moksliniai metodai, taikomi siekiant sukurti geresnes kokybišką bendradarbiavimą užtikrinančias strategijas, kurios sukurtų naują sinergiją, didesnį išteklių optimizavimą ir aukštojo mokslo sektoriaus bendrųjų veiklos rezultatų gerinimą sprendžiant problemas, susijusias su visais jo vertinimais suinteresuotomis šalimis ir ekosistemos tinklo naudos gavėjais.

Mokslinės problemos sprendimo pasekmės. Pagrindiniai aukštojo mokslo politikos poveikio į žmogaus orientuotų inovacijų ekosistemų padariniai yra šie:
– Kultūriniai ir socialiniai bei ekonominiai (makro-aplinka). Socialinė, ekonominė ir kultūrinė aplinka taip pat lemia, ar į žmogų orientuotos inovacijų ekosistemos harmoningai plėtojamos, atsižvelgiant į veiksnius, dalyvius ir finansavimą, kad būtų remiama jos, kaip strateginės aukštojo mokslo sektoriaus priemonės, veikla. Institucinis (ezo- ir mezo-aplinka). Institucinį poveikį lemia galimas silpnas institucijų *tarpusavio* ir *vidaus bendradarbiavimas*, slopinantis ekosistemos plėtojimą. Taip pat būtina atsižvelgti į bendrą vidaus ir išorės institucinę aplinką, išteklius, technologijas ir infrastruktūrą, kurių reikia funkcijoms palaikyti.
– Gebėjimų ugdymas (mikro-aplinka). Į žmogų orientuotų charakteristikų, tokių kaip pasitikėjimo, komunikacijos, inovacijoms atviros organizacinės ir institucinės kultūros stoka, yra kelios kliūtys, užkertančios kelią į žmogų orientuotų inovacijų ekosistemų plėtrai aukštojo mokslo institucijose.
– Individualinis (talentas). Individualiu lygmeniu išskiriamos į žmogų orientuotos savybės, tokios kaip gebėjimų ugdymas, tinkamumas ir inovacijoms būdinga motyvacija.

Disertacijos struktūra. Disertacijos struktūra atitinka disertacijos tikslus ir uždavinius. Pirmąją dalį sudaro kritinė mokslinių šaltinių analizė, apžvelgiama literatūra, nagrinėjanti ekosistemas, žmogiškojo kapitalo plėtojimą, aukštojo mokslo sistemas ir valdymą, kas yra būtina kuriant teorinį į žmogų orientuotų inovacijų ekosistemos modelį, naudojamą empiriniams tyrimams atlikti. Antrąją dalį sudaro tyrimo metodikos pagrindimas, metodai ir duomenų rinkimo priemonės. Trečioji dalis apima empirinius tyrimus ir gautų išvadų praktinio pritaikymo vertinimą pagal į žmogų orientuotų inovacijų ekosistemų plėtojimo poveikio analizę. Disertacijos struktūra pateikta 1 paveiksle.



***1 pav.:** Disertacijos struktūra*
Šaltinis: sudaryta autorės

Raktiniai žodžiai: Ekosistemos, aukštasis mokslas, švietimo politika, inovacijos, į žmogų orientuotos inovacijos.

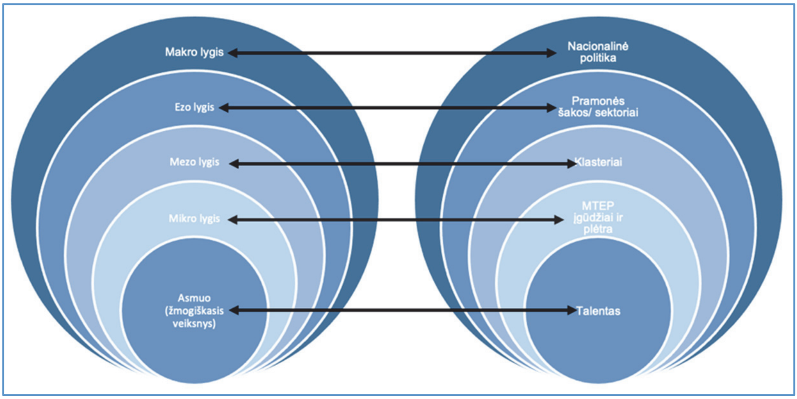
KRITINĖS LITERATŪROS APIE EKOSISTEMAS, ŽMOGIŠKĄJĮ KAPITALĄ IR AUKŠTOJO MOKSLO SISTEMAS BEI VALDYMĄ ANALIZĖS APŽVALGA

Inovacijos ekosistemų, žmogiškojo kapitalo ir į žmogų orientuotų aukštojo mokslo institucijų ypatumai yra pokyčius skatinantys terminai, kurie didina į žmogaus orientuotų inovacijų ekosistemų naujovių socialinę ir ekonominę vertę. Mokslinėje literatūroje inovacijos ekosistemos išsivystė iš verslo į antrepreneriską inovacijos ekosistemos modelį, kuris nėra analogiškas į žmogų orientuotai inovacijos ekosistemai, nors ir turi bendrą veikėją - žmogiškąjį veiksnį. Į žmogų orientuotos inovacijos antropocentriškai apibūdina inovacijas, kurios pagerina žmonių gyvenimo kokybę. Į žmogų orientuotos inovacijų ekosistemos yra tinklai, užtikrinantys kūrybiškumo procesą jame dalyvaujantiems žmonėms. Analogiškai vertinant šias ekosistemas per naują institucinę teoriją, išteklių priklausomybės teoriją ir izomorfizmo institucionalizmą, atskleidžiami pagrindiniai žmogiškojo veiksnio, būtino į žmogų orientuotoms inovacijų ekosistemoms, bruožai. Todėl žmogiškojo veiksnio vaidmuo į žmogų orientuotose inovacijų ekosistemose reikalauja švietimo politikos, kuri skatintų asmenų puoselėjimą, įgūdžių įsisavinimą ir gebėjimų plėtojimą. Žmogiškojo kapitalo kognityviniai gebėjimai, tokie kaip individualūs asmenybės bruožai, pasaulietinis mąstymas, kūrybiškumas, kritinis mąstymas, problemų sprendimas, analitiniai ir sprendimų priėmimo įgūdžiai, taip pat optimizmas, empatija ir motyvacija pabrėžia žmogiškojo kapitalo plėtros ekonominę ir socialinę vertę, kuriamą per visą gyvenimą trunkantį mokymąsi. Siejant visus į žmogų orientuotus elementus tarpusavyje, žmogiškasis kapitalas yra iš tiesų susijęs su kokybiškomis inovacijų ekosistemomis. Be sukauptų gebėjimų ir pagrindinių kompetencijų, įgytų iš *natūralios* žmogų supančios aplinkos, atsiranda neįkainojamo "kapitalo" didinimo svarba.

Analizė taip pat parodė, kad empirinių tyrimų metu reikia atsižvelgti į aukštojo mokslo sistemos modelius, sukurtus vykdant nacionalinę švietimo politiką. Tai būtina, siekiant suprasti į žmogų orientuotų inovacijų ekosistemų plėtojimą ir valdymą, ekosistemos apribojimus ir naudą, žmogiškojo kapitalo bruožus, susijusius su kokybiškais inovacijų rezultatais, aukštojo mokslo sektoriaus išorės ir vidaus tinklo aplinką, taip pat lyginamąją ekosistemos padėtį šiuose aukštojo mokslo sistemų modeliuose. Be to, teiginys, kad nors aukštojo mokslo politika galėtų turėti įtakos būsimai į žmogų orientuotų inovacijų ekosistemų plėtrai, aukštojo mokslo institucijoms būtų naudinga holistiškai įvertinti tokių ekosistemų valdymo iššūkius. Tai lemia didesnį strateginį įžvalgumą apie tai, kaip į žmogų orientuotų inovacijų aspektas progresuoja ekosistemose ir stiprina bendradarbiavimą su kitomis suinteresuotosiomis šalimis, kurios yra būtinos užtikrinant, kad į žmogų orientuotos inovacijų ekosistemos prisidėtų prie kokybiškų inovacijų per talentingą žmogiškąjį kapitalą. Lyginamoji analizė atskleidė pagrindinius atliktos kritinės analizės trūkumus. Remiantis sudarytu teoriniu pagrindu, nustatoma atvejų, kai aukštojo mokslo politikos sistema nulemia į žmogų orientuotų inovacijų ekosistemų plėtojimą, pagrindžiama jos svarbą bei atskleidžiama tokios politikos vieta tarpdisciplininėje inovacijų ir inovacijų ekosistemų valdymo sistemoje.

Atliekant analizę taip pat daugiausia dėmesio buvo skiriama ES iššūkiams, susijusiems su politikos formavimo sistemų valdymo strateginiu požiūriu į inovacijas aukštojo mokslo sektoriuje. Lyginamosios analizės metu aukštojo mokslo sektorius kiekvienu nacionaliniu atveju buvo vertinamas pagal autentišką ir asociatyvią tarpdisciplininę bendradarbiavimo veiklą kiekvienos suinteresuotosios šalies ar institucijos, atsakingos už indėlį kuriant kokybiškas inovacijų ekosistemas, padedant diegti inovacijas, atžvilgiu. Be to, analizė suteikė žinių, grindžiamų asociatyviomis reikšmėmis, svarbioms politikos įgyvendinimui, kuris vykdomas laipsniškai per žmogiškųjų išteklių plėtojimą aukštojo mokslo sektoriaus vidaus ir išorės aplinkoje. Gaunant papildomas įžvalgas apie su aukštojo mokslo sektoriumi susijusių regioninių inovacijų strateginį pagrindą, tai galėtų sukurti naują požiūrį. Išsami analizė suteikė veiksmingą ir įrodymais pagrįstą strateginį švietimo ir inovacijomis grindžiamų ekosistemų planavimą ir valdymą, kas daro teigiamą poveikį į žmogų orientuotų aukštojo mokslo įstaigų inovacijų ekosistemų konkurencingumui.

