VILNIUS GEDIMINAS TECHNICAL UNIVERSITY
MECHANICS FACULTY
INDUSTRIAL ENTERPRISES MANAGEMENT DEPARTMENT

Veslava Stankevičiūtė

THE IMPLEMENTATION OF QUALITY MANAGEMENT SYSTEMS IN SCIENCE CENTRE

KOKYBĖS VADYBOS SISTEMŲ DIEGIMAS MOKSLO CENTRE

Final Master work

Study programme: Industrial Engineering and Management
Science direction: Industry Engineering
Study direction: Industrial Engineering

Supervisior: Prof. hab. dr. A. Staškevičius

Vilnius, 2005

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Development of science and science institutions, science situation in Lithuania is reviewed in this work. Also analysis of statistical data of science researches is shown, the possibility of innovation in Western Europe and in Lithuania.

The conception of science center was described. The management structure of the science center was studying in this work. In assistance of these definitions was created the model of the quality management systems implementation in science center. Quality management system is created by ISO 9001:2000 requirements. To perfect the activity of science center is implementing quality management systems. However, it is not enough the benefit of the quality management system for organizations but they needs the useful application of these systems in standard for its activity and business.

Questionnaire of Lithuanian science officers was organized to evaluate the factors influenced for quality of science center activity. Data was analyzing and the model of quality of science center activity perfection was created, which main variables are time, information bases, financial resources, personnel qualification, and technological (laboratory) equipment.

Meaningful words: science, science centre, innovation, scientific researches, quality management, quality management systems

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Darbe apžvelgta mokslo bei mokslo institucijų raida, supažindinta su mokslo institucijų situacija Lietuvoje. Atlikta šalies mokslinių tyrimų statistinių duomenų analizė ir inovacijų galimybių analizė Vakarų Europos šalyse ir Lietuvoje.

Apibrėžta mokslo centro sąvoka. Apžvelgta mokslo centro valdymo struktūra. Remiantis šiomis sąvokomis buvo sukurtas kokybės vadybos diegimo mokslo centre modelis. Kokybės vadybos diegimo modelis buvo sukurtas remiantis ISO 9001:2000 standarto reikalavimus. Kokybės vadybos sistemos yra diegiamos tam kad patobulinti mokslo centro veiklą. Organizacijoms neužtenka pelno gaunamo nuo kokybės valdymo sistemų, bet reikia naudingo ir efektyvaus šių sistemų panaudojimo veiklai gerinti ir verslui plėtoti .

Atlikta Lietuvos mokslo darbuotojų anketinė apklausa, tam kad įvertinti veiksnius, kurie įtakoja mokslo centro veiklos kokybę. Duomenys buvo išanalizuoti ir sukurtas mokslo centro veiklos kokybės tobulinimo modelis, kuriuo pagrindiniai kintamieji yra laikas, informacijos rinkimo ir apdorojimo bazės, finansavimas, personalo kvalifikacija, technologinė (laboratorijos) įranga.

Reikšminiai žodžiai: mokslas, mokslo centras, inovacijos, moksliniai tyrimai, kokybės vadyba, kokybės vadybos sistemos

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Introduction

Science is a creative process whereby scientists, scientific officers, and other people referring to new science information analysis, and using innovative science research equipments generate new science knowledge's and concrete innovations. Relation between science and society are very close, which can have various interpretations, for example, when discovery of the science becomes the part of domestic appliance.

The development of science in Lithuania is link with managing to exploit the possibilities of global information infrastructure: ability to apply the most advanced scientific achievements, cooperation on the international scale, ability to satisfy the global market needs. Today the priority sectors in Lithuania are: energy resources, finance, transport and logistics, agricultural produce, ecology, construction industry. Lithuania has potential to reach European standards in fields of biotechnologies, laser technologies, information technologies, exact mechanics etc. Lithuanian is not capable of gaining achievements in all science fields.

The application of quality management systems touched very important view of humanity in the world – science centers. The most important function of science centers are activation and development of the innovation activity and creation of the innovations and it is necessary to improve a quality of all processes proceed in the science centre, to modernize management structure, to change the viewpoint of the organization, to increase the international competitive ability, which is the prime factor of the economy development. Lithuania needs as far as possible to incorporate the manufacturing and scientific institutions into activity of the innovations. Science has to solve the problems of the industry, society, because of in Lithuania is important to educate the new age of the qualified scientists, to stimulate the changes of the innovations, strongly stick up for the innovation rights, to create the high quality services. The request innovations are deficient in Lithuania because of the poor science sponsorship, created the unity of competitive products in outdated laboratories. There are impossible to develop other fields of society (social and public health care, environmental, care, agriculture, education and others) without scientific researches, new technologies, and innovations.

Creation and implementation of quality management systems in organizations long time before became the accepted necessity. The first National quality program was prepared only in 1995 in Lithuania. So, implementation of quality management systems becomes the innovation activity for all organizations and for science centers too. ISO standards only accelerated and provided the importance of this process. These standards presented the model of quality management systems are references by practice of the activity management process.

Process of creating innovation includes science researches, technical decisions, economy, business, and management. It is unique process of technical, technological innovation creation and

realization, changing the society, influencing the economy of the country and development of the culture.

It is very important to create relevant and conceptual innovations [50]. It is necessary to know the innovation level of the world of today moment, for starting the creating process from need level, not from the lower level, repeating already known, not original. Because of the repeated activity is only waste of the finance.

Therefore, the level of creation innovations depends on the all activities of the science centre, because of all chain activity have to proceed very effectively. The science centre has to understand the importance of their work for country economy, and seek to efficiency of the all activity of the science centre.

There were formulated the conception of science centre, created the model of quality management system implementation in science centre and the model of quality of science center activity perfection and performed the research of the quality of science center activity.

The main purpose of this work is perfection the activity of science centre with help of the quality management systems. To achieve this purpose are setting these tasks:

- Analysis of the science center activity;
- Analysis of quality management and their systems in civilized countries and in Lithuania;
- Define the conception of science center;
- Study the management structure of the science center;
- Create the model of the quality management systems implementation;
- Create the model of quality of science centre activity.

1. Science and science centers

1.1 The conception and functions of science

Science is a creative process whereby competence, experienced, proficient, creative people, scientists, scientific officers referring to new science information analysis and using innovative science research techniques, equipments, experimentalize, analyzed, solved raised innovation ideas, hypothesis and by theoretic and experimental research results, generate new science knowledge's and concrete innovations [23,59].

Relation between science and society are very close, which can have various interpretations. The simplest example is, when science discovery passed all practical test stages and become part of domestic appliance (for example, discovery of electromagnetic waves eventually was made up radio). Another effect of science for society is showed through its ideas. Humanity exploration of nature and world, their place in it and purpose in life, took place for great revolutions, coming from ancient times and till our days have been crossed other society evolution stages and was dictated by science. However, science achievements had only positive influence for society. Some of them were unduly used in politics and ideology. For example, wide selection theory by C. Darwin was purposeful used trying explained workpeople exploitation and racial discrimination, comment that only mostly acclimatized people survive [21]

Looking to science as a complicated social expression, which typical components are knowledge system, science activity and for it realization established system of institutions, must be mentioned and science functions. It is possible to separate out 2 groups of functions:

1) Real science;
2) Social [24].

The main function of science – to receive and theoretical systemize perspective knowledge's about reality. Thereby may be proposed that science is a part of world practical management, form of specific people activity, which essentially are different from material production and other moral action forms. For example, knowledge's are used as an ideal tool for material trade, while the main principal objective of science work – recognize and understand the purpose of experimentations, its origin, new products, services, technologies, others innovations and create methods for rationally used material and moral resources [42]. In other words, one of the main functions of science – new nature laws or discovery of consistent pattern, which one way or another may be used in practice.

The functions of real science may be these:

- Searching for problems and problematic questions and elevating of hypothesis;

- Collecting and testing of new facts and checking the hypothesis by doing experiments;
- Searching for widen generalization;
- Technological, related with tools, methods and techniques of research;
- Collection of historical data, research of science history;
- Administrative, executive and organizational;
- Publication of articles.

The functions of social science may be these:

- Extending science services for society;
- Training science specialists, for hold and continue science vitality;
- Open for science society training;
- Knowledge, satisfaction, festival, and glorification [22, 23].

Surely, this separating of science functions is conditional because most functions are interdependent between themselves.

1.2 Classification of science

Scientific researches are grouped into:

- Fundamental science;
- Applied science.

Fundamental researches set to research, and formulate new patterns of the theoretical scientific problems. The objective of applied researches is to perfect particular processes and technology that is to put into practice results of fundamental researches. The next accent of them is not rationally selected underlying direction in fundamental researches, and the underlying direction of researches has been necessary selected in applied researches. These mentioned directions may be associated with public executable programs. However the most allocations are felled on the applied researches, on the other hand, the priority must be accorded to fundamental researches, as development of new and effective fundamental theory's, which will help to resolve a lot of practical problems [23, 24].

Seeking to create new science knowledge by scientific researches, but appealing to known scientific facts, is seeking to estimate and realize the perfection possibilities of expressions (systems, processes, elements and others) by practical researches. Certainty, the advancement of society is determined by fundamental researches. Therefore, the countries, that generate and dispose these knowledge's is on the top of the science and have potential chance to use it first of all. In other words, fundamental researches are often expensive, but practical effect of them for

advancement of manufacturing and people lives are expressed later. So, these scientific researches are more amplified in better economical and cultural development countries [19, 28].

However it does not mean that small countries don't join to establishment of fundamental science knowledge. On purpose of successful seek of high development level and equitable conditions in community of countries, for Lithuania the fundamental researches are necessary. Because of the main purpose of these researches is rising of the Lithuanian science level. First of all, the expedience of these researches in Lithuania are reasoned by destitution of own specialists of different science, who will perform researches, interest in world science, communicate with world scientists, who are disposed of researches data and assessed to be experts, consultants and extended the another services to train new generation of young scientists and stimulate the renovation of higher education [17, 19, 23,].

Talking about science structure, it has been separated science fields and directions. After declaration of independence have been dominated the old classification of science, which was changed a short time ago. The purpose of this change – become closer to European standards. Government of Lithuanian Republic decided to classified science, accordant to recommendations of European Union Commission, in 1998 year. Additionally, these science fields – Balt's languages, Lithuanian language, Lithuanian literature was added to new science classification [6, 22, 58]. Education and Science ministry together with Lithuanian Science Council while estimated science directions. According to them, are founded Graduate (doctor) and granted science levels [22, 31].

Table 1. Classification of science [31]

Science field		Science direction	
H000	Human studies	H001	Philosophy
		H002	Theology
		H003	Art studies
		H004	Philology
		H005	History
		H006	Communication and information*
		H007	Ethnology**
S000	Social science	S001	Law**
		S002	Political science**
		S003	Management and administration**
		S004	Economics**
		S005	Sociology**
		S006	Psychology**

		S007	Educology**
P000	Physic science	P001	Mathematics
		P002	Physics
		P003	Chemistry
		P004	Biochemistry
		P005	Geology and geography
		P006	Paleontology
		P007	Astronomy
		P008	Informatics**
B000	Biomedicine science	B001	Common biomedicine science
		B002	Biophysics
		B003	Ecology and environmental science*
		B004	Botany
		B005	Zoology
		B006	Agronomics
		B007	Medicine and stomatology*
		B008	Pharmaceutics**
		B009	Social health**
		B010	Nursing**
		B011	Veterinary medicine**
		B012	Zoo techniques**
		B013	Biology**
		B014	Wood science**
T000	Technological science	T001	Electricity and electronic engineering
		T002	Construction engineering
		T003	Transport engineering
		T004	Environmental and regional studies**
		T005	Chemical engineering**
		T006	Energetic and thermo engineering**
		T007	Informatics engineering**
		T008	Material engineering**
		T009	Mechanics engineering**
		T010	Measurement engineering**

* Classification of science In European Union: Code H003 ascribable to science: “History and arts” Code B003 ascribable to science: “Ecology” Code B007 ascribable to science: “Medicine” ** Science is not ascribable and do not have code in Classification of science in European Union.

1.3 Development of Science Institutes

1.3.1 The Establishment of Science Institutes in West Europe and Baltic States

At the end of 19th century scientific researches, especially those of Physics and Natural Science became rather complex and required much time and efforts. Therefore, new specific establishments - science institutes founded within universities. The main target of these institutes was to carry out various scientific researches. Apart from this, the scientists used to lecture and coordinate students’ works at universities. In 1871, autonomic Cavendish Laboratory founded at the University of Cambridge. During the same decade, the Institute of Physics and Technical Sciences established at the University of Berlin, a few institutes of Physics founded in Strasbourg, Vienna etc. Large – scale industry companies started establishing science institutes, too [46].

At the beginning of 20th century, it became obvious that fundamental sciences are the base for applied and technical sciences. That is why the state started supporting fundamental researches. In 1900, the National Laboratory of Physics founded in England. In 1911, the Kaiser Wilhelm Society for the Promotion of Science established in Germany. It included all science institutes that carried out fundamental researches. Since 1947, the Society named after M. Planck and today it comprises more than 80 science institutes. Just before World War II, another important research centre was founded in France – CNRS (Centre National De La Recherche Scientifique). The aim of this establishment was to promote and coordinate fundamental researches, too. In some countries, science institutes were incorporated into academies of sciences. Today in many European countries like Holland, Switzerland, Italy and Germany (in Bavaria), one can find many science institutes incorporated into academies of sciences. The latter pattern was chosen to follow in Baltic States. Brothers Biržiškos, A. Purėnas, Z. Žemaitis and other prominent Lithuanian scientists prepared the project of the statute of academy in 1928. However, due to financial difficulties, the first Institute of Lituanistics was founded only in 1938 and the Academy of Sciences was not established until the occupation of the USSR. The other Baltic countries – Latvia and Estonia established their science

institutes, too. There were two institutes founded in Latvia and a few institutes and the Academy of Sciences established in Estonia [6, 22, 23, 59].

After the World War II the Soviet pattern of science establishments was introduced in Lithuania. In 1953, after the end of Stalin's dictatorship, the economy was restored and more funds were assigned for science. Many new academies and institutes of sciences were established and the number of scientists doubled every 7 years. The period was prosperous for scientific researches especially those of natural and technical sciences. In comparison to the humanities, exact sciences were almost free of ideological censorship. It was the time when the main trends of contemporary researches and contemporary schools of sciences were developed. On the other hand, the Soviet pattern of science had a few drawbacks: centralization, bureaucracy, and isolation from the world science community. However, science in Lithuania was less used for military purposes than in other Soviet republics. Baltic States never carried out important military researches. Two incoherent establishments – higher education schools and institutes of the Academy of Sciences, represented Science in Lithuania [6, 22].

After the fall of the totalitarian regime in East Europe, the countries like Czech Republic, Poland, and Romania etc. decided to separate the institutes from the academies of sciences or even to eliminate the academies. However, after long considerations the system of former science institutions was upheld. The reformation of Academic Institutes was explored in accordance with the international program "The Transformation of Science Systems in Central and East European Countries". The results of the survey were published in 1997 in the newsletter "Academic Institutes during the Period of Transformation" [67].

After the reform, the institutes became independent. The academies of sciences operated in sectors of coordination and expertise. They were also engaged in international and financial matters. Measures were taken to strengthen the connections between the institutes of academies and higher education institutions. Czech Republic demonstrates great achievements in this field: there are joint departments and laboratories of universities and institutes, many collaborative works have been carried out, institute representatives are members of faculty boards etc. In the East European countries, the institutes of academies mostly work on fundamental researches. The science institutions subordinate to ministries of sciences should apply the gained results [46, 67].

Another pattern was chosen in Baltic States. The institutes were separated from the academies and directly connected to higher education institutions. The science reform in Latvia was not carried out consequently but rather in the way of shock therapy. The majority of the institutes were forced to join with higher education institutions. The competitive sponsorship was introduced. The results were catastrophic. The president of the Academy of Sciences of Latvia J. Stradinis stated that the reform was too formal and facile. The number of science personnel decreased from

17 thousand (in 1990) to 3 thousand (in five years). The numbers were not so significant in other countries [6, 22].

The reformation of academic institutes was more consistent in Estonia. Even after separation from the Academy, the institutes kept tight connections with them and coordinated mutual science policies. Simultaneously, the institutes made collaborative contracts with higher education institutions. The chosen pattern worked out perfectly and in 1994, there were 19 joint professorates and departments; the collaborative research works were awarded 23 grants. Some institutes associated with higher education institutions. To conclude, the integration of the institutes into higher education in Estonia have been carried out smoothly and useful connections with the Academy of sciences were kept as well [46, 59].

1.3.2 The Reform of the Institutes in Lithuania

The reform started with very rapid changes: the institutes were separated from the Academy, Law on Science and Studies was adopted and the Board of Science of Lithuania was established. However, the reform did not proceed afterwards. The Board did not work out the strategy for the development of science but dealt with routine matters instead. On the other hand, the administration in the Ministry Education was replaced with every new government, therefore the reform slowed down.

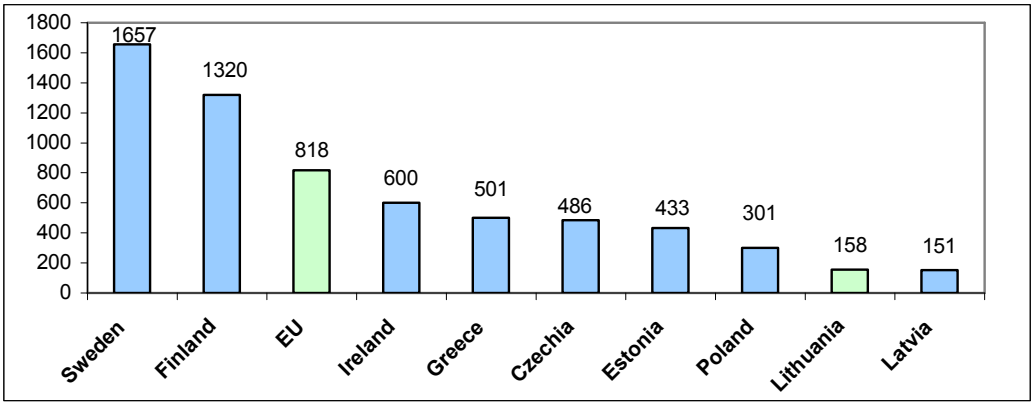
The connections between the state science institutes and some of universities became closer. The employees of the institutes worked on their own initiative starting teaching at universities. In general, the whole process of integration was not promoted by the administration itself [6, 59].

Only in 1997, two expert groups for promotion of the reform were established. A. Janulaitis and R. Sližis supervised the groups. The commission initiated the evaluation of the performance of the institutes and higher education institutions. The institutes were rated and put in several categories according to the evaluation results. However, after long discussions, all the institutes kept the former status. The conclusion was drawn, that the institutions of sciences themselves slowed the reform down. Another important decision was made: the right for salvation the basic issues of science and education was passed to the Board of Science of Lithuania, to the conference of university rectors and the conference of the directors of science institutes. The Department of Science and Studies was established within the Ministry of Education and Science. Its basic function was implementation of state policy of science and studies. During the period of economic crisis, the financing of the institutes was almost cut off. There were strict suggestions to join them with universities immediately [6, 7, 17].

The replaced Law of Science and Studies reflected new state provisions of science policy. In the project of the law, which was proposed to the Seimas for consideration in autumn of year 2000, the former state research institutions like state science institutes were eliminated. The new establishments - national research centers took their place. The university science institutes and other state science institutions had lower status [24].

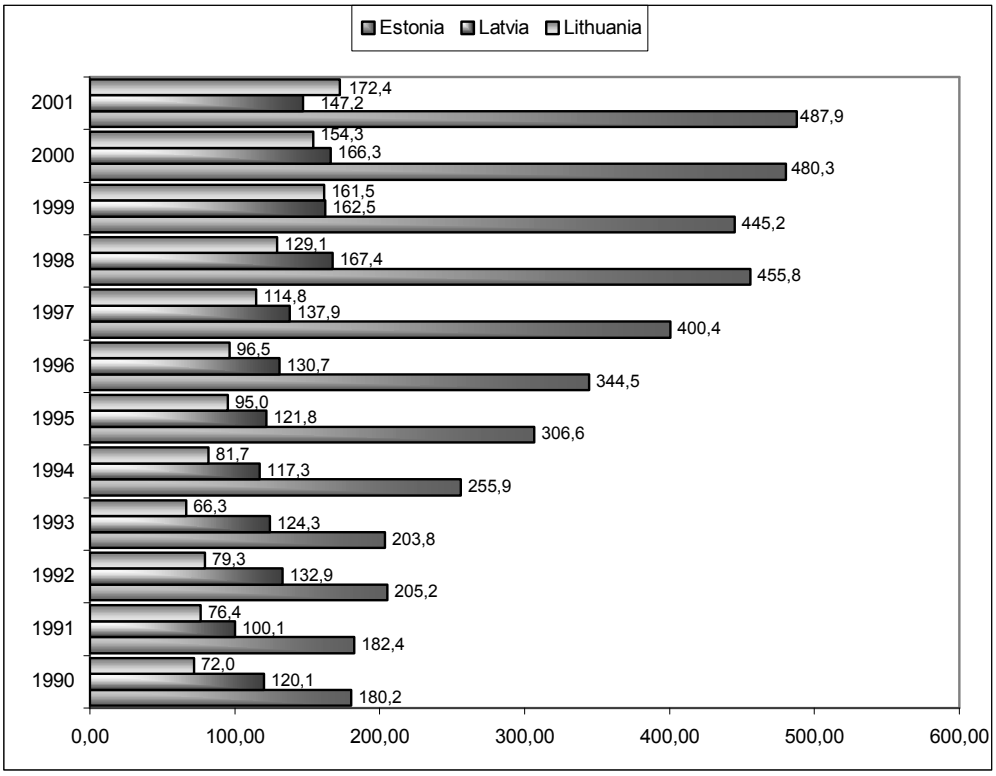
1.3.3 The Efficiency of Scientific Activities

The efficiency of scientific activities of science institutions is rated on the international scale. There are special quantitative indicators for these ratings. One of the indicators is the number of science essays, articles and other publications in the lists of Institute for Science Information (ISI in USA). In 2000 Lithuanian scientists were 5 times below the standard of the EU countries (see picture 1). Estonia was ahead Lithuania (about 2.5 times).



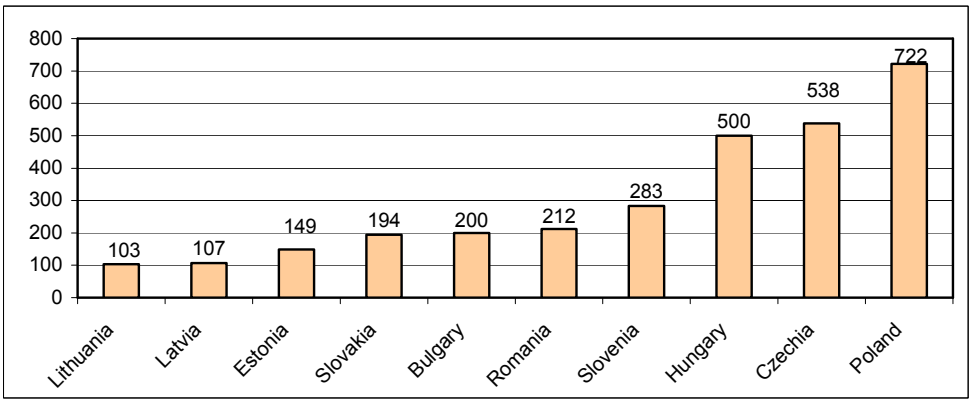
Picture 1. The number of the science publication in the lists of Institute of Science Information (ISI, USA) on for 1 million of population. [15, 39, 58]

In 2000, Lithuanian scientists published about 500 works in ISI journals. The growth is obvious, but in comparison to that of Estonia, it is not satisfactory (see picture 2). The best results demonstrated only a few scientists. There are about 4 thousand scientists in the fields of Physics, Biomedicine, and Technologies. This means, every eighth scientist publishes one scientific essay a year [23, 58].



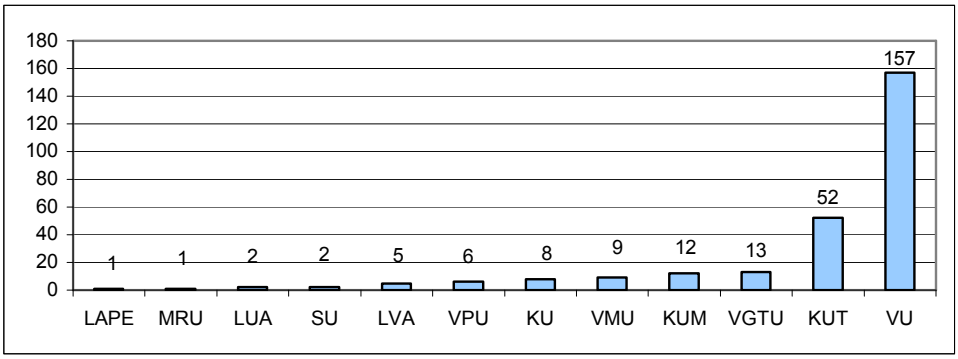
Picture 2. The number of referenced science publication in the lists of ISI in 2000 (on for 1 million of population) [15, 39].

Another indicator is the number of patents (registered at patent offices of EU and the USA) for 1 million of population. This indicator is equal to zero in the science institutions of Lithuania in comparison to the average rate in the EU countries. In 2000, there were 139 patents for one million of population. Several patents with Lithuanian co - authors were registered abroad. The level of scientific competence is the key for the participation of Lithuanian scientists in EU programs. In terms of successful projects participating in the Fifth Framework Program (5FP), Lithuania is behind Latvia and Estonia. In 2003 Lithuanian scientists submitted 103 5FP successful projects while Latvia submitted 111 and Estonia submitted 150 such projects (see picture 3).



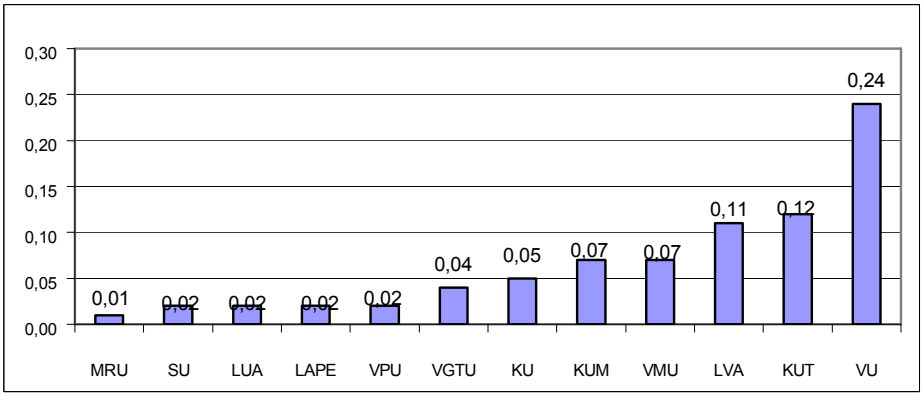
Picture 3. The number of FP projects [15, 58]

With regard to the scientific efficiency of Lithuanian researchers, it could be admitted that some of higher education institutions are below university standards. This tendency is reflected in the scientific publications listed in the ISI database (see picture 4).



Picture 4. The number of science publication in the lists of ISI by Lithuanian universities [15, 39].

The efficiency of scientific activities of universities is clearly shown in picture. 5. The rate of "efficiency" is calculated dividing the number of scientific publications by conditional number of scientists and scholars. The "conditional number" is gained by adding the total number of scientists to 1/3 of number of academics. The method is based on the provision that each academic has to dedicate 1/3 of his work hours to scientific researches.



Picture 5. The number of science publication in the lists of ISI on for 1 scientist

The above-mentioned indicator is not valid for rating the Humanities and Social Studies, but it clearly indicates the difference in performance of universities carrying out researches in the fields of Physics, Biomedicine, and Technologies [15, 58].

1.4. The Situation of Science in Lithuania

1.4.1 Scientific activities

The development of science in Lithuania is linked with managing to exploit the possibilities of global information infrastructure: ability to apply the most advanced scientific achievements, cooperation on the international scale, ability to satisfy the global market needs. Today the priority sectors are: energy resources, finance, transport and logistics, agricultural produce, ecology, construction industry. Other strategic priorities are: information technologies, biotechnologies, the security of a person and society, modern technologies and social matters [43]. Lithuania has potential to reach European standards in fields of biotechnologies, laser technologies, information technologies, exact mechanics etc. With regard to the above-mentioned statements, Lithuania can gain the significant role in developing European scientific research strategies and participate in programs for implementation of scientific achievements. Other science sectors should be developed promoting the overall technological advance [15].

Lithuania is not capable of gaining achievements in all scientific fields. The knowledge foundation is passed over from the global science. However, a country must have experts for all advanced science sectors and be ready to implement the advanced technologies without external help. In 2002, 152 institutions with staff number of 13.540 were working on various scientific and experimental researches (table 2); 5.163 (or 38 %) of them were scientists with scientific degrees or pedagogic names.

Table 2. The number of scientific employees

	1997	**1998**	**1999**	**2000**	**2001**	**2002**
The reported number of institutions	120	115	104	147	175	152
The number of employees:	15 436	15 561	15 296	14 592	14 980	13 450
The number of scientists	5 459	5 588	5 663	5 377	5 130	5 163
Percentage of scientists	35,6	35,9	37,0	36,8	34,2	38,0
The number of employees involved in science activity for:						
1 000 people	4,2	4,4	4,3	4,1	4,3	3,9
1 000 labour people	8,7	8,8	8,5	8,1	8,6	8,3

The number of working scientists has decreased since 1999. This tendency could be explained by their age: in 2002 more than 50 % of all Lithuanian scientists were older than 50 and more than 20 % were over 60. Thus, this problem has impact on the implementation of the advanced technologies in production. The main reasons, why Lithuanian scientists are advancing in

years, are low social status, low salaries and low rate of implementation of scientific achievements in business. More and more promising young scientists go abroad because of the above-mentioned reasons. There is lack of scientists in the field of applied researches, too.

Table 3. The number of working scientists in 2002

	In total		The segment of higher education		National (state) segment		The segment of business enterprises	
In total	**13 540**	**100**	**9 483**	**100**	**3 504**	**100**	**553**	**100**
Scientific officer	9 517	70	7 305	77	1 866	53	346	62
Scientists	5 163	54	4 042	55	1 076	58	45	13
Engineers	1 713	13	764	8	824	24	125	23
Other operating personnel	2 310	17	1 414	15	814	23	82	15
The number of institutions	**152**	**X**	**30**	**X**	**58**	**X**	**64**	**X**

The majority of Lithuanian researchers work in the sector of higher education (77 %). About 55 % of all scientists also work at universities. Others are employed in state institutions: state science institutes, science organizations sponsored and managed by the government (table 3).

After the reorganization of many enterprises scientific researches slowed down in the area of business. In 2002 there worked 62 % researchers (with 13 % scientists among them) in this sector. To promote the implementation of scientific knowledge into business there should work a network of middle organizations attracting financial resources like credits or grants. Now there are about 17 science institutes in Lithuania and about 10 science centres in universities and others science institutions [18, 19, 30]

1.4.2 Innovation the result of the science center activity

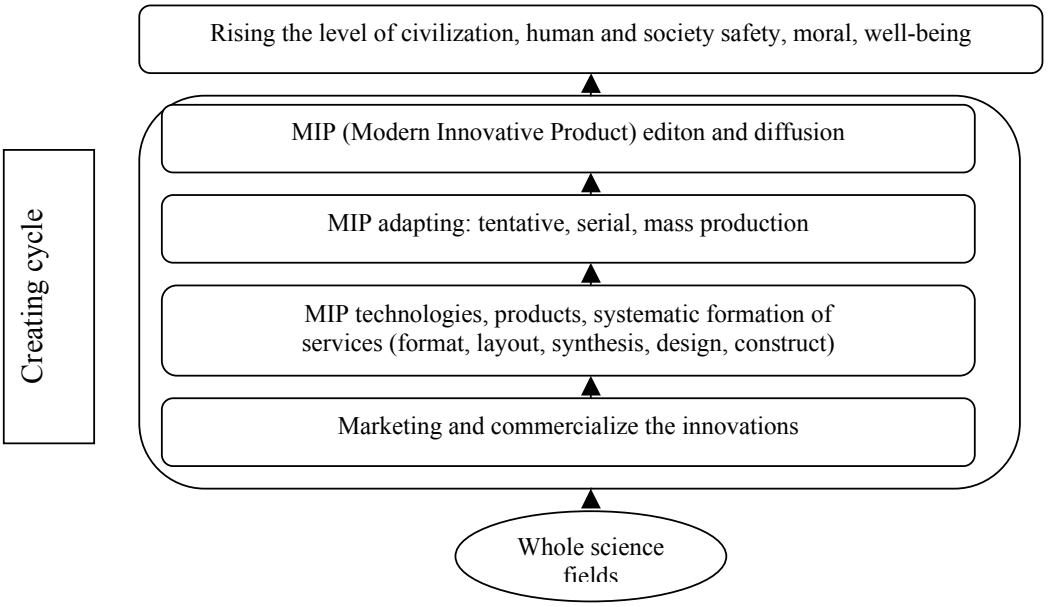
The science institution has a lot of activities, such as scientific researches, laboratory researches and others but the most important function of science center must be to create the innovations. Because only this function of the science center innovation has such important influence for the economy of the country. Describe the processes how the innovation are created and what is the main factor for creating good and useful innovation.

The period of the creating innovations process from formulating objective to get legitimated innovation ranging difficult and expensive collect and analyze information, theoretical and experimental tests, processing and forming the results and other activities. This composed the first cycle of creation innovation. The second cycle named adapted cycle includes marketing of the

innovations, involving legitimating balance of innovations between offer and demand, negotiation between creators (authors) and businessmen, adaptation, circulation and diffusion innovation of economy subjects. (See picture 6). The important result of successful innovation process is the positive change of civilization level in region and generally in all civilization worlds (raising the well-being of the people) [33, 42, 43, 44].

The first cycle always assimilates investments, the second, successful beginning of the innovative products (technology, service, realization, get back the expenditures and give the profits. Analyzing both cycle of innovation creating, arise a problem of offer and demand. In science collectives, which every day activity impose the scientific researches, sometimes were created the innovation, not afford to breakthrough and to follow up the second cycle of the innovation create process. Innovations like that are unprofitable, even loss making and are not using at all. However, there is a little possibility that between such innovations may spring the new, perfect innovations, exceed another's by the level of the novelty. They depend for the future and the future depends on them [29, 42].

The cycle of the creation innovations may be parted into stages. First stage mostly considers the looking for ideas, generates them, and applied science researches. Second stage considers discoveries, forming the inventions, how is created the invention, but not yet practically realized.



Picture 6. Scheme of the innovation process [13, 42, 43]

The third stage named design stage, when innovation are legitimated and prepared for the commercial realize. This stage includes technical design, construction, and technological and

organizational preparation. The fourth stage includes adapting innovations. At that point start to produce of the innovative products and use innovative technological processes. The first and second stages compile the first cycle of innovation creating.

1.4.3 Possibility of innovation in Western European Countries and in Lithuania

Innovations are the main factor for promotion of economic, ecological and social welfare of the people, increase living standard, promote labour productivity in state and private sectors; have impact on new manufacture areas as well as service industries and creation of employment [44]. Innovations are very important in Great Britain, Germany and Japan. For instance, in Germany innovations are therapy for economic diseases. In Japan, they help to create "prosperous society". Rapid implementation rate of innovations is the key factor for maintaining high quality services, competitiveness and high living standard in developed countries.

In accordance with the survey carried out by European Commission, the main reasons for different development of innovation activities in West European countries are the following:

1. Wide *spread of technologies* within a country or worldwide. Therefore, enterprises do not invent new technologies but rather buy them. It prevents the risks and huge expenditures while creating innovations, but decreases the competitiveness of enterprises.
2. Growing *competitiveness* of some developing countries like Singapore, Hong Kong, South Korea, Brazil, China etc. These countries having used advanced technologies and local cheap labour force managed to fill the world market with competitive goods. Today, with the development of market economics in East Europe, the problem is growing bigger. Western countries are not able to compete with cheap goods. Therefore, they have to use innovative technologies and develop non – traditional industries.
3. Different *legislative restrictions* on implementation of innovations. For example, restrictions on environment and protection of health. It makes the process of implementation of innovations longer and more expensive. Currently, the above-mentioned laws determine the priority sectors in creation of innovations.
4. Different *rates of inflation.* The problem is that long – term and expensive scientific and technical innovations require huge investment. When the inflation rate is rapid, the institutions financing innovation development run financial risks.

The carried out survey shows that Europe in the sector of creation and implementation of innovations is behind its rivals – USA and Japan. It is a paradox, that Europe with its hundred

yearlong university traditions and leading scientific achievements cannot maintain high position in the sector of commercial innovation development [33, 42, 43].

The answer lies in finances. In Europe, the expenses for science make 2 % of GDP, while in USA and Japan the number is about 2.7 %. Total expenditures for the development of science and technologies make less than those in USA and Japan (in GDP). In terms of total expenditures for the development of science and technologies for one resident, the rate in Japan is twice bigger than the rate in EU. The expenditures for the development of science and technologies gained from state and industry institutions are similar in EU and in the USA. In Japan, this rate is different: industry spends ¾ of overall expenditures for development of science and technologies. In EU, the number of scientist working at business enterprises is low. In business sector there work about 50 % of scientists in EU and more than 70 % of scientists work in the USA and Japan.

Trying to promote innovative processes in EU, on 20th of November in 1996, the European Commission adopted The First Action Plan for Innovation in Europe. This strategic document presents the scheme promoting innovative processes in Europe. It points out the priority measures, which should be taken by the European Commission. The main *provisions and statements are relevant* to all East European countries – candidate countries. The innovation activities are very important with regard to integration into the structures of the European Union. The problems of implementation of innovations in East European countries (in Lithuania as well) are similar to those in the EU.

The difference in attitude of ten Middle and East European countries to the development of science and technologies is similar to their different development in economics. One of the main indicators showing the attitude of a country to innovations is the expenditure. According to EUROSTAT, the rate of expenditures on innovations in these countries is about 1.5 %. It differs with the country from 1.77 % in Slovenia to 0.47 % in Latvia and 0.57 % in Lithuania [67].

One of the ways to increase competitiveness is promotion of innovations. The main participants of the process are business enterprises promoting innovations, science institutions – sources of innovations and service industry companies responsible for successive implementation of innovations.

State interest in innovations is growing bigger. There are programs like Development of Small and Middle Craft Industries, Development of Exports in Business of Innovations etc.

Since 1998 the Department of Statistics of Lithuania has been carrying out surveys on innovation activities of enterprises. All higher education institutions introduce course of management but only a few institutions (Vilnius Gediminas Technical University, Vilnius University and Kaunas University of Technologies) introduce course of innovation management.

Private education centers do not offer these courses either. This new area requires new qualifications and preparation [58].

However, overall volume of exported output is decreasing. It is determined by low competitiveness in domestic and foreign markets. The reasons are outdated technologies and methods: the manufacturing procedure is not smoothly prepared; there is waste of energy and material resources, insufficient quality. Besides, not in every enterprise analytical research works (oriented to market research, conception of enterprise development and strategic planning) have been carried out. In most cases one and the same person is not capable of dealing with overall management problems [13].

In conclusion, the system promoting scientific and technological achievements into business is not working. Incompetent workers with no relevant education are solving a lot of important problems of production innovation and modernization.

1.4.4 Science Institutes in Lithuania

Over 300 scientists of information technologies (IT) work for science and study institutions in Lithuania. The majority of scientific researches in the area are carried out at Kaunas University of Technology, Vilnius University, Institute of Mathematics and Informatics, Vilnius Gediminas Technical University. The sector is also the priority at Vytautas Magnus University, Vilnius Pedagogical University, Kaunas University and Šiauliai University. 150 doctors of sciences have carried out the scientific researches. About 100 posts – graduate students have chosen doctorial studies in the area of engineering informatics and information technologies. The researches involve the methods of developing software as well as technologies for designing hardware. However, the scientific results are not implemented into production of IT in Lithuania. In most cases, the achievements have been applied abroad [30, 55, 56, 59].

In the sector of biotechnology there work the following institutions: Institute of Biotechnology, Institute of Biochemistry, Institute of Immunology (VU) and Vilnius Gediminas Technical University (departments of Chemistry and Bioengineering). These institutes accomplish contract research works and train highly qualified specialists. There is big intellectual potential and great achievement is gained in the areas like proteins in pharmacy, ferments and nucleic acid in chemistry and biochemistry, prokaryotic and eucharistic cells in molecular biology. On the other hand, the slippage is obvious in the fields like genomic, transcriptomics and proteomic researches and in the field of bio-informatics. The result is insufficient competitiveness in industry of biotechnology [10, 22].

Kaunas University of Technology, Vilnius Gediminas Technical University, Vytautas Magnus University, Šiauliai University, Lithuanian Energy Institute and Semiconductor Physics Institute deal with the research of mechatronic systems. Many contract research works have been carried out at Kaunas University of Technology and many successful projects have been submitted participating in EU and other international programs. The wide spectrum of scientific activities of Kaunas University of Technology includes researches on modelling, strength, dynamics, precision, reliability etc. The complete production includes: new technologies and products on the base of piezoactive substances; intellectual measuring instruments and systems; ultrasonic flow yield meters; ultrasonic precision meters of level and distance; systems of medical diagnostics; converters and devices of ultrasonic echoscopy; mechatronic systems for physiological monitoring; devices for transmitting view (based on signals) and data through telemedicine networks; the software for analysing the control and signals of technological devices targeted to save energy etc. Semiconductor Physics Institute can offer semiconductor sensors for measuring pressure, vibration, fluid level, silicon etc. Lithuanian Energy Institute and Vytautas Magnus University have achieved significant results in creating electrochemical generators. However, due to poor technical base the results are not as satisfactory as those in West European countries. [17, 18, 32, 55, 56].

There are a few science centres of laser technologies and laser research centres in Lithuania:

- Laser Research Centre at Vilnius University together with Centre of Excellence (CEBIOLA);
- Institute of Material Science and Applied Research (Vilnius University) [55];
- Laboratory of non – linear optics and spectroscopy and Physics Laboratory of Molecular Particles (Institute of Physics);
- Laboratory of Opto-electronics (Semiconductor Physics Institute);
- The joint centre of Opto-electronics (Institute of Material Science and Applied Research of Vilnius University and Semiconductor Physics Institute);
- Applied researches and works for development of technologies are carried out by high technology enterprises “EKSMA”, EKSPLA”, “Šviesos konversija“etc. These enterprises give 5 % of their trading margin to scientific research works [57].

Great achievement is the first international project “The Invention of Laser Fluorometer for Detection of Oil Spots on Surface of Water”. Very important researches for development of laser technologies have been carried out at Vilnius University and Vilnius Gediminas Technical University. International projects promoted by EU and NATO have been carried out in the centers of laser technologies and laser scientific research centers. Lithuanian budget and the State Fund support the other researches for Science and Studies.

In the sector of nano-technologies and electronics, the following institutions have made the ultimate contribution: Institute of Semiconductor Physics, Institute of Chemistry, Institute of Physics, Lithuanian Energy Institute, Institute of Biochemistry, Institute of Theoretical Physics and Astronomy of Vilnius University, Kaunas University of Technology and Vilnius Gediminas Technical University. These institutions accomplish the majority of contract research works and also train highly qualified specialists. There is great scientific potential in this field. The publications on nano-technologies cover one-half of all scientific articles listed into the journals of ISI [23, 31, 32, 39].

1.4.5 Financial Sources for Promotion of Science in Lithuania

In Lithuania the major (table 4) financial source for scientific research and experimental development is state budget financing. In 2002, there were 350 million of Litas assigned for the researches. According to the Department of Statistics, the number increases every year. The overall state contribution to the development of science made about 215 million of Litas.