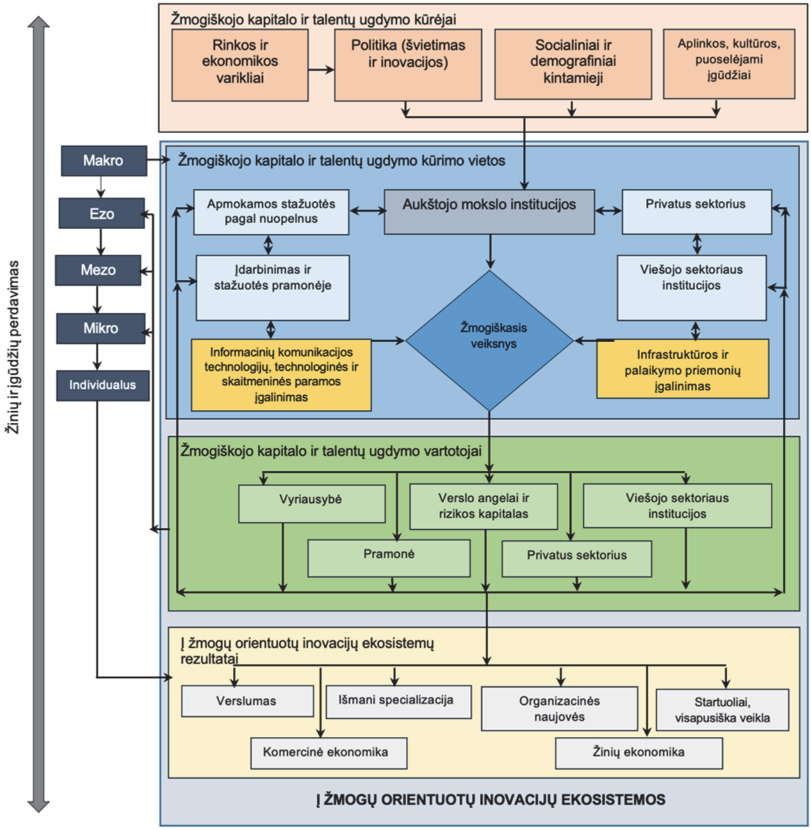
Analizė, nustatanti aukštojo mokslo politikos poveikio į žmogų orientuotų inovacijų ekosistemų koreliaciją, nebuvo visiškai išsami ir paskatino atlikti indukcinius tyrimus. Regioniniu lygmeniu atlikta ekosistemų rūšių analizė, nagrinėjanti, kaip į žmogų orientuoti veiksniai yra susiję su problemų sprendimo procesu nuo aukštojo mokslo iki inovacijų ekosistemų, buvo grindžiama lyginamuoju ES valstybių narių vertinimu. Tai buvo padaryta pagal kiekvieną inovacijų veiklos rezultatų kategoriją, kuri buvo naudojama kaip pirminė imtis. Toliau vertinimas buvo skirstomas į makro-, ezo-, mezo-, mikro-, ir iki žmogiškojo veiksnio lygio, siekiant atskirti į žmogų orientuotų inovacijų ekosistemų tinklų, kaip strateginio valdymo priemonės sistemose, aktualumą.



2 pav. *Inovacijų, modeliuojamų kaip į žmogų orientuotų inovacijų ekosistemų, vertė kiekviename lygyje*

Šaltinis: sudaryta autorės pagal DiMaggio ir Pfeffer ir Salancik, 1978; Powell, 1983; Powell ir DiMaggio, 1991; Moore, 1993; Teece, 2007; Zott ir Amitt, 2010; Nambisan ir Sawhney, 2011; Mitleton-Kelly, 2003; Moore, 1993; Iansiti ir Levien, 2004

Kaip matyti iš 2 paveikslo, inovacijų sąveika ir atitikimas kiekvienam lygmeniui sudaro esminį į žmogų orientuotų inovacijų ekosistemų konceptualų pagrindą. Parengtas teorinis konceptualus modelis aprašo svarbiausius žmogiškojo kapitalo, aukštojo mokslo inovacijų vidaus ir išorės aplinkos veiksnius, visus subjektus, įskaitant suinteresuotąsias šalis ir naudos gavėjus, taip pat neaukštojo švietimo socialinius ir ekonominius veiksnius, kurie strategiškai didina jo indėlį į žinių ir komercinę ekonomiką. Strateginė vertė, sukurta šios ekosistemos dėka vykdant bendradarbiavimo veiklą, investicijos į žmogiškųjų išteklių plėtrą pasitelkiant aukštąjį mokslą, įgūdžių ugdymas, taip pat mokymai sustiprina į žmogų orientuotus veiksnius, būtinus inovacijoms. Remiantis kritine literatūros analize, konceptualus modelis turi dvigubą pritaikymą, kadangi įgūdžiai ir žinios perduodami vienu metu.



3 pav. *Teorinis į žmogų orientuotų inovacijų ekosistemų modelis*

Šaltinis: sudarytas autorės pagal Penrose, 1959; DiMaggio ir Pfeffer ir Salancik, 1978; Powell, 1983; Powell ir DiMaggio, 1991; Moore, 1993; Teece ir kiti, 1997; Mitleton-Kelly, 2003; Iansiti ir Levien, 2004; Al-Alawi ir kiti, 2007; Teece, 2007; Zott ir Amitt, 2010; Nambisan ir Sawhney, 2011; Mahoney ir Kor, 2015; Alva, 2019

3 paveiksle teorinis konceptualus modelis yra apibūdinamas pagal jo kriterijus: *lygiai, aktoriai, procesai, kiekvieno dalyvio vaidmuo* ir *vertės kūrimas kiekviename lygyje.* Tai paaiškinta 1 lentelėje žemiau:

1 lentelė. *Į žmogų orientuotos inovacijų ekosistemos modelio kriterijai ir aprašymas*

Sistemos kriterijai	**Aprašymas / kontrolė**
Lygmenys	Makro, ezo, mezo, mikro, individualus
Suinteresuotosios šalys ir paramos gavėjai	Vyriausybė, pramonė, verslo angelai ir rizikos kapitalas, viešojo sektoriaus institucijos, privatus sektorius, žmogiškasis veiksnys, aukštojo mokslo sektorius;
Procesai	m) sudaryti sąlygas informacinių komunikacijos technologijų, technologinei ir skaitmeninei palaikymo infrastruktūrai; n) infrastruktūros palaikymo įgalinimas; o) politika (švietimas ir inovacijos); p) rinkos ir ekonomikos varomosios jėgos; q) socialiniai ir demografiniai kintamieji; r) aplinkos, kultūros, puoselėjami įgūdžiai
Kiekvieno dalyvio vaidmuo	9) Žmogiškojo kapitalo plėtojimo kūrėjai: politika (švietimas ir inovacijos); 10) Žmogiškojo kapitalo kūrimo ir talentų ugdymo vietos: aukštojo mokslo institucijos, bendradarbiaujančios su privačiu sektoriumi, viešojo sektoriaus institucijomis, nuopelnais grindžiamos mokamosios stažuotės, darbo vietos ir stažuotės pramonėje, grindžiamos informacinių komunikacijos technologijų, technologinės ir skaitmeninės paramos infrastruktūra ir kitos įgalinančios infrastruktūros ir paramos priemones; 11) Žmogiškojo kapitalo ir talentų ugdymo vartotojai: vyriausybė, verslo angelai ir rizikos kapitalas, viešojo sektoriaus institucijos, pramonė, privatus sektorius; 12) Į žmogų *orientuotų inovacijų ekosistemų rezultatai*: verslumas, išmani specializacija, organizacinės inovacijos, startuoliai, visapusiška veikla, žinių ekonomika