Table 4. Financial sources of scientific researches [58]

LTL million	1999	20000	2001	2002
The finance designated for science research	**224,6**	**277,6**	**331,1**	**350,2**
From funds of the state, %	72,4	57,9	53,3	61,4
From funds of the business enterprises, %	14,7	12,1	9,7	11,7
From other funds, %	12,9	30,0	37,0	26,9

However, the financial problem is not solved completely. There are several ways to increase funds: to get more assignments from the budget (but the state is not capable of increasing the finances); another way is to find alternative financial sources like indirect financing or raising funds and assigning bigger financial share for each scientist.

One example of indirect financing could be promoting economic operators to make contracts with science institutions and finance the researches from the charity. Another way is rational distribution of the budget funds: inefficient scientific researches should be cut; inexpedient constructions should not be supported etc.

Having distributed financial sources according to the sectors (table 5); one can see that the biggest support is given to science. Business enterprises use for science their trading margin what makes about 90 %, while state budget financing makes only 0.7 %. The participants of various

international programs are basically higher education institutions. Unfortunately, foreign business enterprises very rarely support Lithuanian research science.

According to the Department of Statistics, expenses on scientific researches, especially in the sector of fundamental researches, increased from 1999 to 2002 (see fig. 6). In 2002, the expenses on these researches were about 141 million Litas while applied researches and experimental activities were assigned with 125.2 and 78.5 million Litas. During the period of 1999 to 2002, the financing of experimental development rose significantly but since 2002 the expenses have decreased in 30 % [39].

Table 5. Financial sources for scientific research by sectors [58]

LTL million	In total	The segment of higher education	National segment	The segment of business enterprises
In total	**350,2**	**173,6**	**118,5**	**58,1**
The finances of the state	215,2	128,7	86,1	0,4
The finances of the business enterprises:	40,9	16,1	19,6	5,2
From Lithuanian	28,2	11,0	16,2	1,0
From Foreign	12,7	5,1	3,4	4,2
Partnership in international programmes	12,0	7,3	4,7	-
The finance of the own	79,1	20,0	7,7	51,4
The finances of the others	3,0	1,5	0,4	1,1

Financing rate per scientist in Lithuania is far behind the similar index in developed countries. Every scientist in Lithuania gets 10 times less finances than scientists in developed countries. Obviously, the above-mentioned reasons prevent Lithuanian scientists from fulfilment of their duties to the society and the state, besides poor financing does not guaranty participation in the competitive world science market.

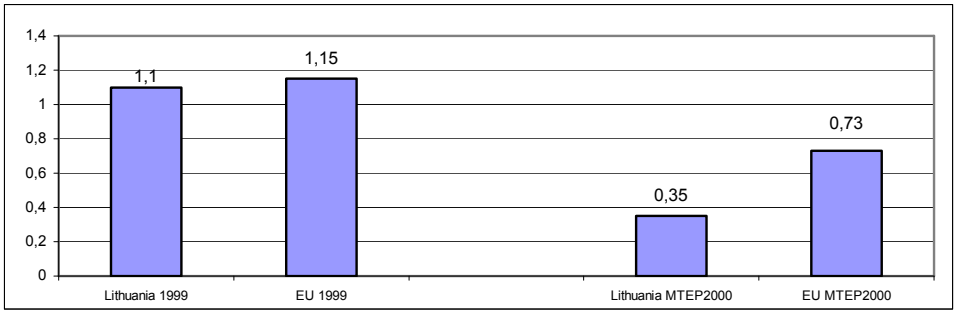
There is possibility that financing of science will get better soon. Lithuanian economy and industry are not capable of sponsoring science as contractors. Therefore, it is very important to distribute the gained funds in the most rational way. The situation today is not very optimistic: budget financing does not promote the efficiency of scientific activities. This has a negative impact on the development of science. Moreover, the current financing system does not promote highly efficient scientists and allows sponsoring the inefficient ones. Competitive sponsorship and financing through various programs should be encouraged as well. There is great need to implement the financing system promoting advanced changes in science development, which would be oriented to higher level of scientific achievements and would be the priority area in state science

policy. The distribution of state budget financing for different science fields is one of the main factors in state science policy. Such policy is not implemented in Lithuania yet [2].

1.4.6 The Expenditures on Scientific Research and Experimental Development

Total expenditures in GDP on the sector of scientific research and experimental development are 3 times behind the rate of EU countries. In terms of state budget financing the sector of scientific research and experimental development, Lithuanian rate in GDP is twice lower the rate of EU (see picture 7). Comparing the proportions of finances for scientific research and experimental development and finances for higher education one can clearly notice that the higher education gains more funds than science. It means that the current finance system is not rational because some universities do not carry any scientific researches. Today the EU rate of expenditures for scientific research and development of technologies is 1.9 % GDP. Total rate of the expenditures for scientific research and development in Lithuania makes about 0.52 % GDP. There is hope that in 2010 the total expenditures on science and technologies will make 3 % GDP. The perspective is optimistic because only new scientific research and new quality technologies implemented in industry, agriculture, economy etc. can guaranty better living standard in Europe and the leading economy in the world.

There is tight connection between investment in scientific researches and the growth in economics as well as its innovation. That is why every country increases its potential in the sectors of scientific researches, development of advanced technologies and their implementation in industry and business. In 2002 expenditures on scientific research and experimental development were 344.7 million Litas, i.e. 6 % more than in 2001 (picture 7). Total expenditures In Lithuania on the sector of scientific research and experimental development were 0.68 GDP in 2002. The rate is obviously far behind the rate of EU countries



Picture 7. Expenditures on scientific research proportion with GDP (%) [58, 59]

The main financial source was the state budget (about 53 %) and only 10 % finances were from business contractors. The conclusion is that large – scale industries are not interested in

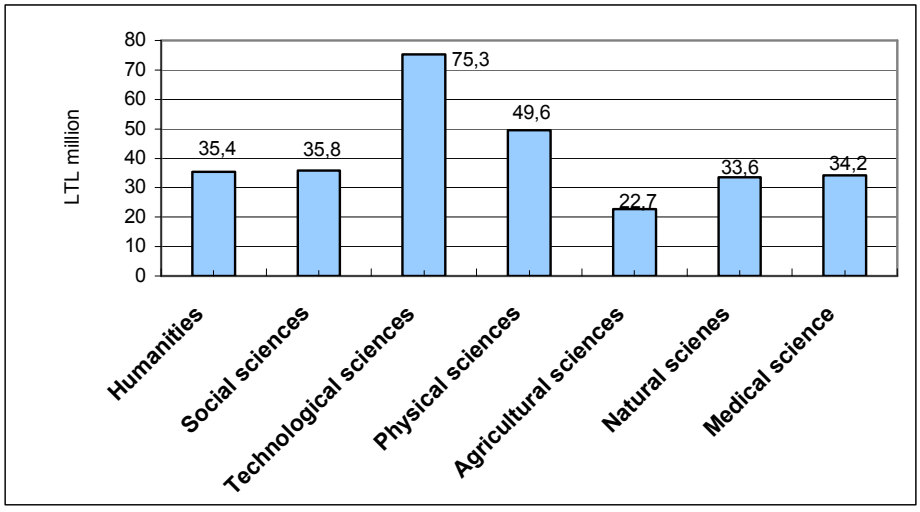
scientific innovations while small and middle craft industries cannot afford scientific production and modern technologies.

There are not special measures promoting relationship between science and industry in Lithuania but some scientific search profiles (like biotechnology, biochemistry, chemistry, physics, mathematics, preservation of the environment) have huge potential in the area of applied research and is capable of carrying out contract research works. The proof is the distribution of the expenditures according to the science profile (see picture. 7). The most advanced areas (like optical and medical devices, production of biotechnology) are competent enough to develop and update the production of high technologies and provide their services.

Table 6. Expenditures on scientific research

Expenses	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**
The expenses for science activity, LTL %	217,2	244,5	220,3	269,9	326,8	344,7
For fundamental research	41,1	46,6	55,7	41,7	35,3	40,9
For applied research	44,1	43,3	34,5	36,3	29,8	36,3
For experiment works	14,8	10,1	9,8	22,0	34,9	22,8
The expenses for science activity, % of DGP	0,57	0,57	0,52	0,60	0,69	0,68

Scientific achievements of a country are evaluated in terms of scientific articles quoted in relation to the total number of publications worldwide, the number of registered patents and acquired licenses. Lithuania has no significant results in the areas (picture 8). Thus, Lithuania is



Picture 8. Expenditures on scientific research by science in 2002. (mln.Litas)

weak in creating, spreading and applying new scientific knowledge, which could satisfy needs of the society [58]

Changes in the market must promote business people to get more interested in innovations, to maintain international relations, to solve production quality problems. There are very few innovative enterprises in Lithuania, which are able to order scientific researches improving the quality of their production. Low number of scientific production could explain the gap between scientific researches and business, which could be competitive in the world market [54].

2. Quality management.

2.1 Evolution of quality management.

A lot of modern quality management principles have been developed step by step by evolution way, as opposed to sensational revolution way. There are four different stages in evolution of quality management methods. The first is control (inspection), the second – statistical quality management, quality assurance and strategic quality management it is total quality management [51].

The approaches are an expression of quality philosophy, which is a fact-based systematic inquire into the totality of quality [35].

Supposing, that quantity and quality are the main categories of man's life philosophy and life practice, the question is, why only in second part of XX century the humanity started particularly interest in quality? Does the quality be not important in earliest civilization? The Stone Age implements are the surprisingly perfect, its form are not so different from today analogical tools. And no wonder quality of these tools was life and death important.

The second question is – when was easily to achieve good quality - in Stone Age or today, in the beginning of the XXI century? Do not compare technologies of today and Stone Age. The main management aspect of this problem is division of labour. The division of labour didn't exist in primitive society. The same person was the designer, producer, and consumer. The persona was very interested in good quality of the product, the person made tools and weapons, conforming to his own needs. The industrial revolution destroyed this positive factor for quality assurance in organization.

The today people may enjoy of high quality of built roads, bridges, temples, ships and other masterpieces before thousands years in Rome, Greece, China, India, Japan and other. These countries have had its own systems of standards and special quality control.

The level of quality management in ancient times is better to analyze by evolution of quality management in China. China was one of the earliest countries that developed a civilization [35, 36].

For long history times in China was formed quality management system, which was legitimated. Quality was managed by country administrative elements. The state has been initiate the quality standards, control of manufacturing processes, check and evaluates the quality of products. Such many-sided state influence for quality was unusual in other countries in ancient times.

Different from other ancient civilizations, evolution of China has not stopped, have been developed for long centuries. In old China quality management was formed, developed, according to big experience. The product made in China was valued in all worlds and extended till our time. Quality management in China existed from XVII c. B. C. till III c. B. C. and was formed relatively finished quality management system. This system was closely attendant to society of China. Was create centralized quality system from the beginning to the end for all handcraft producing processes. Starting with the XI-VIII c. B. C. a system of control of the production has already been set up in the state administrative organizations. The control system in these organizations concluded five main facilities:

1. Charge of production, collection, storage and distribution of raw and semi-finished materials.
2. Production and manufacturing.
3. Storing and distributing completed products.
4. Formulating and executing standards.
5. Supervision and examination [35].

All these five facilities were strongly associated together. All these facilities were independent and have their own specific functions; however the activity was coordinated formulating simple production system.

The system of standards for length, capacity and weight was formulated so as to carry an examination of the products quality. The law provided that in the same category of utensils the forms, height, length and breadth must be identical. The law provided that products would be manufactured with full names of the workers. The officials were able to confiscate all false and indiscriminate goods in training [35, 36, 51].

The standards of the manufacturing of 30 special departments include in the officially owned industries of that time. The expensive contents relate to product designing, product specifications, quality requirements, manufacturing techniques, production tools and methods of inspecting and testing [36, 51].

2.2 Quality management in our time.

In the 18-19th centuries control for quality, as we understand it today, did not yet exist. Goods were produced in small volumes; parts were matched to one another by hand, and after the fact inspection was conducted informally, if at all.

From the Industrial to Quality revolution the management for quality made a long way of evolution [35].

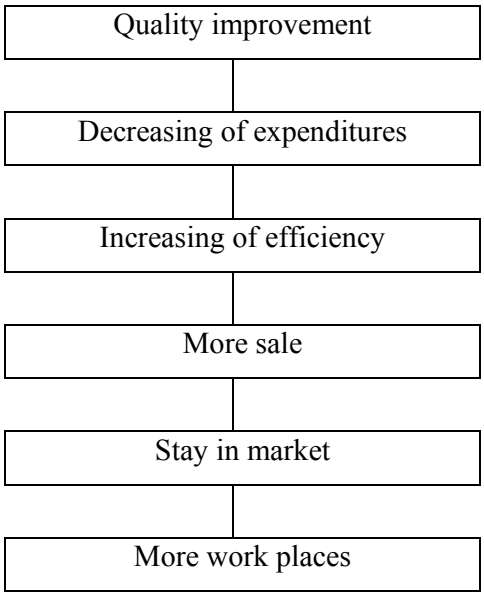
2.2.1 Quality management in Japan

Before 1945 Japan's quality efforts were limited primarily to inspection. Statistical quality management methods was known but rarely used, however in Japan standards was developed about 1910. Japanese quality was poor, and a lot of design for production and quality management methods was random and not coordinated [40, 50]

After the Second World War the real changes began. American specialists motivated these changes. Quality management methods of USA were widely used the world over, however the biggest success had in Japan. The Japanese producers were interested in statistical quality management methods by E. Deming and W. Shewhart. So the Union of Japanese scientists and engineers invited E. Deming to train its members to quality and efficiency conceptions. The base of quality philosophy that statistical quality management methods seeking for products high quality may be used in all management levels of enterprise. He was pointed, that the consumer is the main important component of production process. He introduced the Japanese to modern methods of consumer research. Every company had to produce products, which will satisfy the customer. The beginning of quality revolution in Japan often is associated with E. Deming personality. He oriented management to create quality improvement systems. E. Deming had proved that development of quality might help to solve economic and social problems. He introduced E. Deming named chain reaction. Development of quality is useful to decrease expenditures of production and increase efficiency of production. Because of, it is possible to sell more and cheaper. In this way the enterprise is stayed in the market for a long time and created more work places (see picture 9).

The Japanese achieved their success with technical and economic help of the USA and efforts of Japanese managers. [38, 50].

Another quality specialist from USA was J.Juran. His lectures were focused on planning, improvement, and responsibility for quality. J.Juran appreciated that the Japanese companies went into quality improvement at a revolutionary pace and maintained that pace year after year.



Picture 9. Chain reaction by E. Deming

The quality management specialist I.Ishikava was the president of this union and very important and rich producer. He was a pioneer in statistical methods, the author of several texts in quality control, the greater believer in the need of quality education and training .One of the most distinctive features of the Japanese quality movement was its national focus. National organizations – the Industrial Standards Committee and the Union of Japanese Scientists and Engineers mobilized support for quality movement, and new ideas diffused throughout the country.

Japanese Company Wide Quality Control (JCWQC) program was developed drawing on leading edge Western thinking and national value system. This term was introduced in 1968.

CWQC program includes four principle elements:

1. The involvement of functions other than manufacturing in quality activities.
2. The participation of employees at all levels.
3. The goal of continuous improvement.
4. Careful attention to customers' definition of quality [51].

The involvement of all employees is uniquely Japanese. The fourth element of CWQC is strong customer orientation and quality is defined from customer's point of view. The development of employee empowerment signaled about a fundamental change in quality management. A manufacturer and American and Japanese scientists worked together for the development of the innovative approaches to production. These innovations reduced a management system. Japanese CWQC system was named Total Quality Management (TQM), which is the most advanced management approach based on the theoretical works, mostly Americans, and on the Japanese practice [51].

World recognized, that the Japanese success in the world market is a result of the improved product quality. They suggested that Japanese worker's participation in problem solving is the key to the Japanese success, but Japanese development in Quality field had several field.

According to J.Juran three are three major ingredients in Japan quality movement:

1. Massive quality related program;
2. Annual programs of quality improvement;
3. Upper management leadership of the quality function.

The Japanese head the world quality leadership.

The quality management revolution is going on [35, 38].

2.2.2 Quality management in USA

The best-known companies of USA like "IBM", "General Motors", "Motorola", "Xerox" and others had a feeling the big competition in world market. They have to understand that their opinion of quality management is in "sleep stage" and pass to "searching stage" for quality of practice and efficiency of production helped by Japanese businessmen. Customers started to compare, evaluate, select critically the products, looking for the whole value – quality, price, and service. The enterprises mean of ideas by E. Deming, other well-known quality improvement specialists and the improvement of constant quality methods which was used in Japan [51]

However the searching of quality and production efficiency by USA manufacturers in the end of XX century, was not only simple using of mentioned quality management discoveries in Japan, but it is new philosophy for decision these problems. The quality management specialist T. Piters proposed that neither statistical quality control, nor quality teams, nor stimulation systems rational offers, nor medals or shields, nor catchwords, nor programs or any other devices, which will be used singly, do not solved problems of the quality and the efficiency implementation. To solve these problems, are necessary to have all these devices together and a lot of other devices.

The well-known quality specialist from USA dr. H. Harrington underlined that correcting the work mistakes we have not to criticize the people, but most to care about systems, which helped to regulate and manage production activity. Supposedly, about 75-80 % bad quality depends on these systems and only about 25-15 % - on people. In this time, the companies of USA have founded new methods for quality and efficiency improvement. Primarily these methods were named different: The Improvement Process, Total Quality, Total Quality Control, and finally, Total Quality Management [35, 50].

The implementation of Total Quality Management in USA was characterized by original way, not ways in other early countries. This activity was named "quality revolution" in USA.

The Government of the United States understood that quality is the main factor, which helps to develop the economy of the country. From 20Th august of 1987 year the President of The USA signed the Malcolm Baldridge National Quality Improvement Act, which established the annual awards of quality in USA. Malcolm Baldridge was man who a lot of deserved in total quality management promotion [51]. The aim of quality awards is to stimulate the management, to improve quality and to make the success factors of excellence management practices visible and public [35].

The aim of this Act is to plan in advance the program for creating and managing the national quality improvement. The awards will be hand in seeking to see the companies of USA and others, which have been implemented the quality of products and services by effective quality managing, and the information about successful strategy and programs will be broadcast [50, 51]

The "revolution of quality" in USA has a big influence for development of Total Quality Management in the world. When Japanese fabrics started to push the American products from the world markets, the USA manufacturers had analyzed the reasons of poor quality. Well-known quality assurance methods, "zero defects" production, statistical quality management methods were overmuch limited to solve this difficult problem. It was necessary to predicate on new quality management methods the developmental strategy of the companies for improve the competitive ability. The main decision was to determinate the quality by customer opinion. The American quality management association generalized that:

- There is no one, who supplies the products, but there are buyers, customers who decided do the products satisfy their needs and expectations.
- Satisfaction depended on competitive offers.
- Satisfaction is forming in all product life cycles, not only in sales.
- To satisfy the customer is needed all product feature completeness [51].

Here is the first time the quality was describe as comparing with competitors, but not with fixed internal standards. Customers, not the facilities of the company, said the ultimate word in the product quality acceptability [50].

Relating to this reason there are some new requirements. The quality research in market was very important. Knowledge about analogical product quality in the market is very important. Not only the sale-price but also the product life cycle price is very important for buyers too. All comes to a conclusion, that quality is powerful mean of the competitiveness. Therefore, it was necessary to rethink traditional philosophy of quality and since now is associated with continuous development, training quality management specialists, employers constant practice training and with all, that we named as Total Quality Management [41].

Quality in the Total Quality management system is the main strategic factor for company development.

2.2.3 Quality in Europe

The intensive competition in world and Europe stimulate the Governments of European countries to contemplate about production quality. Recognized that the supply process became uncontrolled, the European organization of industry and service section have changed the project, management, manufacturing and other processes inside organizations [67].

Comparing with other countries, European countries were behind in quality management and quality control field in the end of the XX century. This proposition based on rating, comparing with USA, Japan and Europe car manufacturing enterprises efficiency: for example, in over 1000 produced car in Japan 60was poor quality, in USA – 82, in Europe – 92. For production 1 car in Japan needed 16,8 work hours, in USA – 24,9 h., in Europe – 35,5 h. As we see, not only quality is behind in Europe but work productivity too [51].

Decreased competitive ability of the European industry reduced to change an old stagnation view of quality management. However, it is not so easy to change a rule formed lot of years ago: for example, it was very difficult to put away the outdated management style for German industrialist, who were on the top of a lot of main industries after postwar period.

Because of the world competitive ability a lot of European politics, scientists and industrialists understood that only cooperation in country and in region, the market's consolidation, and division of experience and knowledge might have good ascendancy. Supposedly, only high quality is the key to harmonic European progress in XXI century [45].

The multicultural nature of European business organizations demands flexibility that is less apparent in the U.S. and Japan. These organizations use different approaches and model for quality management [35].

Quality police of Europe is implementing by European Quality program. It is proceeding in EU by national and enterprises level, supported by common strategy.

The main fields of activities in European Quality program are these:

1. To stimulate the quality and implement of tools for quality improvement. It include the quality improvement in this activity not only public but private enterprises, organizations, and firms.
2. To accomplish and promote the methods of quality management. It includes the creation and implementation of quality management systems by ISO 9000 family standards.
3. To develop the infrastructure of quality.

4. Training and refresh the qualification.
5. Coordination of management structure [35].

European organization for Quality (EOQ) was formed in 1956. This organization supports the development of quality practices and serves for the commonality of disseminated practices. EOQ catalyzed a development of the new approaches for the Europe of the new millennium in the concept of a Vision for Quality in Europe. The concept of a Vision embraces the public administration and essential orientation to the cultural change [1,2]. The main attention of EOQ is given to public service, because the public services in Europe now – the growth, profitable sector of economics, which comprised 60 % of all common national products in European Union [51].

In 1988 the European Foundation for Quality management (EFQM) was established in recognition of the strategic importance of total quality management for the competitive position of European business [35, 67]. This foundation was created by these well-known companies like: Philips, Bull, Fiat, British Telecom, Olivetti, Bosch, Renault, Sulzer ant others [2]. The EFQM was a key role to enhance the effectiveness and efficiency of European organizations reinforcing the importance of quality in all aspects of their activities [45, 67]. EFQM has been driven by a vision of helping to create strong European organizations that practice the principles of Total Quality Management in the way they do business and in their relationships with their employees, shareholders, customers and communities in which they operate. EFQM's mission:

- ✓ To stimulate and assist organizations through Europe to participate in improvement activities leading ultimately to excellence in customer satisfaction, employee satisfaction, impact on society and business results.
- ✓ T o support the managers of European organizations in accelerating the process of making Total Quality Management a decisive factor for achieving global competitive advantage.

The implementation of Total Quality Management programs can achieve significant benefits such as increased efficiency, reduced costs and greater satisfaction, all leading to better business results [63].

In the last ten years in Europe the most significant trend of quality management and its improvement was the creation of quality system of an organization and its registration on the basis of ISO 9000 standards. Other important trend was use of the business excellence self-assessment mechanisms [35].

In 2003 the Lithuanian Quality Management Association was accredited in EOQ. Hopefully, the membership of Lithuanian Quality Management Association in EOQ will stimulate the development of quality management in Lithuania. Then we will better impart European's quality management newest technologies and experience for Lithuanian enterprises [51].

2.2.4 Quality management in Lithuania

The first National quality program was prepared in 1995 and approved in 1996 by Lithuanian Government for implementation the Total Quality Management in Lithuania. It's made by executing the Act of "Improving the regulation tools of foreign trade and extending the export" in 1995 [2].

Lithuanian National quality policy and program were prepared sustaining by analysis of existing conditions and leading by standardization, metrology and assessment quality concepts, by European quality policy elements, Spain quality program, North England quality campaign experience, elements of implementation of TQM in Japan and USA and other sources.

The aim of National quality management policy:

1. To help for subjects of Lithuanian economic becomes the competitive in Europe and world markets,
2. To allow the harmonic integration of Lithuania in EU;
3. To formed new position of work quality in Lithuania;
4. To raise the level of living standards till it seek the level of the richest countries of EU;
5. To inform and train the society of the quality tools;
6. To create and implement economical and social invitation for producing high quality products in all Lithuanian economic sectors;
7. To motivate the science researches in quality achievement fields,
8. To train and qualify specialists for solving quality management problems;
9. To implement the newest quality management methods;
10. To stimulate the implementation of quality management tools and management schemes by ISO 9000 standards;
11. To estimate the potential unsafe products for people, animals and environment and to coordinate with EU directives;
12. To develop the activity of organizations for standardization and metrology harmonized it with EU relative service [9, 58, 62]

The implementation of National quality policy

National quality policy was prepared and implemented considering what was achieved in this field in Lithuania, it means various initiatives and tools, already using and developing science and academic institutions. In this way were seeking to create common, competence, and believable and effective infrastructure to solve quality-seeking problems.

1. Social principle.

Implementing National quality policy was seeking to create social and economic conditions, that it's using and developing becomes National Lithuanian patriotic feature. National quality policy appeals to:

- Respect to man, his rights and dignity;
- Cultural improving of Lithuanian citizens, enterprises and organization;
- Creative side in everyone work quality, its material and moral stimulation;
- Rise of wages and living standards [50, 62].

2. Complex principle

It was seeking to regulate economic sector and territorial management agencies struggle, develop and strength quality ambition infrastructure and closed collaboration with all economic subjects of Lithuania [62]

3. Conceptual principle

National quality policy accordance with Europe and world wide initiated quality development conception, methods and techniques perfecting national standardization, metrology and equivalent evaluation systems, implementing international quality management ISO 9000 standards, organizing certification of quality management systems. It is only the first sign in National quality program.

The main National quality policy aims were achieving in Europe and in all world prevalent quality management methods, to implement them is necessary to educate society, training, economic and social quality promotion and other techniques [36].

4. Sequence principle

All country, region or separate economic subject level newest quality management philosophy and techniques first of all have to recognize the top management heads, after them – middle chain heads and their subordinates, and eventually, all working and unemployed citizens of Lithuania, it called principle of "waterfall".

5. International recognition principle

Implementing of quality policy were seeking to get assurance of Lithuanian made products in worldwide markets, subscribe to free product moving in internal and worldwide markets by law acts [40, 49].

The main aim of National Quality program is to create infrastructure and favorable environment for every economic subject to seek quality.

The first National Quality program included these parts:

- Maintenance of quality;
- Propagate and inform the society with results of National Quality policy and its implementation;

- Training;
- Science researches, creating and propagating the new quality management techniques;
- State regulation of product quality, standardization, metrology and equivalent evaluation proceeding development;
- Organization of implementation ISO 9000 quality management standards;
- Economical and social quality promotion [62, 64].

One of the main tasks of national quality program is training. Training is divided into two parts – first, training of employee and second, Total Quality management study in science institutions. The main goals of it:

- Promote and organize the employee training of all management level;
- Promote and organize quality management studies in schools;
- Promote and organize quality management studies and quality engineers and qualify management specialists in special schools and universities.

The goals of creating and propagating science researches and new quality management techniques:

- Range and promote scientists to solve technological and quality management problems;
- Make conditions for economic subjects to introduce with new quality seeking techniques and methods.
- Organize and promote specialists, which can consult manufacturing and service enterprises and other organizations in quality management and other quality seeking questions.
- Legitimate scientific research, associated with quality seeking scientific problems [38, 51].

Another task of National quality program is implementation of ISO 9000 quality management standards. The main goal of implementation the ISO 9000 quality management standards is to step first sign towards essential quality seeking. This sign helps for economic subjects:

- To formulate and implement quality management systems, accordant to LST EN ISO 9000 and other quality, which are regulated by requirements standards;
- To obtain certificates of quality management standards.

The separate fields of National quality program are underway.

National quality policy and program have to be related with other underlying programs and strategic documents for Lithuanian economy, for example, creation of mental society, region policy of European Union, innovation policy, considering to long-term development strategy, white book of Lithuanian science and technology and so on [58, 62, 66]

In 2001 was established Lithuanian quality management association (LQMA), which joined the European quality organization and represent Lithuania in this organization. The mission of LQMA is to help for Lithuania economic subjects to improve competitive ability in country, Europe and around the world, sustaining advanced quality management theory and practice, help for country management and public administration institutions to improve quality of their activities, for better citizens requirements satisfaction, cooperation with society, citizens and organizations and support their interest in quality, develop international cooperation in quality management field, support quality management studies, initiate and organize practical training to members of association, consulting and other education, supply information and other services [62].

The problems of quality management development in Lithuania.

Although implementing the quality management conceptions in Lithuanian economy and adapting experience of foreign countries, their some actions, however seeking of quality is permanent perfection process, which does not have any limits.

Political, economical, and social sectors are yet not enough reformed and there are not using Total quality management principles. Lithuanian economy for successfully seeking this aim followed by principles of Total quality management, which become the main objectives in developing economical, political and social sectors [40].

Development of quality management methods in various fields is very difficult process. Because it is very useful to get inspiration from other countries, developing international cooperation, knowledge, and information change systems [51].

Lithuania needs to cooperate closely with other countries and international quality organizations, get experiences from international companies, leading to total quality management principle.

All economic sectors are very conditioned by politics, because it will be dependent on Lithuanian policy, sustaining total quality management initiatives. For greater economic development very important is quality management propagation in social sector.

Recent state of Lithuanian education system and science is unsatisfied. In this sector are in want of finance for main education institution uses, the same situation are in scientific researches and innovation sectors. This sector also is the dependence on politics. Science institutions spread of learning mind, because the supporting of educational system is the main goal to warrant one of the main principles of total quality management – continuous improvement. By this aspect is very important quality training and qualifying programs [64].

Quality management is a tool enables to create the most strength “weapon” of competition – a high quality product, to satisfy customer needs at most; o may even to exceed it.

Integrated into European Union, Lithuania needs to assimilate the main principles of this structure activity, in quality management field we already are leading and will lead to European quality vision.

2.3 The influence of quality management for country economy

The economic reforms that take place in various countries now and examples from the past show the importance of quality management in country economics. It is useful to learn the positive role of quality management in development countries economy.

It is very important for Lithuania the examples of second group countries such as India. After economic reform in 1992 India started to implement the quality management. Implementation of the quality management creates a niche for national products in world market and focused on quality of planning, production, and marketing. The positive changes helped to understand the importance of quality. It is obviously bigger export, which from 22.17 billion of US dollars in period of 1993-1994 increased to 26.2 billion of US dollars in 1994-1995. This situation shows that India's economy will be more oriented on export, because of the Indian products and services were accepted in the world. The positive changes of economy in India were determinate by these factors:

- The Indian businessmen reached for better quality and bigger productivity;
- Quality was understood as usage level;
- Increased competitive ability;
- Industries expanded into international market from local;
- Increased number of the organizations that have had quality systems formulated by ISO 9000 family standards [51, 58, 62].

Nowadays in many organizations Total quality management is reputed as fundamental factor of success. It is an involvement on quality development using Total quality management. Some of private and state (public) organization propagated methods of total quality management by various training programs.

Essentially quality management changes the economies of South America countries, especially Brasilia and Argentina. The governments of these countries understand the world market requirements and assumed necessary tools for improving production and quality and for decreasing the expenditures of its. Quality organizations have changed of experiences, invited foreign experts, and gathered the data of quality level, publication articles. Correct understanding and evaluation the needs of business environment and increasing competitive ability in international markets gave the positive results such as, export in 1993 year increased 38 percent in Brasilia and even 94.5 percent

in Argentina. Process of progressive integration of South America countries into world market is continuing [63, 66].

The role of quality management becomes more important not only for the different organization but for all country economy life too. Total quality management is reputed as essential factor for economic growth, stability and prosperity even in recent days.

Methods of quality management successfully applied in manufacturing organizations, increasingly searched into public management and service sectors. In recent days, especially in development countries, is more interested on quality in governmental organizations, education, science and other sectors [51].

Implementation of Total quality management provided an opportunity for managers and people to change improving their work environment and results. Practice of quality management in USA governmental organization helped to obtain these positive results:

- Decreased the expenditures of management and service in public offices,
- Improved the image of the states which implemented Total quality management;
- Increased the ethic, professional and production level;
- Changed the traditional management style (hierarchic, centralized, oriented into control) into management methods, reasoned by Total quality management methodology;
- Increased the satisfied level of state (public) institutions [2].

In USA, Great Britain, Sweden and Canada mostly is care of quality management in science and education field. These countries understand that on activities of the education and science system depend all country scientific researches, effectiveness of innovations and economic advance.

Improvement of product and service quality in Great Britain often is considering at national level. Yet in 1991 year, Education and science secretary has been declared that motivation for greater economic development will be quality in universities and other science centres [63].

2.4 The development tendency of quality management in XXI century

Business environment constantly changing: increasing the competitive ability, expanding the international economical collaboration, quick technological headway and economical, political, and industrial creation of alliances, increasing the needs on a world scale because of the world globalization.

International Academy of Quality forecast that till 2010 year in business environment will be these changes:

- The main differences between first and third-world countries will remain, as regards the differences of well-being between these countries, because of the speedy economic

rising of third-countries, which may be finished by increasing problems of overpopulation, impurity control problems, political instability, inadequate health service and other reasons;

- Will start new type of organizations, that will afford the new management, work-sharing, information transmission, training of employees, professional rising, salary for the work and commissions forms;
- Will continue the information society formatting processes;
- Life quality and quality as a lifestyle will be the basement of future society;
- Will surface the personalized product and services needs, and these requirements will be meet by creating the products which specialized for every client (individual);
- Education process will change and become the training, needed new knowledge presented tools and more effective education process, which will be continued for all life;
- Will expand the technological advancement quickness and spring new developmental tendency;
- World economic globalization will continue by deepen knowledge and raising the capital, technology and labour movement [37, 51, 61].

These forecasts of International Academy of Quality demonstrate that in the future, every countries economic success will depend on economic development policy of the country, sustained initiatives of quality management [51, 37].

Perception of quality management continued. “Some of the today’s principles and conceptions will survive becoming the part of the new quality management techniques, but it will be applied in new context, and quality will be assured using new methods, reasoned by new values. Will existence the cooperation demand between competitors, suppliers and consumers. It will influence the commitment of the quality [51]

This proposition of famous USA quality management specialist A.Feigenbaum is based on the experience of creating and implementing processes and management systems of General Systems Company in Europe, America and Asia and also, on accumulative information about competitive ability in world market.

A.Feigenbaum set the main six features of quality management development, showed the active development of quality management:

1. The change of the people behavior. A lot of people in the world think behave and believe that they may improve the quality of their work and work results, and of the products and services.

2. Quality becomes one of the mains management ideas in the XX century. To produce the high quality products are the best way to cultivate the business.
3. The main feature – new economy of the quality expenditures, which is used to supplant the longstanding view. Because of it, the companies did not know where and how much expenditures being. It was the main cause why is failed all ways of the decreasing expenses. The quality problems did not solved and only moves from one subdivision to another. It had bad influence for relationships between clients, organizations, employees and suppliers and also blocked the ways to increasing the sales.
4. The essential feature – Quality becomes the language of international business. Quality improvement methods, used in one part of the world, faster are accessible in all parts of the world. It becomes one of the glaring examples of international collaboration.
5. Decisions making by facts. Particular this has influence to the USA economic crisis in 1975. Becomes necessary to change the view to quality in end of the 90's.
6. The organization activity results started to measure by quality view .

These six views will influence business development in XXI century. In XXI century is necessary to solve some quality problems [51, 61].

The key to success is continual quality assurance and orientation to the consumers.

The strength of organization may be keep by quality seeking. The organization have to understand why are necessary to cultivate the quality and how to use the possibilities of it.

Quality was the essential aspect raising the life level after the Second World War; the same role will be in the third world countries.

XXI will be the Century of the quality. Quality becomes the success factor not only in business but also in social well-being and economical stability [37].

3. Implementation of quality management systems

A management system of an organization manages with regard to quality as a network of processes and focuses on the achievement of quality objectives and the creation of the confidence to the customer and other interested parties [35].

Quality management system (QMS) models are not today's invention. They were developed in the way of the evolution. These models give an opportunity to create an original management system to direct and control an organization with regard to quality.

The QMS should function in such a manner is to provide confidence that:

- ✓ The system is understood, implemented, maintained and effective;
- ✓ The products actually do satisfy customer needs and expectation;
- ✓ The needs of both society and the environment have been addressed;
- ✓ Emphasis placed on problem prevention rather than dependence on detection after occurrence. [27]

The modern approach to quality management goes further problem prevention.

The organization manage " a system of interconnected processes necessary to implement the policy and achieve objectives, measure and analyse the adequacy, efficiency and effectiveness of each process in fulfilling its purpose and objectives, and pursue the continual improvement of the system…" [25]

QMS of an organization is not uniform and cannot be standardized. Only universal recommendations and guidelines for QMS and its elements can be standardized.

3.1 Evolution of quality management system

Universal recommendations and guidelines for quality management were given in a form of standards. The development of quality management standards was driven by two strong forces: first, by the stringent requirements of the defense industry and later on by stringent requirements of nuclear power stations. Because of that, quality management standards were developed in USA and Europe.

In 1959 the USA Department of Defense issued a quality management standard MIL-Q-9858 for military purpose that later has been used in military and commercial sectors. In the Environmental Protection Agency and the Nuclear Regulatory Commission developed their own standard around MIL-Q. [51].

Major companies began to establish their own standards and assess their suppliers.

In order to control the increase of different types of QMS's standards British Standards Institute eventually developed the military standards into BS 5750 series [51].

In the recent past, the global need for quality assurance requirement in an economic sector has accelerated the development of ISO 9000 standards for quality management.

International standards preparing was normally carried out through ISO technical committees. International organizations, governmental and nongovernmental organizations also took part in this work [61, 66].

The International Standardization Organization (ISO) has the national standards organizations as its members. The purpose of ISO is to facilitate global consensus agreements on international quality standards.

The first quality management standard was USA military standard (MIL-Q-9858) in 1959. Various quality standards were created since 1959, but they all have general point and in 1987 overgrew in ISO 9000 series standards. The standards series was several years in the making before its first publication in 1987 as a full International standard ISO 9000 series. It evolved from MIL-Q-9858, from NATO quality standard AQAP and the British quality standard BS 5750. (see table 7)

Table 7. History of ISO 9000 quality management family [51].

The name of the standards	Publication date
MIL-Q-9858 (USA military standard)	1959
AQAP (Quality assurance documents of confederates)	1969
10CFR50 (Codex of Federal regulation. Nucleolus equipments)	1970
ANSI N45.2 (American National standard institution)	1971
ASME Codex of Boiler and compression equipments. (American insurance of mechanical engineers)	1971
United Kingdom department of defence (05 series)	1973
CSA Z 299 (Canada Standard institution)	1975
Reference of good pharmacy production practice	1979
BS 5750 1,2 and 3 parts (Standard association of Great Britain)	1979
NS 5801, 5802 (Standard association of Norway)	1981
ISO 9000: 1987 series (International Standardization Organization)	1987
ISO 9000: 1994 series	1994
ISO 9000: 2000 family	2000

ISO 1400 series standards for environmental management were developed in 1996.

European committee for Standardization (CEN) declared the ISO series of standards as European norm naming it EN 29000.

Member countries of the EU adapted those standards and named German – DIN ISO 9000, Switzerland – SN\EN 29000, Austrian – ONORMEN\EN 29000, Lithuanian – LST EN ISO 9000, etc. International QMS standards are applicable to a broad range of organizations [35, 51]

In 1980 European Community (EC) began the creation of mechanism to ensure product conformance to technical standards and other requirements in each country that should help economic integration process.

Later EC adopted the new approach, which embraced two concepts:

- ✓ Harmonization of European standards;

- ✓ Mutual recognition and free movements of products.

Harmonization is the European term, which is used for creating a system of regional standards instead of each country's national standards. Harmonization attempts "to make a standard transparent or compatible in terms of application and content. Harmonization is especially imperative with standards dealing with health, safety, consumer, and environmental issues, and is often incorporated into laws". [67 ,68]

ISO 9000 series was born out of the defense industry where there was a long tradition of command and control. Those series standards followed the same pattern of imposing requirements to prevent failures, but the experience showed that this way is not effective to achieve quality.

The first revision of ISO 900 family standards was in 1994. This revision was relatively minor and mostly concerned the removing the internal inconsistencies.

The mechanism for a product quality assurance was included into ISO 9000:1994 standards as QMS's models that embrace a recommendation for quality audit, product inspection, testing and versification.

The second revision of ISO 9000 family took part in 2000. This revision represents an overhaul of the standards to take into account the development and experience in the field of quality management.

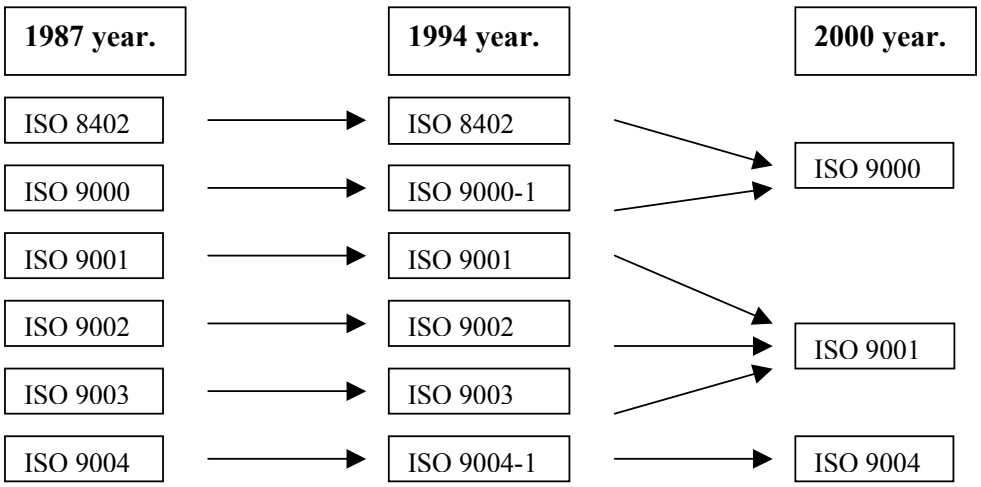
More substantial modifications were made:

- ✓ The number of standards is being reduced simplifying their selection and use.
- ✓ "Quality" means that it enhances customer satisfaction.
- ✓ The requirements for a quality system and organizational performance improvements were coordinated, and the standards are as "consistent pair".
- ✓ The revised standards are based on management principles thereby the quality system may be foundation for other quality initiatives, such as pursuing a national or regional quality awards.
- ✓ The responsibilities of top management in relation to quality and requirements for communication with staff and customers are defined.
- ✓ ISO 9004 standard includes a self-assessment questionnaire, which assists organization to determine the level of quality management system function [65, 66].

3.2 ISO 9000 family of quality management standards

ISO family standards in the ISO 9000 family provide a generic core of management system's standards applicable to a broad range of organizations in economic sector and public administration.

Version of 2000-year standards invalidates and changes the 1994-year standards. (See picture 10). Since this year the group of quality management standards began to name family standards, because the ISO series must to admit to 9000.



Picture 10. Composition of ISO 9000 quality standards [51]

The ISO 9000:2000 family standards provide the basis for a management system – not merely a quality management system – that is the means for an organization to fulfill its purpose and mission. An organization manages the processes and focuses on achieving objectives that they have been derived from the understanding of the needs of customers and other interested parties.