Sistemos kriterijai	Aprašymas / kontrolė
Vertės kūrimas kiekviename lygmenyje	***Makro:*** socialinė, ekonominė, geresnė gyvenimo kokybė ir visuomenė; didesnis tyrimų rezultatų komercialiavimas, žinių ekonomika; į žmogų orientuoti sprendimai, kokybiško žmogiškojo kapitalo pritraukimas ir išlaikymas; orientavimas į inovacijas vykdant veiklą, išmanioji specializacija, startuoliai ir visapusiška veikla, verslumas; ***Ezo:*** pagerinta pramonės ir sektorių bendradarbiavimo veikla, strategiškai valdomi pramonės inovacijų tinklai; ***Mezo:*** įvairios, į žmogų orientuotos inovacijų ekosistemos, lengvesnis žinių ir įgūdžių perdavimas siekiant geresnio koordinavimo, glaudesnis bendradarbiavimas; ***Mikro:*** patikimas, atviras bendradarbiavimas, didesnė inovacinių veiklų įvairovė, didesnis aktualių įgūdžių naudojimas, mokymo ir žinių įgūdžių plėtojimas pagal rinkos ir ekonomikos veiksnius, įtraukimas, didesnis pasitenkinimas žmogiškojo kapitalo kokybe, didesnis aukštojo mokslo sektoriaus konkurencingumas; kokybiškos ekosistemos ***Individualus:*** įkvėpti ir kūrybingi žmogiškieji ištekliai, geresnė socialinė ir ekonominė gyvenimo kokybė, kokybiška aukštojo mokslo kvalifikacija, orientavimas į įgūdžius ir žinias, problemų sprendimas, pilietiškumas, pasitikėjimas, atvirumas, verslumo mąstysena, motyvavimas, lyderystė, iniciatyvumas, lankstumas ir pritaikomas požiūris (psichologinis), su pramone susiję įgūdžiai, naudojant praktinę patirtį; globali mąstysena; sprendimo ir atsakomybės priėmimas; strateginis mąstymas; gera komunikacija; bendradarbiavimas; analitinis, kiekybinis mąstymas; orientavimas į riziką

Šaltinis: sudaryta autorės pagal Penrose, 1959; DiMaggio ir Pfeffer ir Salancik, 1978; Powell, 1983; Powell ir DiMaggio, 1991; Moore, 1993; Teece ir kiti, 1997;
Mitleton-Kelly, 2003; Al-Alawi ir kiti, 2007; Teece, 2007; Zott ir Amitt, 2010;
Nambisan ir Sawhney, 2011; Mahoney ir Kor, 2015; Iansiti ir Levien, 2004; Alva, 2019

Į žmogų orientuotų inovacijų ekosistemų teorinio modelio vertės kūrimas iš pradžių yra apibrėžiamas *individualiu* lygmeniu ir yra sudarytas pagal tai, kaip žmogiškasis veiksnys plėtojamas siekiant skatinti inovacijas ir būti jų kūrėju.

Individualiu lygmeniu sistemos vertės kūrimas iliustruojamas atsižvelgiant į naudą, kuri gaunama per aukštojo mokslo studijas ar mokymąsi bei per į žmogų orientuotų inovacijų ekosistemų asociatyvias paskatas. *Mikro* lygmenyje konceptualaus modelio vertės kūrimas iliustruojamas atsižvelgiant į naudą, matomą visiems sistemos dalyviams. *Mezo* lygmenyje konceptualaus modelio vertės kūrimas atskleidžiamas atsižvelgiant į naudą, kurią užtikrina aktyvus bendradarbiavimas, didesnis ir tinkamas žinių, įgūdžių ugdymo ir mokymų aukštojo mokslo sistemoje panaudojimas, atitinkantis aktualius rinkos poreikius. *Ezo* lygmenyje konceptualaus modelio vertės kūrimas atskleidžiamas atsižvelgiant į naudą, kurią to lygmens veikėjai, t. y. Vyriausybė, ministerijų politikos kūrėjai, suinteresuotosios šalys ir ekosistemos naudos gavėjai. *Makro* lygmuo yra susijęs su į žmogų orientuotų inovacijų ekosistemų konceptualaus modelio rezultatais ir nauda visiems ekosistemos dalyviams.

TYRIMŲ METODŲ APŽVALGA IR METODOLOGIJOS MODELIS

Metodologijos pagrindu buvo pasirinkta grindžiamoji teorija (*angl. grounded theory*), siekiant atrinkti duomenis, skirtus aukštojo mokslo politikos poveikio į žmogų orientuotų inovacijų ekosistemų plėtojimo vertinimui. Epistemologijos pagrindu buvo panaudota Čikagos sąveika (*angl. interactionism*), kuri buvo pritaikyta metodologijos pozicionavimui, o pragmatizmas buvo pasirinktas kaip filosofinė pozicija. Mokslinių tyrimų nuoseklumas buvo sistemingai išlaikytas integruojant filosofiją, pasirinktą metodologiją, tyrimų metodus ir priemones. Simbolinė sąveika buvo naudinga analizuoti duomenis, gautus grindžiamosios teorijos, paremtos pragmatizmu, bei mokslinių tyrimų dėka.

Tyrimų duomenų rinkimo priemones sudarė nestruktūrizuoti stebėjimai, atvejo analizė ir pusiau struktūrizuotas interviu klausimynas. Priemonės buvo tinkamos, nes jos papildė kitus pasirinktus kokybinius metodus, naudojamus empiriniuose tyrimuose. Nestruktūrizuotas stebėjimas, kaip bandomasis tyrimo metodas, buvo labai svarbus užtikrinant didelio kiekio duomenų surinkimą pradiniame tyrimo etape. Atvejo analizės metodas suteikė bandomajam tyrimui platesnį tyrinėjimų lauką ir didesnį supratimą dėl sudėtingų klausimų, susijusių su aukštojo mokslo sektoriaus valdymu ir žmogiškojo veiksnio plėtojimu, nukreiptu į žmogų orientuotų inovacijų ekosistemoms.

Papildomi tyrimų duomenys buvo surinkti interviu su ekspertais metu nuo 2019 m. rugsėjo iki 2019 m. spalio mėn. Lietuvoje. Interviu klausimynas buvo parengtas pagal lygiagrečiai plėtojamą teorinį į žmogų orientuotų inovacijų ekosistemų konceptualų modelį, ir koncepcijos buvo analizuojamos kartu su teorinio modelio struktūra. Vienuolika ekspertų sudarė imtį ir atstovavo visoms su tyrimų aplinkai svarbiomis sritimis Lietuvoje. Ekspertų atrankos metodas buvo atliktas pagal „sniego gniūžtiesi“ metodą, suderintą su tiksline atranka.

Teorinė atranka po ekspertų apklausos leido nustatyti proceso konceptualų tankį, kuris analizuoja, kaip gerai visi surinkti duomenys pasiekė prisotinimo lygį. Konceptualus tankis atsiranda, kai visi atsakymai yra vienodi ir interviu metu neatsirado jokios naujos informacijos. Tai pateisina vienuolikos ekspertų atranką tyrimui, kadangi didesnė imtis galėjo sukelti papildomų sunkumų nustatant pagrindines sritis ir temas iš surinktų duomenų.

Kitame tyrimų etape buvo atlikta pokalbių metu surinktų duomenų analizė, naudojant kodavimo procesą. Atrenkant ekspertų atsakymus kokybiniams tematiškai suskirstytų kategorijų duomenims gauti buvo taikomas atviras, ašinis ir teminis kodavimas. Tai leido nustatyti pagrindines tikslines sritis, skirtas įvertinti į žmogų orientuotos inovacijų ekosistemos plėtojimą.

Be to, integruotas kokybinis vertinimas nustatė, kad empirinių tyrimų išvados yra teisingos ir susijusios su sukurta į žmogų orientuotų inovacijų ekosistemų konceptualia sistema. Taigi, ekspertų pusiau struktūrizuotų interviu rezultatai ir atvejo analizė apie Lietuvos Respubliką buvo įvertinti, siekiant gauti įžvalgų apie tai, kaip yra plėtojamos į žmogų orientuotos inovacijų ekosistemos, nustatyti jų naudingumą ir strateginį pritaikomumą kaip priemonės, gerinančios aukštojo mokslo sektoriaus vidaus institucinę aplinką. Aukštojo mokslo politikos poveikio į žmogų orientuotų inovacijų ekosistemų plėtrai vertinimas buvo atliktas, siekiant spręsti šiuos vadybos iššūkius:

(1) apibūdinti į žmogų orientuotų inovacijų ekosistemų strateginio valdymo ir rekomenduojamų kokybinių į žmogų orientuotų atributų rodiklius, taip pat ir jų asociatyvų pritaikymą ekosistemai aukštojo mokslo sektoriuje;
(2) nustatyti koreliaciją tarp talentų ugdymo ir inovacijų žinių ir komercinės ekonomikos srityse;
(3) nustatyti į žmogų orientuotų inovacijų ekosistemų pritaikymą aukštojo mokslo sektoriuje;
(4) įvertinti ir nustatyti svarbiausias žmogiškojo kapitalo, išugdyto aukštojo mokslo inovacijų vidaus ir išorės aplinkoje, savybes. Nustatyti suinteresuotų šalių, dalyvių, neaukštojo mokslo į žmogų orientuotų inovacijų ekosistemų veiksnių vaidmenį plėtojant žmogiškąjį kapitalą ir prisidedant prie žinių ir komercinės ekonomikos;
(5) nustatyti socialinių ir ekonominių, pramonės, akademinės bendruomenės ir sektorių suinteresuotųjų šalių aplinkos svarbą į žmogų orientuotoms inovacijų ekosistemoms.

EMPIRINIŲ TYRIMŲ IR AUKŠTOJO MOKSLO POLITIKOS POVEIKIO Į ŽMOGŲ ORIENTUOTAI INOVACIJŲ EKOSISTEMAI VERTINIMO APŽVALGA

Atvejo analizės rezultatai atskleidė kad Lietuva tebėra viena iš pirmaujančių ES valstybių narių pagal aukštojo išsilavinimo įgijimą. Atvejo analizės rezultatai taip pat parodė, kad veiklos, tiesiogiai siejančios Lietuvos aukštojo mokslo sektorių su pramone ir verslu, skatina kūrybinių industrijų sektoriaus plėtrą tarptautiniu lygmeniu. Nors atvejo analizė parodė, kad aukštojo mokslo sektoriaus tinklų ir infrastruktūros plėtrai reikalingos didelės apimties investicijos, į žmogų orientuotos inovacijų ekosistemos galėtų sudaryti Ekonomikos ir inovacijų ministerijai, Švietimo, mokslo ir sporto ministerijai gaires, kaip šias priemones būtų galima aktyviau panaudoti. Taigi, atsirastų potencialių galimybių, kurios sukurtų pridėtinę vertę visuomenei.