In 2000 ISO 9000 standards have anew approach, intent and direction:

1. These standards bring new approaches to quality management and its system:

- 8 management principles as based for quality management those help for the achievement of TQM. (see table 8)
- Quality objectives are not different from other management objectives and they might be achieved through a set of interconnected processes that should be effectively managed.
- QMS is the part of whole management system of an organization that focuses on the achievement of outputs (results) in relation to quality objectives. Quality objectives are integrated to other management objectives [35, 50]

Table 8. Principles of ISO 9000 family standards [51]

Nr.	Principles of ISO 9000
1.	**Customer focus.** This principle is a strategic concept. An organization should understand and determine customer needs and expectation and strive for customer satisfaction.
2.	**Leadership.** Leaders establish unity of the organization's purpose and direction, focused to customer and oriented to future.
3.	**Involvement of people.** People are the essence of an organization. This principle requires that the involvement of people would be managing a system of processes rather than functions. Involvement enables to use the abilities of people for the organization benefit.
4.	**Process approach.** The systematic identification and management of the processes contribute to the improvement opportunities and help to achieve the objectives more efficiently.
5.	**System approach to management.** Managing interrelated processes as a system serves the organization's effectiveness and efficiency in achieving the desired results.
6.	**Continual improvement.** Continual improvement of the organization's performance should be a consistent organization wide approach. It embraces products, processes and systems.
7.	**Factual approach to decision making.** Manager's decisions may be effective if they are based on the objective analysis of data, obtained from measurements, information and evaluation.
8.	**Mutually beneficial supplier relationship.** An organization and its suppliers are interdependent parties. Their relationship should be built on determining needs and expectations of other interested parties.

2. QMS according to ISO 9000:1994 standards was based on documentation and quality assurance.

In practice the quality of service cannot be assured by documented procedures. Quality assurance requires the new approaches to quality management and the changes in the culture of an organization.

The new ISO 9000:2000 standards require only six documented procedures, but an organization may decide on documentation needs. These standards intend that an organization should be managed as asset of interconnected processes. These processes are necessary to implement policy and attain the objectives. Management might effectively implement standards intent if it uses 8 quality management principles as the key of success. Quality management principles can play an important role in the prevention activities [58].

3. Processes management embraces resources, information and human behavior

management to produce the output (result) in an efficient and effective way.

If this output meets the requirements of a customer, an organization proves its conformance to standard requirements and may be certificated.

QMS's audit should be based on auditor's skills, competence and understanding of quality management and a process approach [35].

The structure of ISO 9000:2000 family standards is such:

1. ISO 9000:2000. Quality management systems: Fundamentals and vocabulary. It helps to understand better the terminology and the other standards.

2. ISO 9001:2000. Quality management systems: Requirements.

This standard specifies the requirements that can be used for the assessment of organization ability to meet customer, regulatory parties and the organization's own requirements and for the creation of quality management system.

3. ISO 9004:2000. Quality management systems: Guidelines for performance improvement. This standard can be used for the advancement of quality management system. ISO 9004 is based on 8 quality management principles. It helps for the establishment, maintenance, and continual improvement of quality management system.

4. ISO 19011: Guidelines on Quality and\or Environmental Management system Auditing. Publication of this standard is a target for future. ISO 19011 standards will provide guidance on quality and environmental management system's auditing, the management of auditing programs and the qualification for management system auditors [65, 66].

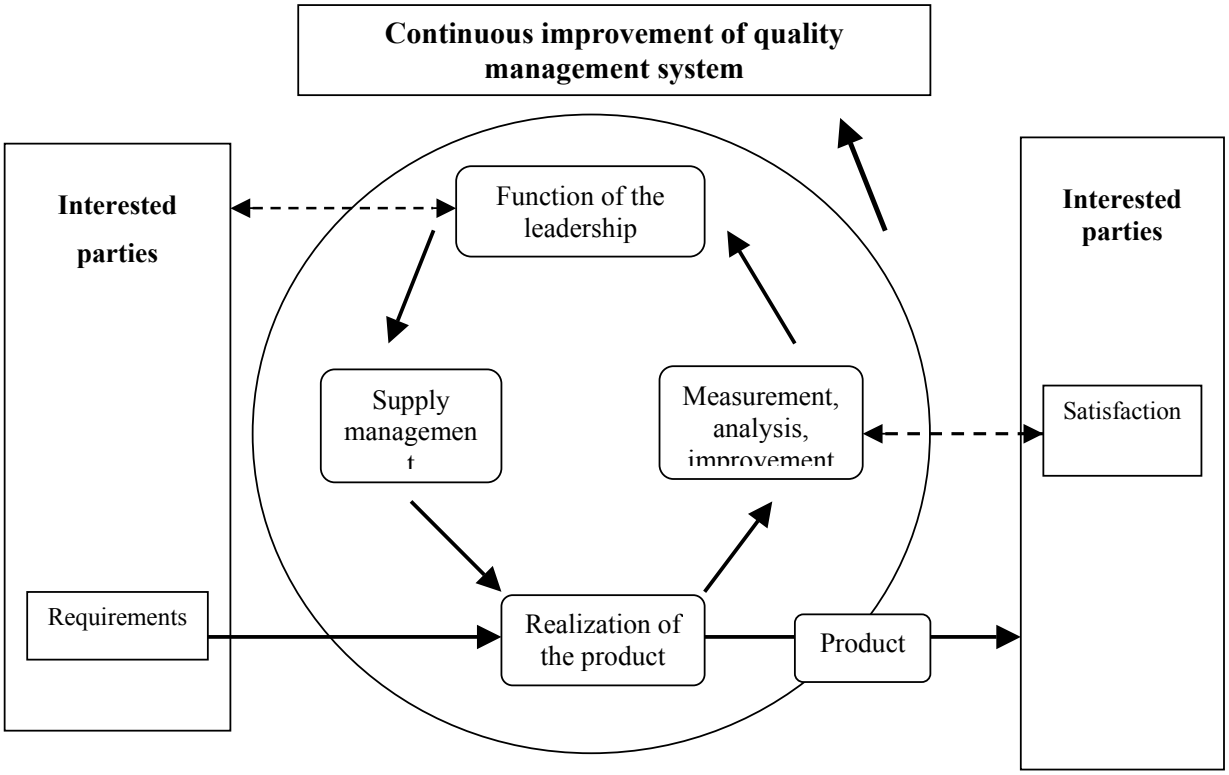
ISO 9000:2000 family standards try to expand the conception of the customer and necessity to satisfy the needs of interested parts. ISO 9000:2000, ISO 9001:2001 and ISO 9004:2000 standards have the main scheme named "A model of quality management system based on processes". (see picture 11) [51]

In this chart there is a model from 9004:2000 standard, where is shown that is necessary to satisfy the needs of the interested sides and all activity develops sustaining interested sides. However ISO 9001:2000 standards said, that only customer needs have to be satisfied, because there is no methodology to satisfy needs of the interested sides.

A model of quality management system based on process view (see picture 11) shows the links, which are in all ISO 9001:2000 standard chapters from 4 till 8. Here, we may see that interested parties perform the important role determinate the requirements of the products. Processes management seeks that results would satisfy the customers meeting customers' and other interested parties' requirements. Very important is to separate the inside processes and the relations between them. [51].

3.3 Structure of the ISO 9001:2000 standard "Quality management systems. Requirements"

Quality management systems are creating by ISO 9001:2000 requirements [2]. Quality management system's design and implementation should be decided by an organization. Requirements for quality management system are explained in the ISO 9001:2000 standard, which is the international model for this system [35, 36]. Requirements are built up upon management principles and activities. This aspect is very important so management principles support the achievement of Total Quality management.



Picture 11. A model of quality management system based on processes

Quality management system is not a simple set of documents, but a network of processes that should be managed. Quality management system's implementation gives an opportunity for an effective operation, successful competition in market and getting benefit for an organization [35].

Content of the ISO 9001:2000 standard:

0. Introduction

0.1 General provision

0.2 Process view

0.3 Relation with ISO 9004

0.4 Compatibility with other management systems

1. Application field
   1.1 General provision
   1.2 Application
2. Normative reference
3. Terms and definitions
4. Quality management system
   4.1 General requirements
   4.2 General requirements for documentation
5. Responsibility of leadership
   5.1 Commitment of leadership
   5.2 Customer focus
   5.3 Quality policy
   5.4 Planning
   5.5 Responsibility, commitments and relationships
   5.6 Leadership analysis for value
6. Resource management
   6.1 Supply the resources
   6.2 Human resources
   6.3 Infrastructure
   6.4 Work environment
7. Product realization
   7.1 Planning of product realization
   7.2 Processes associated with customer
   7.3 Design and creation
   7.4 Buying
   7.5 Manufacturing and providing the services
   7.6 Management of monitoring and measurement appliances
8. Measurement, analysis and improving
   8.1 General provision
   8.2 Monitoring and measurement
   8.3 Managing of the inadequate product

8.4 Data analysis

8.5 Improving

The requirements for quality management system are preceded in 4, 5, 6, 7 and 8 chapters of the standard. The forth "Quality management systems" chapter introduce the general requirements for system, requirements for documentation, constitution of the documentation, regulate managing of documents and registration [25, 26].

3.3.1 General requirements

Standard refer that organization have to implement, supervise and continually improve results of the quality management system and create, formalize it by documents. This chapter maintains that organization have to:

- Identify processes needed for quality management system and set the application of its in organization;
- Determine sequences of its processes and their interaction;
- Determine effective operation of processes and its criteria's and methods of managing;
- Ensure that will be receivable resources and information for monitoring and proceeding;
- Observe, measure and analyze these processes;
- Implement needed operation for achieve planning results and processes.

Consequently, when organization selects the outside processes, which influence product equivalent, the organization must to ensure managing of such processes. Managing of these processes must be identified in quality management system.

Quality management system founds on some management structure. Processes needed for quality management systems, which were mentioned earlier, conclude leadership actions, resource supply, product creation, manufacturing, measurement, consumers, and others [25, 26, 62, 66].

3.3.2 Requirements for documentation

Foremost quality management system project represent documents, later the quality management system is implementing. Naturally, why are so important requirements for documents, because the bad documents may be translated by various ways, different understand, and then it will not be the strong quality management system. First of all, documents requirements presentation by general provisions, which regulates the structure of these documents:

a) Quality policy and quality objectives;
b) Quality guide (book);
c) Formed (documented) procedures which are asking by this standard;
d) Documents ensure the effective planning, proceeding and managing of the processes;
e) Registration asking by this standard.

Volume of this documentation may be different for various organizations. It depends on the size of organization, type of activity, complexity and interaction of the processes, competence of personal and others [26, 66].

3.3.3 Quality manual (book)

This term "quality manual" means a book (document), which closely describes all quality management system. Standard require to formulate and oversee quality guide (book), represents the application fields, exception and their detailed excuse, documented procedures of quality management systems and references, interaction of quality management system processes [51].

3.3.4 Managing of the documents

Special attention is spare for managing and registration of documents. Really, it is the most important objects of quality management systems, and their quality very important for successful assurance and management in organization.

Because of it, standard prescribe the needs to formulate the documented procedure, which will define the order and will allow to:

a) Confirm the correctness of the documents before publishing;
b) Analyze, renew and confirm the document if it will be necessary;
c) Ensure that changes of the documents and current review position will be identify;
d) Ensure, that adequate version of documents will be where they are using;
e) Ensure to sign the outside documents and manage their assignments in organization;
f) Prevent to use unavailable documents and to sign them in right way, when documents are leaving for some purposes.

Thereby the procedure for manage documents is necessary. It is the first of the sixth required procedures in this standard [26, 62].

3.3.5 Managing of the registration

To prove the adequate requirement and effective proceeding of the quality management systems, it must be commit and oversee the registration documents. They must be legible, identifiable and findable. It is necessary to ready the documented procedure for registration identifying, storing, securing, finding, keeping in time and shredding. It the second procedure required by standard [51]

3.4 The purpose of creating quality management systems

Quality management systems, according to the requirements of ISO 9000 family quality management standards, are creating and implementing, because of two main purposes:

1) To prove for the customer (buyer), that products always satisfy their requirements. The guarantee of it – certificated quality management system;
2) To improve quality, regulated it by procedures, instructions, standards, and other documents, of the organization activities.

First purpose associates with formal feature of quality system implementation; it is the certificate, procurable, implementing quality management system.

However, the widely important is the second purpose of quality system implementation – to improve the quality of the organization activities. It affords great advantage. The researches of motivation and effectiveness of certificated quality management systems implementation, shows that in Lithuania, mostly implemented system - to satisfy the customer requirements and to improve the competitive ability. Implementation of quality management systems helps to decrease inadequate products, number of customers complaint, to establish conditions for better work, for improving the collaboration and team-work [1].

There are economical analyses results, which shows that implementation of quality management systems, according to the requirements of ISO 9000 family quality management standards, help to decreased the prime cost till 20 percent and increased the volumes of the production, it means, demand of the production, sometimes even till 40 percent.

The implementation of quality management system is like foundation for implementation of Total quality management. It is associated with further desire of organization perfection. ISO family standards are the component of the Total quality management, by theoretical provision and empirical researches results, confirm this conception [35]. There are a half of million certificated quality management systems in the world. The implementation of quality management systems enables the organization to implement Total quality management.

To implement the Total quality management in organization have to be created sympathetic quality culture of the organization, because implemented quality management system, according to

the requirements of ISO 9000 family quality standards and recommendations, can, but by itself uncreated sympathetic conditions for Total quality management implementation. For this purpose, after the implementation of quality management systems, the organization needs some changes in organizational culture [37].

3.5 The creation and implementation of quality management systems

The process of implementing ISO 90001:2000 standard requirements depends on:

- The size of organization and complexity of processes;
- Sophistication of existing quality management system;
- Competencies of personnel [35].

Quality management system must be circumstantial and must fulfil the quality seeking purposes. It means that the first of all, the quality management systems have to found on policy and objectives of the organization's and on standard requirements.

Processes of creation and implementation of quality management system are the main factor to achieve results of quality system. All employees - from top to low level – have to understand quality management system, also procedures, which help to manage the processes.

For creating and implementing the quality managements system in science centre, very important to assure that all requirements for the processes are implemented. Next will be describe the regulation (question) which are susceptible for the check and evaluate the main requirements for the processes implementing quality management system for solving this problem and the science centre specialists convenience [38]. With reference to this regulation, the questions may be grouped into 6 types:

First group (determinate the processes):

- How many and which processes have to be separated in quality managements system of science centre?
- Does the organization clear know the customers of each process (internal and external)?
- Does the organization know the requirements of these customers?
- Who are the managers of these processes?
- Does the organization need the external processes?
- What are procures and products of each process?

Second group (relations and interaction):

- What is the common interaction of the processes?
- How is describes the interactions? By block-scheme or map?

- What is the communication channel between processes?
- What documentation needs to be prepared?

Third group (evaluation indexes and criteria):

- What the resulted indexes (characteristics) have been evaluated?
- What are the criteria of monitoring, measurement and analysis?
- How it is connected with planning of quality management system (quality objectives) and product realize processes?
- What is the economical index (expenditures, time, wastes and so on.)?
- What kinds of the methods are used for collecting and analysing data?

Forth group (supplement of resources and information):

- What resources are required for each process?
- What are the channels of the information exchange?
- How is possible to receive internal and external information about each process?
- How is making sure about the reversible contact?
- What kinds of data are collected?
- What records are managing by process?

Fifth group (monitoring and measurements):

- How are managing the monitoring of the processes indexes?
- What measurements are accomplished?
- How is the collected information analysing? What statistical methods are used for this purpose?
- How are making the conclusions about analysis results?

Sixth group (activity improvement):

- How may be improved the results of the process activity?
- What correction and preventive actions are necessary for this?
- Are these actions regulative? [51]

These questions are very useful not only for science centre but for almost every organization, which seek to implement the quality management systems.

3.5.1 The main steps to create and implement the quality management system

There are no existed standardized methods or steps for create and implement the quality management system. Here is the one of the mostly use version of it.

Steps of the creation and implementation:

1. Awareness of the creation (decision and support);
2. Formation of the organizational committee;
3. Planning of the project;
4. Review of existing situation;
5. Training;
6. Development of the documentation;
7. Implementation;
8. Audits and analysis;
9. Perfection of the system's. [51]

1. Awareness of the creation (decision and support)

The top management must take the initiative and decide on the creation of the quality management system according to the requirements of ISO 9001:2000.

The necessity for creation comes from market as direct and indirect pressure of the customers and competitors, and the growth ambitions of an organization to exploit market opportunities.

The top management should define the set of goals for system creation and make it now to every employee. The senior manager should appoint and commit the project team, and the management representative to coordinate this activity. The project team is appointed from the members of an organization that know the organization's activities, understand management principles. They should have undertaken some training in the requirements of ISO 9001:2000 standard [4, 35].

For implementation of quality management systems have to be time limit about 2-5 percent work time in a year from various employee's levels. It may continue from half a year till two years [51].

2. Formation of the organizational committee

It is purposeful to organize the committee for project implementation. Committee will consist of top managers, head of the departments, head of the project and employees, and trade union. In small organization, the group of the heads can execute the duty of the organizational committee [4].

The organizational committee commonly are responsible for the proving the plans of the project implementation, for the determining the positions and works, for the decision making of quality management system, also for the project controlling and analysing.

Delegate the head of the project. It has to be the person, who know the organization very well and have an authority. The main work of such person is to coordinate the project of quality

management system. In addition, he is responsible for the quality book and some procedures of common use preparation.

The success of the project depends on big experience of the head of the project. This person has to motivate people, respectable by all organizational levels, know-how about the organization technology, and about the business problems. To make the right selection of such person are the strong guarantee, what the process will pattern without big conflicts and lateness [51].

3. Planning of the project

The project team is responsible for quality management system's design, allocating resources and creating of an organization's manual and whole documentation system. The project team should determine whether a consultant is required. The consultant will provide intermittent guidance to keep the project on the track. The consultant should not assign the responsibility for developing documentation. The organization should carry out itself.

The plans of the implementation have to be easily understood (for example, graphs by Gantt, see Table 9), have to be simply measured advance of the implementation. Have to be defined supreme and medium objectives (when and who), imposed responsible persons, ratify the plans and to oversee and correct them regulate.

Table 9. Actions of the project sequences (graphs by Gantt) [51].

The main steps	Months														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Awareness of the creation															
Formation of the organizational committee															
Review of existing situation															
Planning of the project															
Training															
Development of the documentation															
Implementation of QMS															
Internal audit															
Analysis															
Perfection of the system's															

4. Review of existing situation

The review of the existing system includes the identification of various processes and documentation that are used in working practice. Documents that need modification should be identified and listed.

The assessment of the existing system of an organization can be doing internally if

management is able to do that. In interviews with everyone involved in processes, the project team members analyse the situation and compare it with the requirements of the standard [9].

Team members collect ideas and suggestions how the requirements can be meeting.

Identification and management of the processes, their sequences and interaction are the essential aspect of resulted quality management system. Sequence of the processes identification:

- Establish the purpose of the processes;
- Establish the receptions;
- Establish the needful result;
- Determine the running of the processes;
- Set necessary resources;
- Provide the required management tools;
- Provide the supervision methods [3].

Every organization may separate top management, primary (supporting) and common processes.

Top managers processes are development of the strategy (quality policy, objectives, planning of QMS), analysis of quality management system management (administrate the QMS, internal audits, budgets and others).

Primary processes are these: marketing (identification of the products/services requirements, agreements), design (implementation of new products/services and activities), buying (buying of the raw, materials, equipment and services), service (planning of the services, identification of the results and trace ability, keeping of the equipments, payments, and reversible relations) processes [11].

Common processes include activities, which are compulsory for everyone, for example, manage the documents; manage the correction and preventive actions of inadequate products [12].

5. Training

The training should cover the basic concepts of quality management and their impact on the strategic goal of the organization. ISO 9001 requirements may be understood through training, advisement, and group discussion.

Training programs should be different for employees – top management, middle level managers, supervisor, and workers.

The training will help to realize the QMS and support it by employees [35].

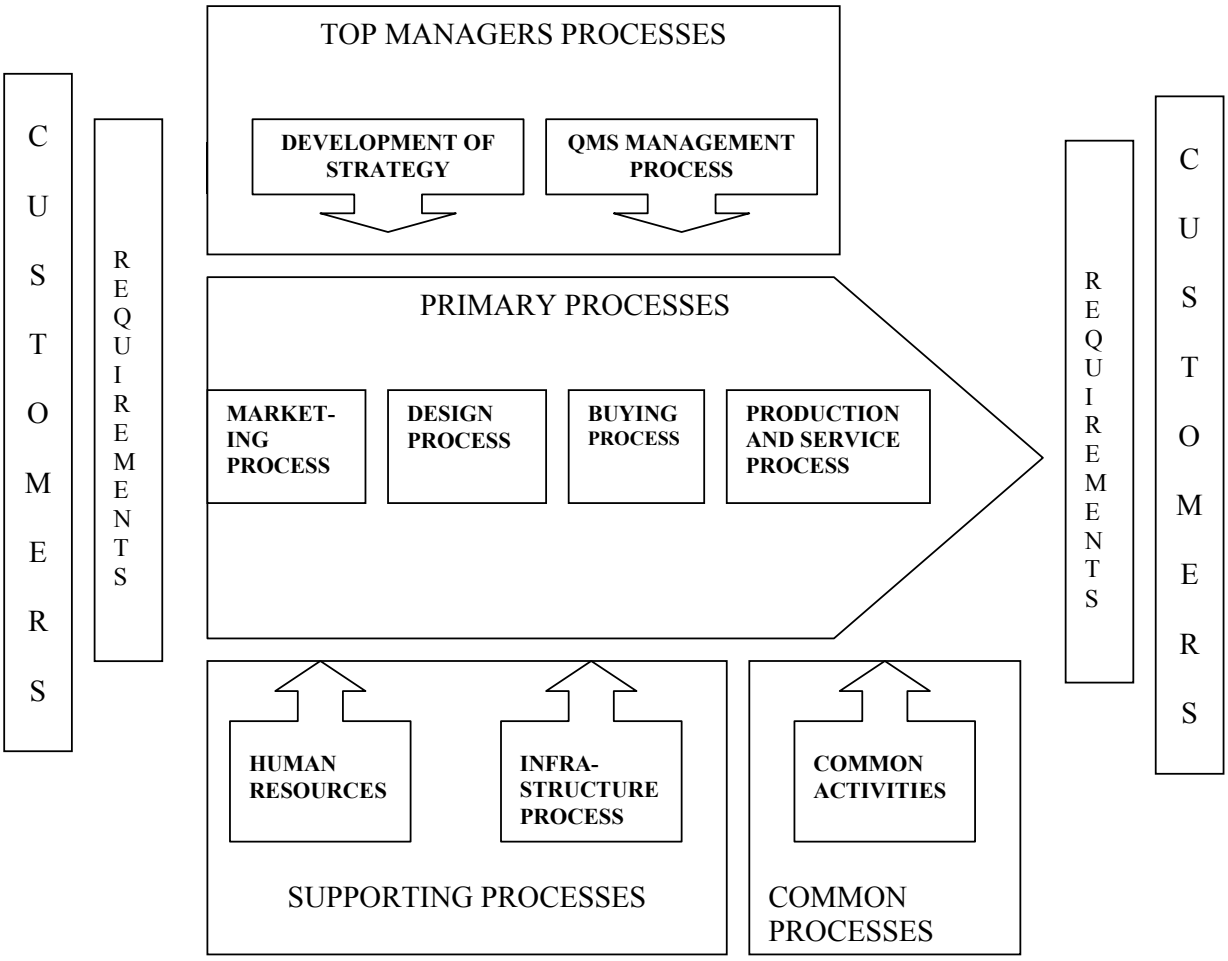
6. Development of the documentation

The documents should reflect the requirements of ISO 90001:2000 standard, existing working practice and identify the interface with other procedures.