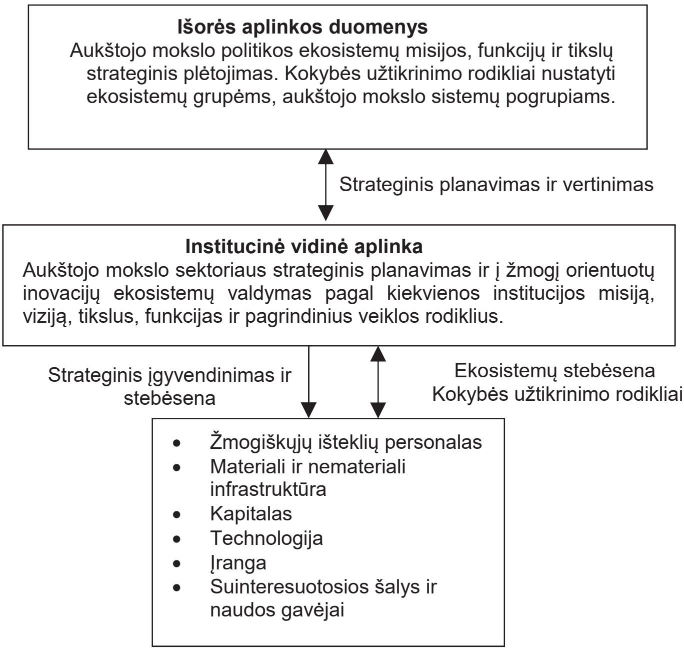
Pagal į žmogų orientuotų inovacijų ekosistemų konceptualų modelį aukštojo mokslo institucijos galėtų labiau prisidėti bendradarbiaudamos su įmonėmis bei tarpusavyje, o ne vien būti absolventų paruošimo šaltiniu. Tai būtų pasiekta perduodant žinias, skleidžiant tyrimų rezultatus ir prižiūrint, kaip žinios naudojamos ir įgyjamos visuomenės labui. Pagal konceptualų modelį verslumas, talentas, doktorantūros studijos (aukštasis mokslas) arba mokslinių tyrimų sektorius taip pat turėtų bendradarbiauti su privataus sektoriaus įmonėmis. Be to, kadangi verslumas yra rodiklis, nustatantis inovacijų reitingą, atvejo analizė parodė, kad Lietuvos aukštojo mokslo sektoriaus absolventai nėra verslūs. Tai lemia absolventų įdarbinimą darbo vietose, kurioms užimti nereikia aukštojo mokslo kvalifikacijos. Tai turi įtakos Lietuvos inovacijų rodikliams.

Į žmogų orientuota inovacijų ekosistema veikia gerai, kai turima aukštojo mokslo kvalifikacija atitinka verslo poreikius. Studentų nuomone, investuoti trejus ar ketverius metus į sistemą, siekiant įgyti pranašumą darbo rinkoje yra naudinga, kai įgyta kvalifikacija yra susijusi su verslo naujovėmis ar operacijomis. Taigi, konceptualus modelis parodo, kad aukštojo mokslo programų strateginis planavimas ir stebėsena sumažina internetinių ar savarankiškų mokymo programų tikimybę aplenkti auditorinį, tradicinį aukštojo mokslo mokymosi metodą šiame sektoriuje. Šios programos paprastai siūlo trumpesnį laikotarpį mokymuisi ir pasirengimui, kurie yra labiau susiję su darbo rinkos poreikiais bei pramonės ir verslo sektoriaus savireguliacija. Parengtas modelis pasiūlytų mišraus požiūrio gaires, kad ši mokymosi alternatyva būtų įtraukta į tradicinį mokymosi metodą.

Taikant į žmogų orientuotą požiūrį į švietimą, veikiantį kaip skaitmeninių ekosistemų tinklų dalis, individualių studijų programų kūrimas suteiktų geresnį būsimos darbo jėgos perėjimą į darbo aplinką. Lietuvoje šių individualių švietimo programų paklausa yra didesnė robotikos, informacinių komunikacijos technologijų ir kitose skaitmeninėse, technologiškai susijusiose švietimo srityse. Taigi, aukštojo mokslo sektorius galėtų perorientuoti savo strategines veiklas, siekiant prisidėti prie “Industry 4.0” ekosistemų plėtros plano Lietuvoje per į žmogų orientuotas inovacijų ekosistemas, kurios ateityje užmegztų simbiozinius santykius inovacijų “sprendimų teikėjo” vaidmenyje. Tai būtų pasiekta vykdant nuolatinę bendradarbiavimo veiklą, kuri prisidėtų prie skaitmeninių technologijų sektoriaus plėtojimo. Tyrimas parodė, kad aukštojo mokslo sektorius, kaip pagrindinė suinteresuotoji šalis, galėtų aktyviai teikti studijų programas tiek magistro, tiek bakalauro lygiu, kurios yra pagrįstos inovacijomis, nustatytoms kaip “sprendimų teikėjų” iniciatyvos pramonės 4.0 plano dalis. Tyrimas taip pat parodė, kad akademinių aukštojo mokslo institucijų sąrašas skiriasi nuo institucijų, kurios dalyvauja inovacinėje veikloje (“sprendimų teikėjų” veikloje). Tai pasiekiama vykdant taikomuosius tyrimus (kapitalas ir technologijos) ir organizuojant stažuotes bei gamybinę praktiką (talentas).

Iš išvadų, susistemintų pagal į žmogų orientuotos inovacijų ekosistemos konceptualų modelį, jo fizinį pagrindą sudarytų tokie apčiuopiami infrastruktūros vienetai, kaip mokslo parkai, mokslinių tyrimų, inovacijų ir plėtros centrai (kompetencijų centrai), laboratorijos ir bandymų centrai ir kt. Išvados taip pat atskleidė jų nematerialią infrastruktūrą, pavyzdžiui, technologijas, informacinių komunikacijos technologijų paslaugas, skaitmenines technologijas ir aukštojo mokslo sektoriaus talentus, ekspertų paslaugų teikėjus, taip pat kitus klasteriais grindžiamus žmogiškuosius išteklius ir asociacijas. Kaip rezultatas, atsiranda simbiozinis ryšys tarp “sprendimų teikėjų” (ekosistemos įgyvendintojų) ir “vartotojų” (naudą iš ekosistemų gaunančios institucijos). Konceptualiame modelyje tai būtų sudaryta iš į žmogų orientuotų inovacijų ekosistemų “gamybos vietų” ir “gamintojų”. Bendras elementas tarp “sprendimų teikėjų” ir “vartotojų”, panašus į aptinkamą į žmogų orientuotos inovacijų ekosistemos konceptualiame modelyje, yra talentas. Be to, atvejo analizė parodė, kad siekiant padidinti inovacijų potencialą ir labiau suvienijus Švietimo, mokslo ir sporto ministerijos ir Inovacijų ir ekonomikos ministerijos veiklą, rekomenduojama ekosistema remtųsi konceptualaus modelio siūlomomis strategijomis. Abi ministerijos, kaip suinteresuotosios šalys ir naudos gavėjos, galėtų nustatyti kriterijus, susijusius su valstybės valdomais ištekliais, tiek materialiojo, tiek nematerialaus pobūdžio, kurių reikia nustatant ir didinant inovatyvių veiklų lygį Lietuvoje pasitelkiant talentą, technologijas, išmaniąją specializaciją ir kapitalo infrastruktūrą, kurie į žmogų orientuotos inovacijų ekosistemos konceptualiame modelyje tampa "produkcija". Dabartinė politika, plėtodama Lietuvos inovacijų potencialą, grindžiama prielaida, kad inovacijos būtų kuriamos žiedinės veiklos, kuri suteiktų daug galimybių, principu. Pagal į žmogų orientuotų inovacijų ekosistemų konceptualaus modelio struktūrą tai turėtų būti vieningas, glaudžiai susijęs junginys, kurį sudarytų visi minėti subjektai, suinteresuotosios šalys ir naudos gavėjai, reguliuojami pagal Lietuvos švietimo ir inovacijų politiką. Tai didintų aukštojo mokslo sektoriaus inovacijų potencialą, kad būtų galima spręsti turimų įgūdžių neatitikimo ir trūkumų, susijusių su kokybiškų inovacijų ekosistemos plėtojimu, problemą.

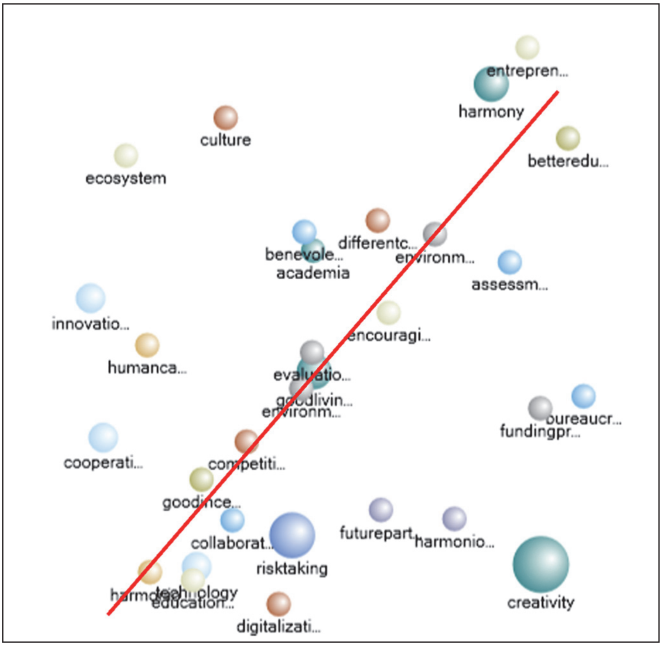
Lietuvos atvejo analizė ir ekspertų grįžtamasis ryšys taip pat pateikė įžvalgas apie institucijas ir jų poveikį strategijos plėtrai, tačiau daugiau pastangų galėtų paskatinti glaudesnę partnerystę ir bendradarbiavimą sprendžiant aukštojo mokslo sektoriaus problemas. 4 paveiksle apibendrinta, kaip veikia šis procesas:



4 pav. *Strateginė plėtra per į žmogų orientuotas inovacijų ekosistemas.*

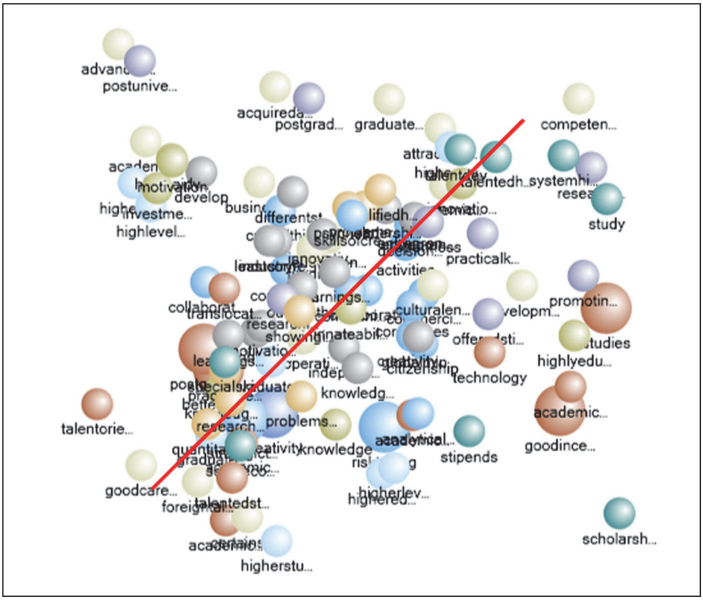
Šaltinis: sudaryta autorės

Bendras požiūris, derinant aukštojo mokslo institucijų studijų programas su darbo rinka, remia bendradarbiavimą su suinteresuotosiomis šalimis ir naudos gavėjais kolektyviai prisidedant prie misijos, tikslų, ekosistemos funkcijų pagal kiekvieno iš suinteresuotųjų šalių ir naudos gavėjų poreikius. Tai stiprina aukštojo mokslo sektoriaus rezultatus, gerina jo struktūros ir funkcijų kokybę ir kiekybę. Žmogiškojo kapitalo, gauto iš aukštojo mokslo į žmogų orientuotos inovacijų ekosistemos vidaus ir išorės aplinkos, savybės yra pranašesnės verslumo srityje, kadangi jie yra novatoriški ir linkę bendradarbiauti. Į žmogų orientuotos inovacijų ekosistemos tinklo suinteresuotųjų šalių, dalyvių, neaukštojo švietimo veiksniai, susiję su žmogiškojo kapitalo plėtojimu prisidedant prie žinių ir komercinės ekonomikos, kokybės užtikrinimo rodikliai galėtų stebėti kokybinius duomenis, procesus, rezultatus, produkciją ir rezultatus. Remiantis Pearsono koreliacija, toliau pateiktame paveikslėlyje parodyta stipri linijinė priklausomybė tarp ekosistemų indėlio į žinias ir komercinę ekonomiką, todėl tokie kokybės užtikrinimo rodikliai turėtų būti suformuluoti taip, kad ekosistema galėtų nuosekliai juos stebėti.



5 pav. Koreliacija tarp į žmogų orientuotų inovacijų ekosistemų kokybinių rezultatų ir rezultatų žinių ir komercinėje ekonomikoje.
Šaltinis: sudaryta autorės

Vertinant ekspertų atsakymus socialinės ir ekonominės, pramonės, akademinės bendruomenės ir sektorių suinteresuotųjų šalių aplinkos svarba į žmogų orientuotoms inovacijų ekosistemoms galėtų atsiskleisti, padedant nustatyti kokybės užtikrinimo rodiklius, kurie nulemia ekosistemos išlikimą. Taikant Pearsono koreliaciją nustatytas ryšys nuo maždaug 0,5 iki 1. Kokybės užtikrinimo rodikliai taip pat turėtų būti suformuluoti šiai aplinkai ekosistemoje stebėti. Šios priemonės ir ištekliai, kuriais vertinami veiklos rezultatai, produkcija, procesai ir poveikis ekosistemos plėtrai, turėtų būti taikomi santykyje su įdėtais ištekliais.



6 pav. Išorinės aplinkos koreliacija su ekosistemos išlikimu.
Šaltinis: sudaryta autorės

Empiriniai tyrimai įgyvendino tikslą - įvertinti aukštojo mokslo politikos poveikį remiantis teoriniu konceptualiu modeliu, sukurtu į žmogų orientuotoms inovacijų ekosistemoms. Jie taip pat patvirtino, kad teorinis konceptualus modelis, skirtas į žmogų orientuotoms inovacijų ekosistemoms, yra tinkamas ir teisingas. Be to, siūlomas konceptualus modelis yra tinkamas vertinat į žmogų orientuotų ekosistemų plėtros tyrimus nagrinėjant aukštąjį išsilavinimą turintį žmogiškąjį kapitalą. Vertinimo metu gauti rezultatai, tokie kaip kokybinės įžvalgos apie temines koncepcijas ir kategorijas, kurios atskleidžia kokybiškų ekosistemų plėtojimą, suteikia papildomos naudos visoms suinteresuotosioms šalims ir paramos gavėjams. Tai gali būti panaudota kuriant naujas žinias apie inovacijų ekosistemų, kurios taiko į žmogų orientuotą požiūrį, ypatybes. Į žmogų orientuotos inovacijų ekosistemos galėtų būti laikomos strategine vadybos mokslų priemone, leidžianti suprasti ir stebėti kokybiškas ekosistemas, kurios inovacijų dėka sukuria vertę su suinteresuotosioms šalimis ir ekosistemos naudos gavėjais.

Gauti rezultatai suteikė geresnį ekosistemos plėtrai reikalingų požymių supratimą. Tai buvo įvertinta pagal būdingus talentingo žmogiškojo veiksnio bruožus, suvokiamus kaip į žmogų orientuotų inovacijų paskatinimus įgyti kvalifikacinius įgūdžius, kas yra nauja ir svarbu vadybos mokslui. Tyrimai taip pat suteikė supratimą apie visų dalyvių tikslus ir funkcijas, į žmogų orientuotų inovacijų ekosistemų tinklo struktūrą ir padeda aukštojo mokslo sektoriui nustatyti jo indėlį ir sutelkti dėmesį į svarbiausią jo suteikiamą naudą ir galimus apribojimus. Empirinių tyrimų rezultatai taip pat yra nauji ir naudingi aukštojo mokslo sektorių institucijoms.

IŠVADOS

Į žmogų orientuotų inovacijų ekosistemos konceptualus pagrindas.