The custodians prepare the draft process definition and\or procedures and competencies. The

people who are stakeholders in the process or procedure develop the documents. Preparation of the documents may be in the form of a "brain-storming" session that is supervised by the custodian. Development of the documentation has these stages:

- Determination the demand of the documents;
- Posting the responsible organizers;
- Description of the purpose and using field of the documentation;
- Recording and research of the existing situation;
- Preparation the projects of the documents;
- Accumulation of the remarks, edification and ratification of the documents;
- Distribution of the documents;
- Introduction with new documents and their usage;
- Describe the activity audit in the documents;
- Edification and renovation of the documents.



Picture 12. Processes and their sequences [51]

All types of quality related documents reflect the relevant requirements or results, but the specification is the stating requirement document (see picture 12)

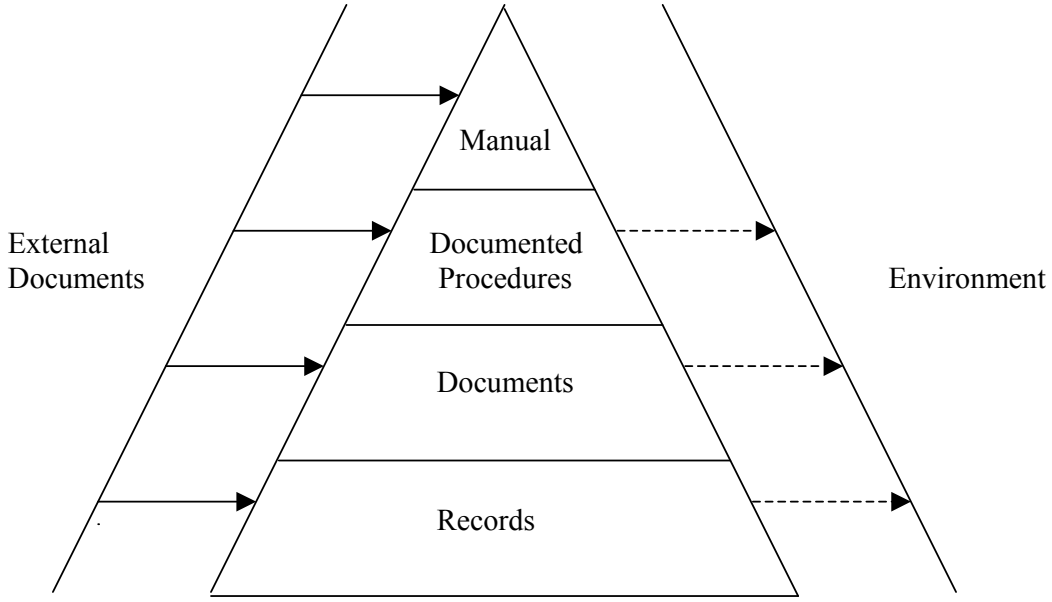
Specification can relate to activities (procedure document, process specification, test specification) and products (product specification, performance specification and drawing). (see picture 13.)

The employees feel like owners, if they are responsible for developing and documenting of the procedures. Empowerment is given to employees by the authority to develop the documents and to participate in quality system's creation. Ownership and empowerment of employees are the keys to effective implementation of quality management system. The documents are coordinated with internal interest parties [41].

In the final stage, the developed documents must be approving for issue.

The documentation is necessary for quality management system, for controlling all basic processes of the organization, included production, and management processes.

Constitution of the quality management system helps to imagine pyramid form. Pyramid shows, how moving toward low level of the organization is increasing the complexity of the documents and plenty elements in it. In picture 13 showed the example of the document system [2].



Picture 13. Structure of quality management documentation [26]

Quality policy have to be understood, implemented and sustained in all levels of the organization, because the standard imperative it. All employees have to have common knowing about quality and understood what they have to do working to satisfy notion of the policy [51].

Very important part of the quality system is quality manual or book. Quality book is a document where are described all quality management systems. It may be associated with activity of all organization or only with part of it.

There have to be quality policy, responsibility of the personal and authorities, inter-relationship, procedures of quality management system and instructions or with reference about it, guide rulebook of control, renovation, and review in quality manual (book) [25].

ISO 9000:2000 standard determinate the procedures like rule have the set activity and process performance [66].

Organization preparing the quality management procedures has to regard requirements of the standard and also requirements of organization to administer the activity. The main part of this employ is to prescribe work place or work operations, where the inadequacy and is necessary to establish responsibility, have asserted. Often it is approached like identification of critical places.

Procedure can include these parts: objective, field of the practice, authorities and responsibilities, activity description, perfection of the procedure and fixation of the changes.

The danger is up, that of information of the procedure is may increase too much. To prevent this, the elements may be changed by various documents is named work instruction. The work instruction explain who, when and whose are the responsibility. Work instruction may be used explaining how the work must be done. In the following way, small work description involves to work instruction (not to procedure). Elements must be described in quality system when are supposed to watch them. In another way, elements must be leave on individual decision by work situation [41].

Procedures are assigned to second level, while the work instructions are the document of the third level in quality management system, having both procedures and work instructions. Quality guide (book), quality policy, and objective are the documents of the first level [51].

Quality plans are the documents, where is determining, which procedures and their using expenditures, what and when they are using for specifically project, product, processes or agreements. Purpose of the quality plan is to argue the buyer, that the quality of the demanded product or services is achieved. The particular attention is applied to product presentation of client.

Standard are require preparing the quality audits, training, and arrangement of the employee's plans. These plans have regularly been renewable (every year). Plans shows how the quality audits and training plans are fulfilled by expire of the time. Plans are prepared for managing by them and nonconformity of these plans will be the inadequacy of the requirements [65, 66].

7. Implementation.

When the necessary QMS's documentation has completed then it is time to put the system into effect.

Procedures and other instructional documents define how the activity is been done. In this extremely important phase, management must pay a close attention to the results to make sure that the processes and procedures are effective. Management at all levels should watch out for gaps in procedures and steps that are difficult, ineffective or impractical and change them. [41].

Implementation may continue the period of 3 months, but it depends on the size and the type of organization, the complexity of the processes, etc [9].

8. Audits and analysis

Important aspect of the QMS's implementation is the selection and training of the internal auditors. The training of internal auditors should be focused on the aim to add value rather than to find fault in the auditing areas.

In implementation it is especially helpful to begin, the internal audit immediately because many problems may be solved at the local level.

Internal audit is carried out according to the audit program. Management undertakes review of the QMS. It uses the conclusions of internal audit for corrective actions of QMS.

Pre-assessment audit is carried out by the external audit according to the program. The conclusions of audit must direct the management attention to difficulties.

Assessment audit. External audit assesses the QMS of the organization and it conformity to the requirements of ISO 9001:2000 standard [35, 36].

9. Perfection of the system's

Very important that quality management project will be appeal to the available documents and routine practice. Even small modification in most organizations is test. Consequently, the modification must be only when it necessary. Thus the modification of the activity have been encouraged only in this way when this activity are out of character with some requirements of ISO 9000:2000 family standards.

It is required to avoid the unnecessary documentation. System must be fitted for activity complexion of the organization, committed for organization, opposed the organization for the quality management system [27].

3.5.2 Results of quality management system implementation

Positive results come to light at once when quality management system has been implemented effectively.

The potential benefit or advantage of implementing a quality system for the science institution falls into next categories:

1. The advantage of having a system;
2. The additional advantage that system has been independently assessed [35].

Some considerable benefit is that an organization will improve the performance and customer's satisfaction, lead to increased sales, competitiveness, and profitability. An organization will get economic benefit because rework, production wastage, etc. will come down.

Benefit of the customers is the increased satisfaction, confidence, and trust, saved time to search for and select suppliers, reduced costs. Implemented quality management system provides assurance to customers that an organization can provide the required quality product and services. This means both parties will get benefit from ISO 9000 standard implementing [51].

Potential benefit can be got from implementing the quality system for environment. Business organizations are influenced by government, environmental organizations, and the general public to avoid environmental damage. The pressure to avoid environmental damage is increasing, and ISO 14000 could respond to this requirement.

The possibility to demonstrate conformity to legislation and customer's demands is a very import motive of a business organization for implementing ISO 14000 standards. Implementation of ISO 9000 and 14000 standards requires management attention. The management should also be prepared to face certain issues related to quality system implementation [66].

Important deterrents to implementing ISO 9000 and ISO 14000 standards are cost of setting up quality management system, lack of awareness of benefits, cost of consultancy and certification, lack of competency, no management commitment, etc. [25]

There may be some resistance of employees' as changes have to be made to the existing systems. Some people may regard the system as too bureaucratic and discourage others to implement it [35].

To analyze the advantages of the quality management systems are accomplished some researches. These researches proposed that standardized quality management systems provides for organizations a lot of advantages, such as concentration on the mission implementing in organization, decreasing of outgoings, increasing image, reducing to internal order. Therefore, there is talking a little or not talking at all about the role of these systems to identify and manage risk of activity. Because the traditional understanding of quality management fulfill the nowadays need only partial, evaluating the nowadays business environment context [37].

This variance is the one of the main reasons why the spread of certificated quality management systems slowdown of late years. In table 10 there are present the data about the number of quality management certificates development in the world over last 9 years.

Table 10.Dynamics of the number of ISO 9000 certificates [26]

	1995	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**
Number	127349	162701	223299	271847	343643	408631	510616	561747	567985
Growth	32232	35352	60698	48548	71796	64988	101198	51131	6238

This table shows that in the 2003 the growth of number of the certificated quality management systems was only 6238. It is totalled scarcely 12 percent of the 2002 growth and scarcely 6 percent of the 2001 growth.

Indeclinable, that it is the result of the short modern view of the quality management in organizations. In other words, it has to be talking not about what is the benefit of the quality management system for organization or how these systems may be more useful. By traditional opinion, the question is "what and how we have to do what quality management system fulfils the requirement of the standards?" While, seeking the better benefit has been asked, "How we may use the quality management system which requires the standards for business and activity developing?" [43].

3.5.3 Cultural feature of the organization, which implemented the quality management systems

One of the most important conditions for quality management system implementation is creating of special organizational culture. For example, some authors describing the quality management propose that quality is "not fixed purpose, but process, when the present culture change is managing in organization, while it becomes oriented to total and continuous perfection" [35].

After implementing of quality management systems, for science institutions becomes typical these points:

1. Decision-making.

The ideal form of organization when all employees have enough knowledge and rightly evaluate given responsibility, is not quick and easy can be achieved. The heads must to evaluate the preparation of the employees to make decisions and do not allow to make decisions for people who do not have enough information and are not ready for this. In organization that has implemented the quality management systems solving the problems is not suspended. Before becomes the problems, it are predictable and "receivable", its mean, that is trying to allow the conditions, when it would be impossible. This may be achieved just solving problems in lower level of the organization. It is seeking to make the time of improving quality shorten and perfect the climate of the organization.

These methods are using to form the effective organization. Sustaining with vision of ideal organization, the members of the science center are organized for common activity or team work [41, 43].

2. Continuous improvement and team work.

Every member of the organization has to be involved to quality management activity; however the perfection has been initiated from the direction of the organization. A lot of work has to perform in small teams. Every problem related with different subordinates has to be solved by teams of integration and perfection processes. Team work has to be the base of everyday activity. The ability of team work has to be training, and the essence of whole activity has to be understood equally by all organization members [51, 52].

3. Satisfaction of customer demand.

The employers of organization, which implemented the quality management systems, are aware of the strategy, results of activity, internal and external customers of the organization, and are constantly informed about successes and failures, advance and reaction of the customers. The same attention has to be for internal and external customers. They have to seek the better ways for performing the work and believe that their work will change by customer demands [35].

4. The head of the organization has to become leader.

The head of the organization have to be or become a leader, because of his special role formatting organizational culture. He has to inspire the trust of the peoples, that they can improved their working environments and change the things, which disturbed them to perform their work perfectly and to stimulate the desire for creating innovations. There have to dominate the consistency and carefulness, novelty, and challenge values [34, 51].

Organizational culture shows how the members of the organization understand quality, how achieve it and how the self-control do. Organizational culture may be described by:

1. Process orientation;
2. Employees orientation;
3. Employees identification with organization, not with their profession;
4. Organization, as a system, openness and acceptance for new employees;
5. Free activity control;
6. Pragmatic, customer orientation – how opposite for dogmatism and organization orientation to norms and rules.

Activity of the organization has a big influence for it culture [34].

3.6 The role of quality management in the process of innovation development

Implementation of innovations gives an opportunity to modernize the structures of manufacturing and services, to improve products and technologies, to raise their international competition. What could quality management as science and as separate management methods act as innovations do in this context? [8]

In Lisbon 2000 European Council underlined the goal until 2010 to make European Union the most competitive and dynamic economic in the world based on knowledge, there harmony economics expansion, employment of better quality with social union would be compatible. Many tools described in Lisbon are intergovernmental and are based on the coordination and benchmarking between country members. Lithuania as a new EU country has to bring the same amount of work into development of economics as other countries too [68].

In Lithuania governmental support is not enough well implemented. There is no unified system, which would include the whole cycle of innovations – science and research works, applied research, commercialization of the product [64].

Finland's TEKES program is very good example where is an information system created, which helps in all areas, which have to-do with innovations: technological information, science research works, searches for financial aid, management information and etc. The key issues of this system, witch evolution for quarter of century and then changed the economics after the crisis are these:

- Countries active innovation politics, based on big investments for research;
- Business innovations. The main reasons are capabilities of organization to support and use talented specialists – researchers and inventors; possibility to insure the base financial level to make it possible to make products from innovations using the market and innovation culture of companies
- "Hackers" innovations – they are invented by talented individuals, who are mainly supported by government sources [51, 68].

Innovations are based on newest knowledge or newest ways of applying them, that's why science research and development needs coordinated actions of researches, business, and government. [16].Lithuania cannot claim any great knowledge in it. Finance of the science research and development is poor and ineffective, industry and science institutions are interacting enough. This is visible in results also – weight of high-tech industry is very small. Lithuania is one the rarest patent countries. "It's a paradox, but we are preparing the biggest amount of specialist in Europe" [33].

Lithuania has an opportunity to adopt the knowledge of modern countries and to avoid the search of own way. But rapidly changing conditions the effective solutions of yesterday or even today will make them useless tomorrow. "That's why creative search for own way could be very hard, but can be very effective, especially if this search is based on knowledge from other countries" [42, 53].

In rapidly changing surrounding a very important role have people who have the newest knowledge and who can use it. It's noticed that traditional management is not adequate to requirement of today management was effective in stable structure and was characteristics for capitalism beginning. Our day science and business is becoming the outcome of people's global work. In order to that science institutions should get oriented to quality management of human resources, which includes the setting of competence and qualification, theoretical and practical education in order to support the qualification and to get oriented to one of the goals –leadership.

Organizational culture and quality management are interconnected, including the ways of performing jobs and semantic systems. Because of this reason can assert that changes, made by quality management, affect the cultural change of the science institution [34].

Quality management is being all-inclusive very rare in the science institutions and other organizations too. It's also a fact that by implementing quality management systems attention is being paid to the cultural changes [51].

It is important that today's business surroundings are very unstable. To stay competitive in under these conditions, organizations should become more flexible, should transform to suitable form. Must be confess, that by change of surrounding conditions, also the view point to quality should be change. The connection between quality management principals and implementation of innovations should be found in space of economical knowledge. The implementation of quality management systems should help to solve innovation problems [42, 52].

In stable surrounding quality management constant improvement methods would be useful and effective. In our days organization like science institution has to improve the ability quick to adapt to changing business surroundings. Strategic goals should be directed to creation of innovations but not improving existing innovations [33, 42]

Today the most spreading innovation in Lithuania is implementation of management systems. Main reasons why science institutions decide to implement quality management systems based on ISO 9000 family are these:

1. Hope that implemented system will assure demand of customers and their satisfaction;
2. Foresight how to become competitive by minimizing costs;
3. Perfect the activity of all science center fields;

4. It is essential to be competitive in EU.

Successful implementation of quality management systems in science institution gives the ability to create more perspective innovations and adapt to changing conditions. Although the of quality management methods are considered as management innovations.

4. Quality management in science centers

4.1 The conception of the science center

By science and study order of Lithuanian Republic [24], Lithuanian science and study system consists of:

1) Science and study institutions: higher educational institutions and research establishments;
2) Fund of national science and study of Lithuania;
3) Science council of Lithuania;
4) Science academy of Lithuania;
5) Confederation of Lithuanian scientists;
6) Science academy of Lithuanian Catholics;
7) Conference of rectors of Lithuanian universities;
8) Conference of Lithuanian science institutions directors;
9) Association of science and study institutions;
10) Science and technologies parks;
11) Organizations of scientists and investigators, confederations, agency of students;
12) Other institutions and organizations, which activities associated with evaluation and organization activity of the science.

What is the content of science center? Try to determine this. Therefore, I maintain that science center involve such institutions:

1. State science and research establishments:
    1) state science institutes;
    2) university science institutes;
    3) state science institutions.
2. Association of science and study institutions;
3. Park of science and technologies;
4. Confederation, organizations of scientists and researchers;

5. Scientific private research institutions.

State science institutes are the institutions of scientific researches, which are established to accomplish the Lithuanian economy, culture and international cooperation, main long-term scientific research by international level, which demand the groups of specialized scientists and experimental equipment and also data collection. Science institutes together with higher schools qualify scientists and help to train specialists. Lithuanian Government consolidate the science directions of state science institutes and science researches by Ministry of Education and Science offering, prepared by inspected offers of Science council of Lithuania and interested state institutions [20, 59]

University science institutes are the organizations if the scientific researches, by agreements with university, which provide the scientific base for students and scientists to train in Graduate studies and to qualify the lecturers. University science institutes are established for international scientific researches in different science studies and science directions. University science institute in their practice follow by the Act of higher education and others law acts [6].

The main activity of the science institutions is scientific researches. State science institutions are established for performing the important applied science researches and development work of experiments for development the economy and culture, and escalate the experimental manufacturing, arrange the guidelines by scientific researches for enterprises, country, and other institutions.

The association of science and study institutions. For solving the main science and study, and economical or social tasks, the science and study institutions can associate with each other or with other institutions or enterprises by constant or temporal relations. Decisions of establishment the association or entry to association have to be accepting by Senate (council) of institutions. The purposes, managerial system, their formation rules and competency of associations, the rules of the closing and reorganization of the associations, determinates by statute of associations, constitutes by Associations Law. The changing of the statute of the associations must be assent by the members of the associations – Senate (Councils) [21]

Park of science and technologies are established by the enterprises, which working in the field of the applied science researches and development of the experiments, for supporting the commercial activities of the performed results of scientific researches in science and study institutions and promoting the economical relations and scientific researches [23].

Some owners or partners establish private scientific research institutions as non-profit making public organization. The main activity is scientific research or activity of applied science. Here have to be no less than 3 scientists and (or) researchers. Private institution has the base correspondent with their profile, which is useful for perform the experimental development works,

also equipments of information accumulating, processing, and transmission [25].

Now it is possible to determine the conception of science center.

Science center is the organization of scientific researches, which do the science researches and (or) experimental development works, accumulate the science knowledge, promote the public receptivity of science and culture, ability to compete in the market with high level technologies, productions and services, motivate the development of regions and all country, develop the human, information and technological culture around the country, uphold the traditions of the academic community.

4.2 The management structure of the science center

There are different organization structures:

1. Patriarchal. It is based on the head of the organization. It was determined that, the only one chief of the organization could manage effectively only by the group of 10 person not more.

2. Line. The different production groups divide all organization into subdivisions. Every chief of the subdivision accomplish the all-managerial functions of it activity.

3. Functional. The base of organization is grouping to the subdivisions, set to relative functions.

4. Headquarters. This structure is formed by group of specialists and advisers, which helped to decree.

5. Matrix. It reminds the netting. This structure is formed on the strength horizontal relations. The member of the horizontal work group is under control by the chief of this group and by the chief of the subdivision [4, 12].

Review the management system of Lithuanian science centers. For this purpose were explored the classic Statutes of institutes, parks of science and technologies, rules of the non-governmental science institutions, also the Statutes of the concrete universities and institutes and other documents. By these results there are creating universal managerial system (see picture 14).

Management structures of all organization of science researches are similar

All classic Statutes and rules hardly describe only the higher managing chain in science center [10, 14, 47, 48].