1. Į žmogų orientuotos inovacijų ekosistema yra strateginė priemonė, skirta spręsti valdymo ir talentų ugdymo problemas, susijusias su inovacijų plėtra aukštojo mokslo sektoriuje. Jos modelis, sudėtis ir ypatybės leidžia tikslingai orientuoti strateginį mąstymą į sprendimų priėmimą, atsižvelgiant į aukštojo mokslo sektoriaus institucijų vaidmenį ir funkcijas. Nustačius žmogiškojo veiksnio pažinimo gebėjimus, įgūdžius ir savybes sukurta sistema leidžia plėtoti inovacijas.
2. Daroma prielaida, kad konceptualus modelis, sukurtas į žmogų orientuotoms inovacijų ekosistemoms, suteikia vertę visų lygių dalyviams, suinteresuotosioms šalims ir naudos gavėjams. Modelio struktūra sudaryta atsižvelgiant į žmogiškojo veiksnio inovacijų lygį ir santykį su motyvacija ir įgytų gebėjimų verte. Į žmogų orientuotų struktūrų ekosistema pripažįsta, kad talentas ir motyvacija kurti inovacijas formuojami aplinkos, naudojant paskatų technologijas ir infrastruktūros objektus, taip pat remiantis visų ekosistemos dalyvių požiūriu į inovacijas. Remiantis moksline literatūra vidaus ir išorės institucinių aplinkos veiksniai ir socialinės bei ekonominės sąlygos yra svarbiausi veiksniai, didinantis bendradarbiavimo vertę ir užtikrinantis ekosistemai klestėti ir pasiekti strateginius aukštojo mokslo tikslus.
3. Siekiant užtikrinti vertę kiekviename lygmenyje, konceptualus modelis apima tarpusavyje integruotas, bendradarbiavimo struktūras tarp kiekvieno dalyvio ir ekosistemos institucijų, kurios skatina gebėjimus prisitaikyti, lankstumą, išteklių perdavimo paprastumą ir didinti ekosistemos, kaip atsparios strateginės priemonės, efektyvumą. Saikingai ekosistemoje tai didina dalyvių ir institucijų priklausomybę nuo išteklių, tad leidžia optimizuoti, labiau sutelkti ir perskirstyti išteklius žmogiškojo kapitalo ir talentų ugdymui.
4. Technologinės ir skaitmeninės platformos turi įtakos technologijų perdavimui ekosistemoje. Taigi, politika turėtų užtikrinti, kad suinteresuotųjų subjektų bendradarbiavimo ryšių dėka suinteresuotųjų šalių veiklos išlaidos būtų sumažintos užtikrinant galimybes naudotis ištekliais talentų ugdymui ir žmogiškojo kapitalo plėtrai. Vienas požiūris į tai būtų strateginis technologinio ir skaitmeninio perdavimo ekosistemoje valdymas. Remiantis modelio struktūra ekosistemos suderinimas pagal kiekvieną ekonominį lygmenį galėtų būti problematiškas, atsižvelgiant į skirtingus išteklius, turimus kiekviename lygmenyje, ir numatomus rezultatus. Tai užtikrina horizontalus pagrindinių išteklių ir platformų suderinimas ekosistemoje, kuris leidžia palengvinti jų perdavimą ir didesnį panaudojimą visų dalyvių tarpe.
5. Literatūros apžvalga, skirta į žmogų orientuotų inovacijų ekosistemoms, akcentuoja būtinybę atsižvelgti į jas priimant sprendimus dėl aukštojo mokslo politikos, aktualios aukštojo mokslo institucijoms. Dėl ekosistemų struktūros pobūdžio daugiau įžvalgų apie požiūrį į žmogiškąjį kapitalą ir talentų ugdymą per aukštojo mokslo institucijas politikos lygmenyje atsiranda iš bendrų rezultatų, gautų tai-

kant ekosistemos kokybės užtikrinimo rodiklių priemones. Tai virsta strateginiais neapčiuopiamais inovacijas skatinančiais sprendimais ir svarbia prielaida ilgalaikių tikslų, būdingų bendriems ekosistemos poreikiams, nustatymui.

Į žmones orientuota inovacijų ekosistema ir aukštojo mokslo sektorius.

1. Harmoninga ekosistemų aplinka sukuriama plačių aukštojo mokslo sektoriaus institucijų ir dalyvių tinklų dėka. Paskatos, kuriomis remiama tokia aplinka, paprastai gerai veikia mažesniuose tinkluose ir grupėse, tačiau toks požiūris galėtų būti nukreiptas ir į platų aukštojo mokslo sektoriaus tinklą, naudojant į žmogų orientuotas inovacijų ekosistemas. Nors empirinių tyrimų rezultatai rodo, kad aukštojo mokslo įstaigų vidaus dalyviai, taip pat kitos suinteresuotosios šalys ir naudos gavėjai iš esmės žino apie savo vaidmenį skatinant darnią aplinką inovacijų plėtrai, jie paprastai neatsižvelgia į jos praktinio taikymo vidaus institucinėje aplinkoje naudą.
2. Empirinės išvados apie į žmogų orientuotų inovacijų ekosistemas formuoja požiūrį, kad kaip strateginė priemonė ji sukuria inovacijų vertę dėl bendrų funkcijų, bendro išteklių naudojimo, technologijų ir platformų talentų ugdymui ir žmogiškojo kapitalo plėtrai, taigi, tampa inovacijų valdymo priemone. Be to, tokio teiginio reikšmė pakartotinai grindžiama atsižvelgiant į dabartinius žmogiškojo kapitalo, kuriančio inovacijas, bruožus ir rezultatus. Empirinių tyrimų rezultatai rodo, kad dabartinis žmogiškojo kapitalo pagrindas, apibūdinamas turimais gebėjimais ir savybėmis, atskleidžia, kad būklė nėra palanki kokybiškoms inovacijoms.
3. Taikant kokybės užtikrinimo rodiklius, sukurtus į žmogų orientuotų inovacijų ekosistemų procesus ir rezultatus stebėti ir vertinti, užtikrinama, kad, jei žmogiškasis kapitalas ir talentų ugdymas neatitiktų nustatytų ekosistemos tikslų ir misijos, tuo pačiu metu būtų taikomos taisomosios iniciatyvos, siekiant užtikrinti, kad jos atitiktų nustatytą kriterijų.
4. Be to, išvados nustato, kad, nors aukštojo mokslo institucijos veikia palyginti konkurencingoje aplinkoje, joje trūksta pasitikėjimo ir atvirumo, tad jos neatsižvelgia į galimą nepakankamai įvertintą naudą, gautą ekosistemos tinkle. Tačiau ekosistema galėtų leisti aukštojo mokslo įstaigoms pasinaudoti nepakankamai įvertinta nauda, kuri suteiktų lyginamąjį pranašumą, kuris pagerintų jų institucinį profilį.
5. Empirinių tyrimų rezultatai patvirtina, kad į žmogų orientuotų inovacijų ekosistemų tinklo struktūra padeda aukštojo mokslo sektoriui kokybiškai nustatyti jo indėlio į kokybiškas inovacijas lygį, taip pat išgryninti koncentracijos sritis, kurias reikia plėtoti, taip pat galimus apribojimus ekosistemoje.

Į žmogų orientuotų inovacijų ekosistemų paskirtis.

1. Remiantis modelio struktūra į žmogų orientuota inovacijų ekosistema konceptualiai apibrėžiama aukštojo mokslo sektoriaus politikos planavimo etape. Žmogiškasis kapitalas ir talentai, įtraukti į ekosistemą pagerina gebėjimus ir papildomai sustiprina bendradarbiavimo tinklus. Žmogiškąjį kapitalą puoselėjan-

ti ir talentus ugdanti politika, įskaitant kitus neapčiuopiamus ir apčiuopiamus veiksnius, apibrėžia aukštojo mokslo sektoriaus vaidmenį ir funkcijas, taip pat galimybes, nukreiptas į žmogų orientuotų inovacijų ekosistemų įgyvendinimui instituciniu lygmeniu, kaip strateginį tikslą, atitinkantį jų misiją ir viziją dėl inovacijų plėtojimo.

2. Į žmogų orientuotų inovacijų ekosistemos galėtų strategiškai pagerinti aukštojo mokslo sektoriaus reputaciją ir vertę, taip pat jo būsimus rezultatus, kad šis sektorius galėtų svariai prisidėti prie inovacijų žinių ir komercinės ekonomikos sąlygomis. Metodų pasirinkimas turi būti strategiškai pagrįstas ir palankus sektoriaus vidaus funkcijoms, taip pat bendrai ekosistemos struktūrai. Ekosistema gali nustatyti dabartinę poziciją ir skirtumus, būtinus žmogiškojo kapitalo ir talentų ugdymo vidaus strateginio mąstymo gairėms. Pasiekti rezultatai bus įtraukti į bendrą ekosistemos struktūrą, o tai pagerina bendrą aukštojo mokslo sektoriaus plėtojimo perspektyvą.
3. Kaip strateginė aukštojo mokslo sektoriaus valdymo ir planavimo procesų priemonė, į žmogų orientuotą inovacijų ekosistema leidžia aukštojo mokslo institucijoms kartu su pagrindinėmis suinteresuotosiomis šalimis susieti žmogiškojo kapitalo plėtros viziją, misiją ir tikslus patobulintų bendradarbiavimo ryšių sistemų dėka. Tai pagerina veiklos rezultatus ir tuo pačiu metu užtikrina didesnę paramą iš kitų ekosistemos dalyvių aukštojo mokslo sektoriui, kad pastarasis galėtų vykdyti savo funkcijas aktyviai bendradarbiaudamas su visuomene.
4. Kokybės užtikrinimo rodiklių visuma, sukurta stebint neaukštojo mokslo veiksnius, atsižvelgiant į žmogiškojo kapitalo plėtrą į žmogų orientuotose inovacijų ekosistemose, įvertina aukštojo mokslo sektoriaus vidinio planavimo procesus ir rezultatus bei išteklių paskirstymą ateityje.

Į žmogų orientuotų inovacijų ekosistemų naudojimas strateginiame planavime ir politikoje.

1. Į žmogų orientuotoms inovacijų ekosistemoms parengti kokybės užtikrinimo rodikliai iš strateginio planavimo perspektyvos stebėtų planuojamo parengti aukštojo mokslo sektoriaus ir jo suinteresuotųjų šalių bendradarbiavimo veiklai projekto, kokybės lygį. Žinių ir komercinės ekonomikos sąlygomis sukuriama vertė priklauso nuo indėlių. Sprendimų, kuriais siekiama stiprinti bendradarbiavimo tinklus su ekosistemų suinteresuotomis šalimis ir naudos gavėjais, kokybė įgalina naują praktiką ir skatina mokymus arba diegia mokslinių tyrimų studijų programas aukštojo mokslo institucijose, kurios taip pat sukuria vertę šioms ekonomikoms.

2. Remiantis empirinių tyrimų rezultatais žmogiškojo kapitalo, gauto iš į žmogų orientuotų inovacijų ekosistemų, vidaus ir išorės aplinkos, savybės verslume paprastai yra geresnės, jos yra visapusiškos, novatoriškos ir grindžiamos bendradarbiavimu. Šie požymiai leidžia praktiškai taikyti pažangias specializacijas aukštojo mokslo dėka. Be to, įgūdžių neatitikimas ir talentų netinkamas panaudojimas inovacijų srityje yra susijęs su bendradarbiavimu su suinteresuotomis

šalimis ir naudos gavėjais, siekiant pagerinti įgūdžių suderinamumą ir talentų pritraukimą į pramonę. Pagrindinis veiksnys, užtikrinantis sėkmę, yra geros komunikacijos sistemos ekosistemoje. Iš nustatytų faktų matyti, kad komunikacija ir pasitikėjimas gali nulemti reikšmingus funkcinius rezultatus ir užtikrinti ekosistemų tinklo ilgaamžiškumą. Į žmogų orientuotų inovacijų ekosistemas būtų galima labiau nukreipti link žmogiškojo kapitalo ir talentų ugdymo plėtojimo geriau panaudojant ekosistemos išteklius.

3. Į žmogų orientuotose inovacijų ekosistemose politika, reguliuojanti ekosistemų plėtojimą, vertinama pagal sprendimus, priimtus aukštojo mokslo sektoriaus iššūkiams. Tarpusavio bendradarbiavimo lygis, vidinė ir išorinė institucinė aplinka bei turimi ištekliai, technologijos ir infrastruktūra.

4. Stiprindamos bendradarbiavimo ryšius, aukštojo mokslo sektoriaus institucijos galėtų palaipsniui pasiekti konkurencinį pranašumą naudodamos į žmogų orientuotą inovacijų ekosistemas. Naujai sprendžiamos problemos ir klausimai, susiję su gebėjimų ir talentų neatitikimu, gali suteikti konkurencinį pranašumą inovacijų srityje, tačiau tai sąlyginė prielaida. Palyginimui, konkurencinis pranašumas nustatomas per inovacijų kokybę, kurią šis sektorius sukuria.

5. Naudojant į žmogų orientuotų inovacijų ekosistemas užtikrinamas geresnis valdymo priemonių panaudojimas, kas pagerina aukštojo mokslo sektoriaus veiklos rezultatus suinteresuotosioms šalims ir naudos gavėjams. Praktinis į žmogų orientuotų inovacijų ekosistemų taikymas grindžiamas jos naudojimu kaip strategine priemone bendradarbiavimui ekosistemoje stiprinti, siekiant kad aukštojo mokslo sektorius galėtų spręsti problemas ir uždavinius, didinti bendradarbiavimą, optimizuoti pagrindinius išteklius ir finansuojant šį tikslą.

Pagrindiniai pasiūlymai:

1. Siekiant įvertinti į žmogų orientuotų inovacijų ekosistemų naudą, siūloma, kad ekosistemų modelis būtų taikomas kaip strateginė priemonė, užtikrinanti inovacijas skatinančios strategijos kūrimą ir įgyvendinimą.

Rekomendacijos būsimiems moksliniams tyrimams:

1. Siekiant nustatyti į žmogų orientuotų inovacijų ekosistemų pritaikymo galimybes verslo vienetų ir institucijų inovaciniam potencialui atskleisti, būtina atlikti daugiau mokslinių tyrimų, skirtų įvertinti praktinius ekosistemos procesus, išteklius ir rezultatus, siekiant sukurti strategiją.
2. Reikia atlikti daugiau mokslinių tyrimų, siekiant įvertinti kitų subjektų, pavyzdžiui, reguliavimo institucijų poveikį į žmogų orientuotų inovacijų ekosistemų modelio plėtrai.
3. Siekiant įvertinti į žmogų orientuotų inovacijų ekosistemų taikymo galimybes aukštojo mokslo sektoriuje reikia atlikti daugiau kiekybinių tyrimų, susijusių su valdymo etapais, kad ekosistema būtų naudojama kaip strateginė priemonė, skirta spręsti sektoriaus problemas ir iššūkius, taip pat kuriant įžvalgas stebėsenos procesui parengtų kokybės užtikrinimo rodiklių dėka.

Rekomendacijos suinteresuotosioms šalims ir naudos gavėjams:

1. Suinteresuotųjų šalių ir naudos gavėjų atveju į ekosistemos modelį turi būti įtrauktas oficialus sisteminis dalyvis, siekiant gauti tikslias ir išsamias perspektyvas apie kiekvieno dalyvio indėlį į ekosistemą.
2. Taikyti formalų kokybės užtikrinimo priemonių rinkinį, skirtą ekosistemos ištekliams ir rezultatams įvertinti.
3. Nusimanantys ir patyrę žmogiškieji ištekliai (personalas) turėtų sudaryti pagrindinę ekosistemos modelio dalį, kad būtų plėtojamos strateginės įžvalgos, valdymas ir veiklos koordinavimas.
4. Ekspertai, turintys žinių apie esminius žmogiškojo kapitalo plėtojimo subtilybes, turėtų sudaryti pagrindinę ekosistemos dalį.
5. Siekiant pritraukti talentus inovacijų kūrimui, būtina parengti daugiau stažuočių magistrantūros programose, per kitus finansavimo mechanizmus užtikrinti talentingo žmogiškojo kapitalo įdarbinimą, o aukštojo mokslo programas suderinti su verslo įmonių misija, vizija ir tikslais.
6. Tarpdisciplininis įsitraukimas ir sąveika su aukštojo mokslo sektoriumi ekosistemose gali būti pasiektas bendradarbiaujant ir kuriant partnerystę, kuria skatinamas bendras išteklių paskirstymas inovacijoms užtikrinti. Alternatyvaus švietimo programos ir stipendijų schemos perspektyviems talentams turėtų būti skirtos studijų metu aukštojo mokslo institucijose ir įtrauktos į semestro vertinimo sistemą. Baigus mokslus, talentas turi būti vertinamas pagal švietimo ir techninius rezultatus, aktualius būsimam darbdaviui.

Rekomendacijos aukštojo mokslo sektoriui:

1. Į žmogų orientuotų inovacijų ekosistemos, skirtos techninio profilio aukštojo mokslo institucijoms, turėtų koordinuoti studijų programas inovacijų inkubatoriaus mechanizmo principu, kad būtų užtikrintas gebėjimų suderinamumas su pramonės sektoriumi.
2. Kalbant apie į žmogų orientuotas inovacijų ekosistemas, skirtas institucijoms, kurios orientuotos į mokslinius tyrimus, studijų programos turėtų būti koordinuojamos pasitelkiant tokias mechanizmo schemas, kurios užtikrintų žinių plėtrą ir tikslingą jų perkėlimą į pramonę pagal įgytų žinių suderinimą su praktiniu panaudojimu. Tai leidžia labiau komercializuoti aukštojo mokslo sektoriaus mokslinių tyrimų rezultatus.
3. Studijų vietos, skirtos puikiai apmokytam žmogiškajam kapitalui, neturėtų būti siūlomos vien pagal akademinį ar techninį kriterijų; dalis būsimų stažuočių gali būti siūlomos atlikti bendradarbiaujant su pažangiomis įmonėmis, kurios su mokslo ir studijų įstaigomis formuoja vientisą į žmogų orientuotų inovacijų ekosistemas.

Rekomendacijos Vyriausybei ir ministerijoms:

1. Siekiant užtikrinti, kad ekosistema būtų veiksminga, būtina lavinti suinteresuotas šalis, naudos gavėjus ir dalyvius apie į žmogaus orientuotų inovacijų ekosistemos funkcijas, viziją ir misiją. Siekiant vykdyti savo funkcijas ir veiklą, ekosistemai turėtų padėti procedūrinės, reguliavimo ir teisinės sistemos.
2. Patyrę darbuotojai turėtų būti įdarbinti į žmogų orientuotų inovacijų ekosistemų viduje, kad būtų galima parengti ir vykdyti sprendimus, reikalingus aukštojo mokslo sektoriaus problemoms ir būsimiems iššūkiams sušvelninti. Į žmogų orientuotų inovacijų ekosistemoms įgyvendinti būtinas atviras įdarbinimo modelis aukštojo mokslo institucijose geriausiems, išskirtiniams ir talentingiems asmenims, kurie yra suinteresuoti būti mokomi ir prisideda prie kokybiškų inovacijų rezultatų. Atviros įdarbinimo sistemos turėtų tapti patrauklia paskatos priemone talentams siekti inovacijų.
3. Siekiant reguliuoti ir vertinti į žmogų orientuotas inovacijų ekosistemas, taip pat jų veiklos ir rezultatų kokybę, turėtų būti parengti kokybės užtikrinimo veiklos rodikliai.

Disertacijos tyrimo rezultatai paskelbti: (A) straipsniuose periodiniuose mokslo žurnaluose ir konferencijų leidiniuose ir (B) konferencijų pranešimuose.