In summary may be marked main autonomies bodies in science center (see picture14):

1. General meeting of the science center employees;

2. Council of science center;

3. Director of science center.

The council of science center is the topmost center of autonomous bodies. The supervisor of

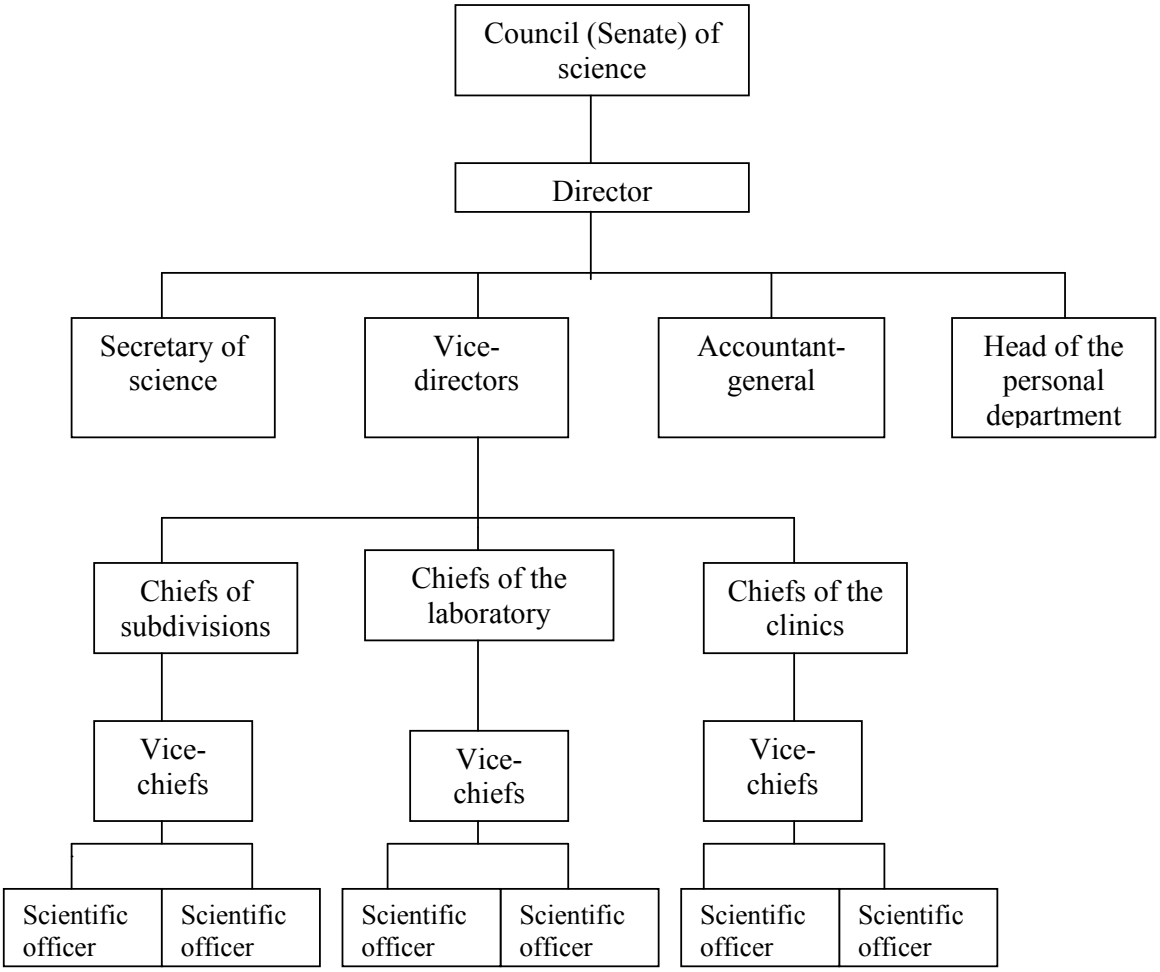
the center is director, who organizes the activity of the science center and operates by institute name. Senate elects director during secret vote. Director, considering with Senate proposals, placed the vice-directors, secretary of science and chiefs of the science subdivisions. At least, the one of the vice-directors and chiefs of the science subdivisions have to be placed from the scientists of the science center. The personal of the science center includes scientific officers (scientists) and other researchers, administration and other employees. The positions of the scientific officers are these:

a) supreme scientific officer;

b) major scientific officer;

c) scientific officer;

d) junior scientific officer.



Picture 14. The management structure of science center

The qualification of these officers is definable by the Senate. The science centre guarantee the independence from ideology and political institutions, protection from sanctions for everyone's research results and airing of their assurance for scientists and other researchers (excepting the

event, when the announced information are the secret of the country or office). The science centre gives for authors the rights of their creation and intellectual work, which are regulated by acts of the Lithuanian Republic and international agreements [48].

4.3 Activities of science center

The science centre as all organization has a lot of common functions such as:

1) Management of the personnel;
2) Management of the finance;
3) Management of the activity.

There a lot of special functions exactly for the science centre, like:

1) Laboratory researches;
2) Gain the useful information, then collect, process, accumulate, analyze it;
3) Scientific activity (creation of the innovations);
4) Juridical protection of the innovations;
5) Execute of the scientific order;
6) Planning of the works (marketing, dispersion of the information, science);
7) Selling the innovations.

One of the most important activity function of science centre are activity of scientific researches are creation of innovation. The results of this activity are the new science knowledge and may be positive and negative innovations [7, 13]. Considering with legitimated science classification in Lithuania, all scientific researches are executing in the art, social, physical, biomedicine, and technological science fields.

Innovation process includes science researches, technical decisions, economy, business, and management. It is unique process of technical, technological innovation creation and realization, changing the society, influencing the economy of the country and development of the culture [13].

It is very important to create relevant and conceptual innovations [53]. It is necessary to know the innovation level of the world of today moment, for starting the creating process from need level, not from the lower level, repeating already known, not original. Because of the repeated activity is only waste of the finance. Relevant, but not original innovations may be bought by license and not need to be created. Afterwards, innovations are getting known for economy and increasing quickly the economical power of the region and country, and improving common level of the civilization.

So, the level of creation innovations depends on the all activities of the science center, because of all chain activity have to proceed very effectively. The science center has to understand

the importance of their work for country economy, and seek to efficiency of the all activity of the science center. The improvement of their activity is implementing the quality management systems, for that purpose, every one must know the responsibility of the work. It is not enough to create the quality management system, it have to work for the science center, because it is not so cheap to implement it and continued for long time, and stick is the culture of science center which is unlike from other organizations. The main goal for science center is to use their resources effectively and create the world level innovation. And it's happened in Lithuania.

4.4 Model of quality management system implementation in science center

Every organization is unique with it special traditions settled for a long time, intellect inheritance, science officers and scientists, methods of work and others. Consequently, the models for managing, improving and perfecting the quality of activity of foreign science centers are not bad, but directly unused, because the model have to be create and fit for every science center.

Analyzed the models of quality management system implementing represented in scientific literature, was noticed that there don't perform the complex evaluation of quality. Generally are detected only the quality management system implementation algorithms. Thus, was evaluated the present condition of Lithuanian science center and their clients, science officers and scientists, and created the model of quality management system implementation in science center (picture 12). In this model are resumptive all fields and methods of science center activities, which must be changed, improved for quality management system implementation and ensuring the quality of all activities.

To show this model was used in the picture, in which are clearly visible the effect (implementation of quality management system) and cause, which influence this process.

Implementation algorithm is shown in picture 12. Last-mentioned model differs from other models, represented in science literature and applied, and content not only separate processes, but also inputs or resources and outputs or results of this processes.

The same as for every field of activity and similarly for scientific researches are needs the financial resources. Although, the Government of Lithuania underlines the priority of science opposite other economic fields, however the finance for science researches is not increased of last years [18]. One of the way to solve the problem of finance resources is to perfect the science center activity.

The implementation of quality management systems requires special conditions and tools.

1. Attention to internal and external customers/satisfy the requirements may be implemented by these conditions: create the standard, which define the requirements for science center activity; detect the requirements of the market and clients; hold the feedback between businessmen and

scientists. This principle may be achieved in VII, VII and X stages of the quality management system implementation algorithm (see picture 15).

Seeking to determine the requirements of the internal and external customer must be design the system of the data's collecting and analyzing.

So it may be solved by method of quality function deployment. The goal of this method is the desires, needs of the clients' conversion to the process characteristics, and performs it systematic in all process of the science center. This method may be used in research field.

2. Continual improvement of scientific activity may be implemented by renovation of the conditions in the laboratories, use of the information technologies, comparison with the other science institution activities, renovation of scientific methods. This principle may be achieved in IX and X stages of the quality management system implementation algorithm (see picture15).

Continual improvement is associated with all inside and outside processes of science center and particularly, with process of scientific researches. For this reason is very important to compare the efficient activities of different science institutions and to detect the advantages and disadvantages of the activities (positive and negative parts). In business such comparison is between the part of the market and profit. However, the comparison is not only the analysis of the competitiveness, but it may give the ideas how to renovate the methods of activity and how to use better information technologies and how to improve the work condition in laboratories and so on. The paradox is that sometime the action in some science institutions are perfectly function and not effective in another. The important thing is to recognize the market and to improve the continuous perfection.

3. Systematic and uninterrupted perfection of the processes may be implemented by these conditions: reorganize the process of the scientific researches, perfection of evaluation process. This involves all stages of the quality management system implementation algorithm (see picture15).

Organization has constantly reviews and analyzes all processes inside it. It is necessary to consider the main needs and requirements of the market (science world) for creating innovations.

4. Involvement of all science officers and scientist in quality management improvement process may be implemented by these conditions: removal all instability and fear feelings in the science center; create the system of motivational tools; organize the team-work. This may be achieved in II, V and X stages of the quality management system implementation algorithm (see picture15).

The removal of all instability and fear feelings in the science center is possible by training. Changing the understanding of quality of personal (science officers, scientists, administrative personal and others) is necessary for every organization which implementing the quality management systems. Very important is creation and using the motivation process that may include:

financial promotion, training courses, international conferences and seminars, payment for scientific missions and so on). By this way progress from external motivation (temporal) to internal motivation (consistent, long-term) for seeking quality. This may be reached by ethical-moral training of all science center employees.

5. Assistance of business representatives to quality of science center activity may be implemented by these conditions: collaboration between business and science, assembly of the business representative participation in science center activities. It may be even in I stage of the quality management system implementation model (see picture15). Business representatives know better the requirements of changing surrounding in the Lithuania and in the world and how to survive in the world of new technologies.

6. The direction commitment to quality may be achieved in this way: initiate the projects of the quality improving, after implementation; promotion of the employees; confidence of their decision-making. It may be implemented in I, II, III, IV and V stages of the algorithm (see picture15), when top direction of the science institution decide to implement quality management system, create the vision, mission, quality policy and organize the quality management trainings for other employees.

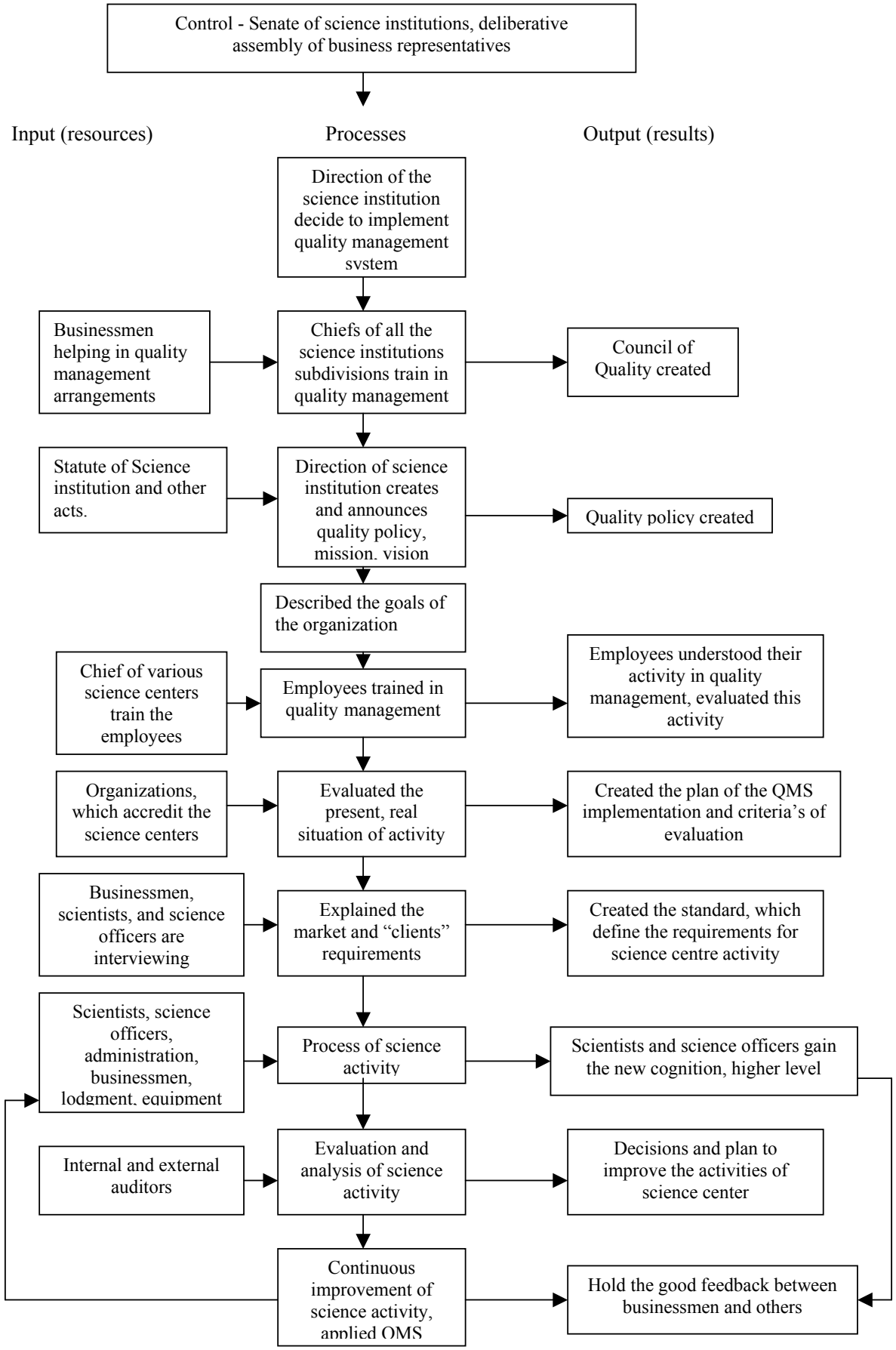
7. Vision, mission and quality policy public announcement and unconditional performance in the science institute may be implemented when the direction committed for manage it and all employees committed to execute it. The creation of the mission, vision and quality policy proceeded in III stage, however the compliance of this have to be improve in all stages of the algorithm (see picture 15).

I propose that the quality policy of science center may be this: establish the conditions under which will be improved the quality of all science center activities.

The vision of science may be this: become the world famous science center.

The mission of science center may be this:

1. Create the world-level innovations;
2. Perform the unexplored scientific researches;
3. Take part in international conference of science;
4. Take part in international research groups;
5. Commercialize the innovation for Lithuanian people well-being.



Picture 15. Model of QMS implementation in science centre

8. Systematic and continuous collection and analysis with reference to questionnaires, data's, and facts may be implemented by such conditions: regularly fill the opinion poll of internal and external customers; analysis of science work reports and conclusions. It continued over VI, VII and IX stages of the (see picture 15).

9. Focus for not only detection but also prevention of all possible inadequacies in science institute may be implemented by such conditions: detect and eliminate the inadequacies in administrative and creating, designing and other processes. (VI stage. see picture 15).

10. Training of all member of science institution with a view of changing the mindset and organizational culture to quality culture may be implemented in this way: ethical-moral training of the employees, increasing of responsibility and science work, seminars. (II and V stages of the algorithm. see picture 15).

11. Team work and cooperation between teams may be implemented by projects between different science centers (VI, VII and X stages. see picture 15). Development of various team projects help to evaluate the real situation and to create improvement plans, creating standard, which define the requirements for science center activity.

Although some organizations use the recommendations of ISO 9000 family's standards, but every organization have to create and implement the quality management systems by adaptation for concrete situation. ISO 9001:2000 is wide and may be used for academic environment. However, quality management is not widely use in science institutions/

I think to start implementation of quality management system is better from small center. And only after all processes, evaluating the reaction to changing situation in the center, real problems, gives the offers for activity improvement and started to implement the quality management systems in all science institution. It is possible to implement the own created model of quality management system implementation.

4.5 Perfection of quality of science center activity

Organizing activity of science center and seeking to achieve better innovations, is trying to prefect the activity of science center by implementing quality management systems in it, which involve all parts of science center activity. The activity of science center must be qualitative organized but also must be used various methods and systems to detect and eliminate the inadequacies. Process like this must be uninterrupted.

The main influence for the quality of all science center activities has not only the creation and implementation of various quality management system but first of all – innovative management of the center. In other words, the innovations (such as creation and implementation of quality

management systems) in process of science center activity are intended for perfection of all aspects, which may be the reason of upspring the inadequacies.

Recently, the evaluation of quality of science center activity becomes the question of the day, because after Lithuania joined the European Union the interest in the achievements of our scientists and in activity of Lithuanian science centers increased.

So, analyzing the today situation of science centers and summarizing the research of scientific literature and other sources were accentuated these main factors, which influenced the efficiency of science center activity:

1. Qualification and competency of scientists and science officers. The quality of scientist's knowledge and skills may be specified by 2 aspects: qualification that is scientific degree (professor, doctor, docent, and lecturer, assistant) and competency, that is assigned concrete functions in science center (generating the ideas; organization of researches; consulting, and etc.)

2. Information equipment. It includes such factors as: electronic bases of information; methodical literature; written information; electronic and published information; libraries; audio and video information.

3. Infrastructure of science center, it means laboratories, computerized workrooms, audio and video auditorium and others. Having the own laboratory and it equipments suitability to researches.

All these factors may be describes how the scientific activity equipments.

That, science center be a leader in particular field of the science must be:

- Create the modern world level innovations, as quickly as possible, and adapt them in the country;
- Create the higher quality innovations, for easy adaptation of them;
- Keep and develop the present potential of the science officers;
- In every possible way, motivate the trainings of high science specialists qualification and chiefs too, qualitative training, professional and uninterrupted perfection.

Analyzed that is the main factors which influences the quality of science center activity, which directly proportional to the amount and quality of created innovations.

Process of creating innovations is such level of the science center able to create innovations, designates **I**.

Quality of science center activity is the optimal quality of all science center departments' activity and designates $\mathbf{Q_{sc}}$.

Then,

$$\mathbf{I = f\ (Q_{sc}).}$$

To create high-level innovation in science center, very important is personnel of science center and their qualifications - ($\mathbf{P_{sc}}$); information base of the science center - ($\mathbf{I_{sc}}$); technical (laboratories and equipment) bases – ($\mathbf{L_{sc}}$); definitely, the financial resources ($\mathbf{F_{sc}}$) and time for process of innovation creating ($\mathbf{T_{sc}}$).

So, the quality of science center activity will be described by this function of variables:

$$\mathbf{Q_{sc} = f\ (P_{sc}, I_{sc}, L_{sc}, F_{sc}, T_{sc}).}$$

$\mathbf{P_{sc}}$ – personnel qualification may include from main (scientists and science officers) and supporting personal (helper worker).

$\mathbf{I_{sc}}$ – information base includes the processes of collecting, processing and price of this information.

$\mathbf{L_{sc}}$ – technical equipment (laboratories) include suitability of laboratory's equipment and modern information technologies inside equipment.

$\mathbf{F_{sc}}$ – financial resources include wages, cost of the infrastructure, other expenditures needed for researches and also amortization of the equipments, electricity and others.

$\mathbf{T_{sc}}$ – time for process of innovation creating include the time before researches when was generating only the idea and time when the researches started.

The main variable of this function is time of innovation created, because now is survival important to create world level innovation quickly as possible, to have competitive ability in world technological market.

Creating innovation, first of all it has been defined the moment from that the researches are started. Till this moment the idea has been generated, partial information is collected about newest discoveries in the science field of the researches. This moment is very important in order to assure that will be created the innovation but not be repeated even existing discovery or innovation.

All these variables are depended on the time, and then the function may be signed in this way:

$$\mathbf{T_{sc} = f\ (P_{sc}, I_{sc}, L_{sc}, F_{sc}).}$$

I will try to analyze all variables in respect of time (timely) in scale. Reasoning of this is clear that if we have a little time to create innovation, we will need the personnel of higher qualification. However, it is not the one variable, which depends on time of innovation creation process; we have technological equipment and financial resources. The situation of these variables

is analogical to qualification, if we have modern and new equipment; we need necessary less time to create innovation. It may be assume, that having good personal and technological equipment, the financial sources are not as essential as have been supposed before [5].

If the science center will be able to concentrate experienced, available qualification of personnel, provide them by financial resources and modern equipment, may be solved relevant scientific problems and promoted new science knowledge and creation of innovation ideas. Of course, no one may guarantee that expected results would be received.

4.6 Research of the science center activity

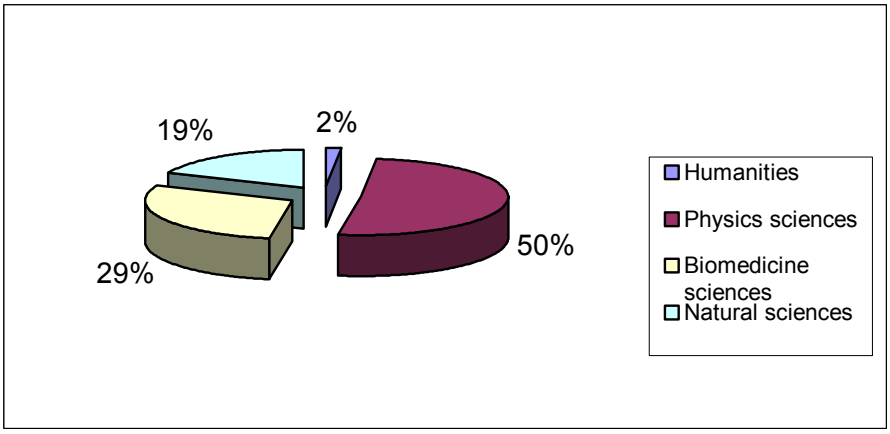
In order to see the dependences on these variables were organized the opinion poll (see the appendix No.1). In our days the science of the world extend the priority for the higher technologies and biomedicine, where the most part of innovations are received, for that purpose the respondents were selected the scientists from physics, chemistry, laser technologies, biotechnology science institutions.