(A) Straipsniai periodiniuose mokslo žurnaluose ir konferencijų leidiniuose:

- Chukurna, O.; Niekrasova, L.; Dobrianska, N.; Izmaylov, Ya.; Shkrabak, I.; Ingram, K. Formation of methodical foundations for assessing the innovative development potential of an industrial enterprise = Формування методичних засад оцінки потенціалу інноваційного розвитку промислового підприємства = Формирование методических основ оценки потенциала инновационного развития промышленного предприятия // Науковий вісник = Naukovyi visnyk Natsionalnoho Hirnychoho Universytetu : peer-reviewed journal. Dnipropetrovsk : State Higher Educational Institution «National Mining University». ISSN 2071-2227. eISSN 2223-2362. 2020, no. 4 (178), p. 146-151. [Academic Search Complete; VINITI] [CiteScore: 1,50, SNIP: 0,911, SJR: 0,345, kvartilis: Q2 (2019, Scopus Sources)] [M.kr.: S 003].
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(A) Straipsniai periodiniuose mokslo žurnaluose ir konferencijų leidiniuose:

- Ingram, Keisha Laraine. Intellectual property protection for brand Jamaica's creative industries // Socialinės technologijos: mokslo darbai = Social technologies: research papers. Vilnius: Mykolo Romerio universitetas. ISSN 2029-7564. 2014, [Nr.] 4(1), p. 151-167. DOI: 10.13165/ST-14-4-1-10. [DOAJ; Academic Search Research and Developement (EBSCO)] [M.kr.: S 003]

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(C) Straipsniai ir tezės konferencijų medžiagoje, paskelbtoje duombazėse Web of Science ir Scopus:

- Nitsenko, Vitalii; Kotenko, Sergiy; Hanzhurenko, Iryna; Ingram, Keisha Laraine. Determination of Weight Coefficients for Stochastic and Fuzzy Risks for Multimodal Transportation // Journal of physics: conference series: The 2nd Joint International Conference on Emerging Computing Technology and Sports (JICETS) 2019 25-27 November 2019, Bandung, Indonesia. Bristol: Institute of Physics Publishing Ltd. ISSN 1742-6588. eISSN 1742-6596. 2020, vol. 1529, 032007, p. 2-8. DOI: 10.1088/1742-6596/1529/3/032007. [Conference Proceedings Citation Index - Science (Web of Science)] [CiteScore: 0,51, SNIP: 0,454, SJR: 0,221, kvartilis: Q4 (2018, Scopus Sources)] [M.kr.: S 003]

CURRICULUM VITAE

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Išsilavinimas:

2016 – 2020	Vadybos mokslo krypties doktorantūros studijos Jungtinė doktorantūros programa Klaipėdos universitetas, Mykolo Romerio universitetas, Vytauto Didžiojo universitetas ir Šiaulių universitetas
2013 – 2016	Socialinių technologijų vadyba, Magistras Fernando Pessoa University (Portugal) – Mykolo Romerio universitetas (Lietuva)
2013	Verslo procesų organizacinio modeliavimo pažymėjimas Johannes Kepler Universität, Linz (Austrija)
2012 – 2014	Elektroninio verslo vadyba Verslo administravimo magistras (MBa) Mykolo Romerio universitetas (Lietuva)
2005 – 2010	Statybų inžinerija Inžinerijos bakalauras (BEng) University of Technology, Jamaika
2003 – 2005	Statybos inžinerijos diplomas University of Technology, Jamaika

Moksliniai interesai:

Statybos inžinerija, paslaugų inžinerija, organizacijų vadyba, taikomosios IKT technologijos, hiphopo muzikos kultūra (Šiaurės Amerika), K-pop muzikos kultūra (Pietų Korėja)

Darbo patirtis:

2020 – dabar	Lektorė • Lietuvos verslo kolegija / Lithuania Business University of Applied Sciences • Vilnius • Letuva
2020 – dabar	Lektorė • Vilniaus kolegija / Vilnius College • Vilnius • Lietuva
2017 – dabar	Lektorė • Tarptautinė teisės ir verslo aukštoji mokykla / International Law and Business School • Vilnius • Lietuva
2019 – 2020	Rektoriaus padėjėja • Mykolo Romerio universitetas • Vilnius • Lietuva

2017 – 2020	One Asia Community programos koordinatorė Mykolo Romerio universitete; programa finansuota Eurazijos fondo Japonijoje, http://www.eurasia.or.jp/en/ Pranešėja metinėje *One Asia* konferencijoje, Seulas, Pietų Korėja, 2019. Pranešimas "Sustainable Connectivity and the One Asia Community".
2016 – 2019	Tarptautinių partnerysčių vadybininkė • Mykolo Romerio universitetas • Vilnius • Lietuva
2015 – 2019	Lektorė • Socialinių mokslų kolegija/ SMK College • Vilnius • Lietuva
2015	IKT žinių vadyba • Stažuotė • Jungtinių Tautų vystymo programa (UNDP), Jungtinės Tautos • Kopenhaga • Danija
2014	Komunikacijos inžinerijos skyrius • Stažuotė • Johannes Kepler University • Lincas • Austrija
2011 – 2014	N'gandu Consulting Limited • Inžinieriaus rezidento padėjėja • Lusaka • Zambija
2011	Copenhagen Contractors A/S • Operacijų vadybininkė (įrenginių priežiūra) • Kandahar • Afganistanas
2010 – 2011	Kier Construction Limited • Inžinierė • Kingstonas • Jamaika
2007 –2009	E. Pihl & Sons A/S • Tiltų inžinierė • Lyngby • Danija
2005 – 2007	National Works Agency • Inžinerijos technikė • Kingstonas • Jamaika

Profesinės narystės:

2015 – dabar	Narė (Associate) • Amerikos civilinių inžinierių draugija • JAV
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Ingram, Keisha LaRaine

THE IMPACT OF THE HIGHER EDUCATION POLICY ON THE DEVELOPMENT OF HUMAN-CENTRIC INNOVATION ECOSYSTEMS IN LITHUANIA: daktaro disertacija. – Vilnius: Mykolo Romerio universitetas, 2020. P. 332.

Bibliogr. 148–163 p.

Šioje disertacijoje yra vertinamas aukštojo mokslo politikos poveikis į žmogų orientuotų inovacijų ekosistemų plėtrai, taip sprendžiant poreikį, kylantį gerinant į žmogų orientuotų inovacijų ekosistemų valdymą ir jų strateginį naudojimą, siekiant sustiprinti aukštojo mokslo sektoriaus konkurencingumą. Empiriškai tikrinant sukurto konceptualaus į žmogų orientuotų inovacijų ekosistemų teorinio modelio, kaip strateginės priemonės, aktualumą ir tinkamumą, atitinkamai vertinamos į žmogų orientuotų inovacijų rūšis per žmogiškąjį kapitalą, turintį aukštąjį išsilavinimą. Į žmogų orientuotų inovacijų ekosistema buvo vertinama kokybiškai pagal tai, kaip ji atitinka aukštojo mokslo sektoriaus, kaip strateginio šaltinio paskirtį, suinteresuotųjų šalių ir naudos gavėjų tikslais, misijomis ir funkcijomis. Šioje disertacijoje ginama, kad:

1. *taikant į žmogų orientuotų inovacijų ekosistemas veikia bendradarbiavimo tinklus sukurtų strategijų dėka;*
2. *į žmogų orientuotos inovacijų ekosistemos palaiko harmoningą ekosistemos aplinką aukštojo mokslo sektoriuje;*
3. *naudojant į žmogų orientuotas inovacijų ekosistemas atsiskleidžia kokybinės priemonės, vertinančios apčiuopiamus aukštojo mokslo sektoriaus indėlio į žinių ir komercinių ryšių grindžiamos ekonomikos rezultatus;*
4. *aukštojo mokslo sektoriaus nustatyti kokybės užtikrinimo rodikliai, skirti stebėti į žmogų orientuotas inovacijų ekosistemas, atskleidžia jos indėlio vertę žinių ir komercinių ryšių grindžiamai ekonomikai.*

The impact of the higher education policy on the development of human-centric innovation ecosystems is evaluated in this dissertation, thus addressing the need evolving to support the management and strategic use of human-centric innovation ecosystems to strengthen the competitiveness of the higher education sector. Empirically testing the relevance and correctness of the developed conceptual theoretical framework of human-centric innovation ecosystems as a strategic resource, suitably assesses human-centered type innovation through the human capital possessing higher education. Human-centric innovation ecosystem was evaluated qualitatively according to how it serves the purpose of the higher education sector as a strategic resource aligned with the objectives, missions and functions of its stakeholders and beneficiaries. This dissertation defends that:

1. *Applying human-centric innovation ecosystems effects cooperation networks through the strategies developed;*
2. *Human-centric innovation ecosystems supports a harmonious ecosystem environment in the higher education sector;*
3. *Using human-centric innovation ecosystems makes visible qualitative tools to measure the tangible outcomes of the higher education sector contribution to innovation in the knowledge and commercial economies;*
4. *The quality assurance indicators set by the higher education sector for monitoring human-centric innovation ecosystem discloses its levels of input value to the knowledge and commercial economies.*

Keisha LaRaine Ingram

THE IMPACT OF THE HIGHER EDUCATION POLICY ON THE DEVELOPMENT OF HUMAN-CENTRIC INNOVATION ECOSYSTEMS IN LITHUANIA

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