The questionnaire was send by e-mail for mentioned science institutes scientists. For this research was intended time of two weeks, was sending for 80 scientists. 70 percent of respondents replied to this questionnaire.

The questionnaire was compiled by the questions for define every variable, one question about time for create innovations, about finance resources, needed for innovation, about science center resources (qualification and equipment) and so on.

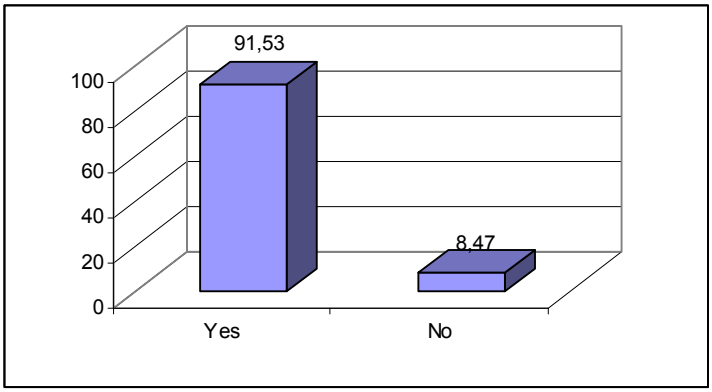
The results of this opinion poll are described in the forward pictures.

The question “The direction of science you are specializing?” was to see the direction of the science centres in Lithuania. Even 51% of respondents reply that they are representatives of the physics science and only 2 % represent the humanities and social sciences (see picture 16).



Picture 16. Distribution of science direction (%)

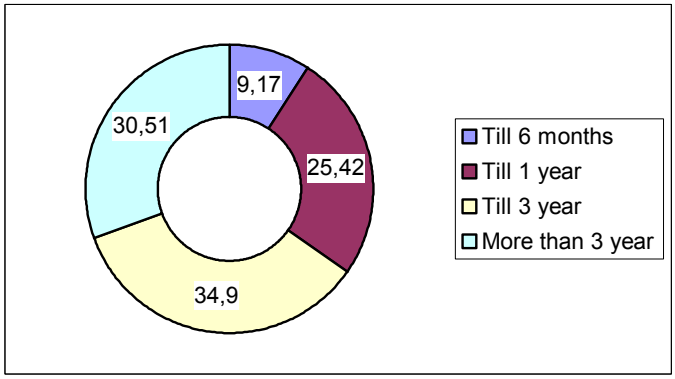
Another question was about scientific research field, in which they are assigned. Almost 92 % of respondents reply, that the researches in their science center are characterized as world innovation (see picture 17).



Picture 17. The novelty of the researches in the world (%)

For the innovation creating very important factor as I mentioned before, is collecting information. For this purpose, various systems of collecting information are used. One question was to see, do the present system of collecting information satisfy the employees of science centres. Respondents separated by almost equal parts. 49.15% are satisfied and 49.15 thought that this system is not enough good for collecting information.

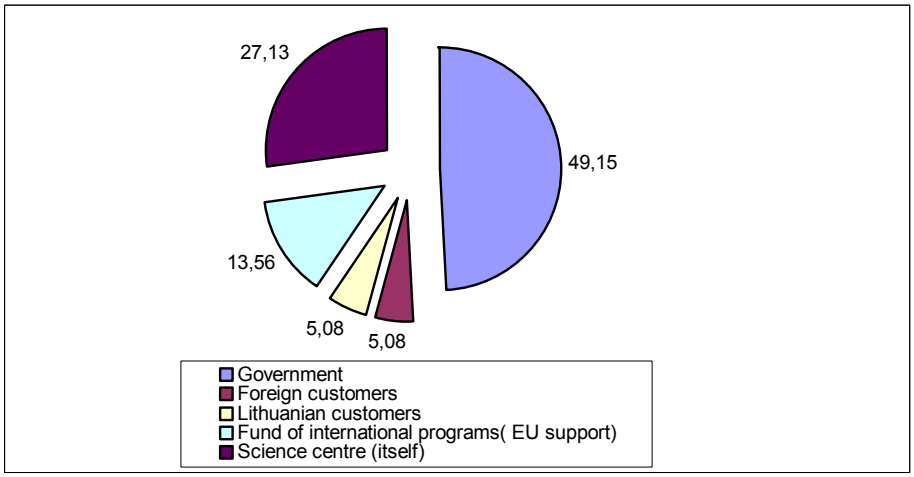
Another question was about time, "How much time do you need for researches to create innovation?" Time-lags was chosen till 6 months, till 1 year, till 3 years and more than 3 years (see picture 18). Almost 34% of respondents reply, that scientific researches performed till 3 years while the innovation are created, and more than 30 % - even more than 3 years. Obviously, that creating the innovation last a lot of time, often more than year.



Picture 18.Average time, needed for creating innovation (%)

The question about financial resources was very "painful", almost every respondent reply that the budget of science center is not enough for better work conditions, new technologies, new

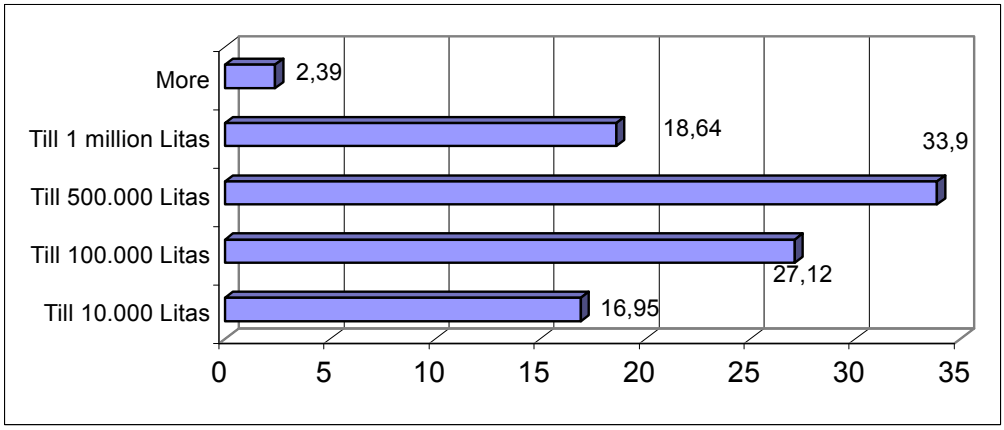
equipment and so on. And 49 % of the finance for science centers is from the government. The finance from foreign customer is very poor, because of the non-existent marketing of science centers, less publication in world science magazines, less known researches in the world and so on.



Picture 19. Financing of scientific researches (%)

The EU support programs are not very popular between science centers. And even 27 % of finance resources are from science center.

The budget for innovation creating is very important too, it show the possibility of the scientific researches. Analyzing the results of the questionnaire (picture 20), often the budget of innovation is not followed 1 million of Litas (96 %). The most respondents reply that for creating innovation is need about 500.000 Litas (almost 34%).



Picture 20. Finances given for creating innovation (%).

Some questions were about science center resources. Respondents evaluating the qualification of their science center personal and technological equipment by 10 point system, where 10 - excellence, 9 – very good and so on. The qualification of the personal are better evaluated neither technological equipment. Respondents qualification evaluated by 7 points (more than 35 %) and upper points (8- about 14%; 9 – about 9 %). While technological equipment evaluated badly, a lot respondents evaluated it only by 5 points (24%).

Conclusions:

1. Governments of all countries recognize the priority of the science. Today the EU rate of expenditures for scientific research and development of technologies is about 1,9 % GDP. Total rate of expenditures for scientific research and development in Lithuania makes about 0.52 % GDP. There is a tight connection between investment in scientific researches and the growth in economies as well as its innovations. That is why every country increases its potential in the sectors of scientific researches, development of advanced technologies and their implementation in industry and business. In 2002 expenditures on scientific research were 344.70 million Litas, i.e. 6 % more than on 2001.The rate is obviously far behind the rate of EU countries. There is a hope that in 2010 the total expenditures on science and technologies will make 3 % GDP. The perspective is optimistic because only new scientific research and new quality technologies implemented in industry, economy etc. can guarantee better living standard in Europe and the leading economy in the world.

2 .Nowadays in many organizations quality management is reputed as fundamental factor of success. It is involvement on quality management using quality management systems. The organization understand the world market requirements and assumed necessary tools for improving processes and quality and for decreasing the expenditures of its. The forecasts of quality demonstrate that in the future, every country's economic success will depend on economic development policy of the country, sustained initiatives of quality management. The key to success is continual quality improvement and orientation to the customers.

3. Quality management system models are not today's invention. It gives an opportunity to control the organization with regard to quality. Quality management system is not a simple set of the documents, but a network of processes that should be managed. Implementation of quality management systems gives an opportunity for an effective operation, successful completion in the market and benefit. Quality management systems are created by ISO 9001:2000 requirements. Implemented quality management system provides assurance to customers that organization can provide the required quality product and services. The number of quality management certificates slowdown in last few years. It is not enough the benefit of the quality management system for organization but need the useful application of these systems in standards for business and activity.

4. Was described the conception of science center. Science center is the organization of scientific researches, which perform the science researches and experimental development work, accumulate the science knowledge, promote the public receptivity of science and culture, and uphold the traditions of the academic community. The level of created innovation is very important for science center efficiency.

5. Analyzed the models of quality management implementing represented in scientific literature, evaluated the present condition of science center, their clients, science officers are scientists, was created the model of quality management system implementation in science center (see picture 12). This model differs from other models; represented in science literature and applied, connects not only separate processes but also inputs and outputs of the processes. Quality policy, mission, vision is implemented by this model.

6. Organizing activity of science center and seeking to achieve better innovations, is trying to perfect the activity of science center by implementing quality management systems in it, which involve all parts of science center activity. Innovations in process of science center activity are intended for perfection of all fields, which may be reason of upspring the inadequacies. So analyzing the situation of science center and summarizing the research of scientific literature and other sources, were accentuated the main factors, which influenced the efficiency of science center activity (personnel; information bases; laboratory and equipment; finances; time). By all these conditions was described the function of quality of science center activity perfection:

$$\mathbf{Q_{sc} = f\ (P_{sc}, I_{sc}, L_{sc}, F_{sc}, T_{sc}).}$$

7. In order to see the dependence on these variables was organized the opinion poll (see Appendix 1). The questionnaire was compiled by the questions for define every variable; about time for create innovations, about finance resources, science center resources (qualification and equipment). The results of this opinion poll are described in the pictures. For science center activity perfection must be implemented not only the quality management systems but also other systems for effective managing of all field of activity.

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Appendix No.1

Questionnaire

Questionnaire (Research of quality of the science centre activity)

1. ***What is the direction of science, where You are specializing? _____***
2. ***What direction of science your science centers (institution) assign?***

    a) Biomedicine sciences;
    b) Physics;
    c) Humanities;
    d) Social;
    e) Natural.

3. ***Are the researches of Your science center characterized the world innovations?***

    a) Yes;
    b) No.

4. ***How much time do you need for researches to create innovation?***

    a. Till 6 months.;
    b. Till 1 year;
    c. Till 3 years;
    d. More than 3 years.

5. ***Who often financed the scientific researches?***
    a. Government (state);
    b. Foreign customers;
    c. Lithuanian customers;
    d. Funds of international programs (EU support);
    e. Science centre (itself).

6. ***What is a budget (in average) for the innovation?***

    a) Till 10.000 Litas;
    b) Till 100.000 Litas;
    c) Till 500.000 Litas;
    d) Till 1 mln. Litas;
    e) More.

7. ***Evaluate the qualification of the employees in Your science center*** (10-excellent, 9-very good etc.)? _____
8. ***Evaluate the technical equipment needed for scientific researches in Your organization*** (10-excellent, 9-very good ir etc)? _____
9. ***Does the information system in the science center require Your needs?***

    a)Yes;

    b)No.

Thanks for answers.

Appendix No.2

Articles

Kokybės vadyba švietimo ir mokslo institucijose

Veslava Stankevičiūtė
Vilniaus Gedimino technikos universiteto magistrantė (PIVm3)

Visuotinės kokybės vadybos susiformavimas ir taikymas įvairiuose srityse pastaraisiais metais laikomas vienu reikšmingiausiu kokybės vadybos raidos etapu. Pasaulyje kokybės vadybos metodų taikymas palietė labai svarbias ir reikšmingas, pažangos požiūriu, žmonijai švietimo ir mokslo institucijas – universitetus. Juose atliekami moksliniai tyrimai ir mokslo žinių perdavimas jaunajai kartai, o tai yra labai svarbus aspektas intelekto tobulinimui. Be to universitetai atlieka ne tik jaunų žmonių bendrojo išsilavinimo pagrindų suteikimo ir profesinių įgūdžių formavimo, bet ir charakterio, moralės ir socialinės brandos formavimo funkcijas [1], kitaip tariant, - įvairiapusišką kūrybingo asmens vystymą. Taigi, tampa akivaizdu, jog vykdant tokias svarbias visuomenei funkcijas, būtina užtikrinti visų universitetuose vykstančių procesų kokybę.

Šio **straipsnio tikslas** yra išstudijuoti kokybės vadybos diegimo mokslo institucijose galimybes, ypatumus ir problemas. Analizuodama kokybės vadybos diegimo galimybes švietimo ir mokslo institucijose, apsiribosiu aukštųjų mokyklų (universitetų) lygiu, nors kokybės vadybą gali būti diegiama ir bendrojo lavinimo mokyklose.

Mokslinė problema yra neatitikimas tarp reikalavimų nuolat tobulinti bendras žinias ir sugebėjimus, kurie padeda kurti intelektualiąją visuomenę, ir šių reikalavimų tenkinimo lygio, kurį turi užtikrinti universitetai. Ypač tarp to, ko iš visuomenės reikalauja dabartiniai pokyčiai, ateinantys iš Europos sąjungos ir - tarp to, ką visuomenei teikia universitetai, ypač ryškus neatitikimas yra Lietuvoje.

Tyrimo metodai: loginė mokslinės literatūros analizė.

Vis labiau elitinis aukštasis mokslas virsta masiniu, daugėja nevalstybinių aukštojo mokslo įstaigų [2], todėl universitetai kaip ir kiti rinkos dalyviai, jau pajautė jos dėsnius. Tik siekis užtikrinti ir nuolat gerinti kokybę padės universitetams išlikti aukštųjų mokyklų rinkoje. Įvertinus pasaulinės ekonomikos globalizaciją ir tarptautinį bendradarbiavimą, prognozuojama kad ši tendencija stiprės ir Lietuvoje. Išsivysčiusiose šalyse padidėjus gyvenimo kokybei, yra kuriama nuolat besimokančią žinių visuomenę. O tokios visuomenės reikalavimus gali patenkinti tik kokybiškas aukštasis mokslas.

Nepakankamas dėmesys švietimo sistemos ir aukštojo mokslo problemoms, nuolatinis finansinis stygius, valstybės lėšų taupymo programa švietimo įstaigų sąskaita susmukdė mokslo institucijas, tarp jų universitetus. Nors Lietuvos Respublikos švietimo įstatymas įteisino švietimą kaip prioritetine, valstybės remiama sritį, tačiau kol kas tai labiau deklaruojama, negu realu.

Todėl yra tik vienas vienintelis būdas pagerinti universitetų veiklos kokybę – įgyvendinti juose kokybės vadybą. Lietuvoje tai yra nauja pažangios pasaulyje vadybos filosofijos dalis, kurioje dar neturime praktinių įgūdžių, tačiau Lietuvos universitetai galėtų remtis išsivysčiusių užsienio šalių patirtimi, įgyvendinat kokybės vadybą.

Lietuvoje nėra vieningos nuostatos, kas yra mokymo institucijos kokybės objektas. Toks apibrėžimas labai padėtų formuojant mokymo programas, reguliuojant mokymo sistemą ir valdant mokymo institucijas šalyje. Kadangi susitelkimas ties vienos srities discipliną nesuteiktų daug naudos, nes studentams reikia tarpdisciplininio mokymo bei vertybių, kompetencijos, sugebėjimų, nuostatų, elgsenos vystymo. Laikantis tokios nuostatos, galima pateikti tokį universitetinio mokymo apibrėžimą: "Universitetinis mokymas – toks mokymas, kurio pagrindą sudaro socialinių-humanitarinių disciplinų kompleksas, orientuotas į individo psichologinį dvasinį vystymąsi ir jo inkultūraciją, bei šiuo pagrindu perteikiamas bent vienos atskiros visuomenės sąmonės (pvz., teisinės, politinės, ekonominės ir kt.) formos pažinimas kaip bazė būsimai kūrybinei ir praktinei veiklai tos srities profesijose"[16].

Kokybė pasaulio universitetuose tapo labai svarbiu objektu. Tam tikslui įgyvendinti buvo paruošta ir sėkmingai įgyvendinta daug programų. Valdžios institucijos suteikė toms programos

nacionalinį lygį, bei skyrė labai daug pastangų, pinigų, žmogiškųjų ir kitų resursų [3]. Plačiausiai kokybės vadyba įgyvendinama JAV, Didžiojoje Britanijoje, Švedijoje ir Kanadoje. Šiuose šalyse suprantama, kad nuo švietimo sistemos veiklos kokybės priklauso šalies mokslo tyrimų ir inovacijų efektyvumas bei ekonomikos pažanga. Stipriausių pasaulio valstybių susirūpinimas švietimo kokybe pasireiškė kokybės organizacijų kūrimu, kurios yra įsteigtos ir sėkmingai dirba.

Didžioje Britanijoje tai Kokybės užtikrinimo aukštajame moksle agentūra, kurios tikslas teikti Didžiosios Britanijos aukštojo mokslo institucijoms integruotas kokybės užtikrinimo paslaugas. Tai nepriklausoma organizacija, įkurta universitetų, aukštojo mokslo koledžų bei Anglijos ir Velso tarybų iniciatyva. Dar numatoma prijungti ir Škotijos aukštojo mokslo fondo tarybą bei Šiaurės Airijos švietimo departamentą. Agentūros misija- įtikinti visuomenę, kad aukštajame moksle būtinas kokybės užtikrinimas ir pripažinti standartai. Agentūra kartu su aukštojo mokslo institucijomis skatina ir remia kokybės nuolatinį tobulinimą, teikia aiškią ir tikslią informaciją studentams, darbuotojams ir kitiems su švietimu susijusiems asmenims apie aukštojo mokslo kokybę ir standartus, kartu su mokslo institucijomis tobulina ir taiko kvalifikacijos schemas, pataria teikiant apdovanojimus švietimo srityje, skelbia gerą patirtį, organizuoja institucijų veiklos ir tobulinimo programos analizę. Pagrindinė agentūros veikla – universitetų ir aukštojo mokslo koledžų veiklos analizė, lankantis mokyklose ir atliekant visapusišką jų vadybos auditą, įskaitant dėstymo ir mokymosi kokybę bei standartus. Analizės rezultatai yra prieinami visuomenei. Agentūra remia nuolatinį kokybės ir standartų tobulinimą universitetuose bei koledžuose. Šiuo metu agentūroje kartu su Didžiosios Britanijos aukštojo mokslo institucijomis kuriama nauja kokybės užtikrinimo sistema [15].

Jungtinėse Amerikos Valstijose tai Amerikos mokyklų administravimo asociacija, padedanti pritaikyti kokybės vadybos principus mokyklų veiklai gerinti. Asociacija teikia konsultacijas, rekomenduoja mokyklas, kuriuose buvo sėkmingai įgyvendinta kokybės vadyba, bei teikia informaciją apie naujausius šios srities kokybės pasiekimus. Aukštoji mokykla turėtų būti vieta kur studentai džiaugtųsi mokymusi, patys nuolat siektų geros kokybės, pasitikėtų savimi ir gerbtų save bei aplinką. Visi turėtų dirbti kartu – tėvai, studentai, bendruomenės vadovai, administracija ir mokytojai, -tobulindami švietimo sistemą [15]. Be to JAV ir Didžiojoje Britanijoje yra pritaikyti ir naudojami ISO 9000 serijos standartai, skirti švietimo įstaigoms [4].

Kokybe švietimo srityje aktyviai rūpinamasi ir Švedijoje. Daugelis veikiančių organizacijų yra įkurtos prie universitetų. Jos atlieka mokslinius tyrimus, kuria mokymo centrus, rengia konferencijas. Vykdomi įvairūs projektai, kurie padeda integruoti kokybės modelį į kasdieninę universitetų veiklą. Tokie projektai apima ne tik studentus ir dėstytojus, bet ir tėvus bei visuomenę. Projektų rezultatai būna tokie: tarp organizacijos narių atsirado didesnis tarpusavio supratimas, pasitenkinimas darbu; pagerėjo bendravimas visuose organizacijos lygiuose; suaktyvėjo personalo, tėvų ir net pačių studentų dalyvavimas organizacijos veikloje; pagerėjo vadovavimas bei tokie projektai dažnai sukelia veiklos vystymo ir tobulinimo "bangą" [15].

Norint įgyvendinti kokybės vadybą universitete, pirma yra susiduriama su daugybę įvairių klausimų.

1. Kas yra aukštojo mokslo kokybė?

Tradiciškai, kokybė apibrėžiama tokiomis sąvokomis kaip specifikacijų atitikimas (santykinis ydų nebuvimas) ir vartotojo reikalavimų tenkinimas [14]. Šiuo metu stebima nauja tendencija, kuomet kokybės sąvoka yra įtraukiama į aukštojo mokslo veiklos sferą, kur suvokiama kaip "atitikimas užsibrėžtam tikslui". Naujoji kokybės samprata įpareigoja aukštojo mokslo institucijas kelti tikslus, kurių įgyvendinimo laipsnis traktuojamas kaip veiklos kokybė [12]. Aukštojo mokslo kokybė yra multi-dimensinė sąvoka, kuri priklauso nuo konkrečios sistemos, institucijos skelbiamos misijos bei nuo tam tikru sąlygų ir standartų [13] Ši sąvoka apima mokymą ir akademines programas, mokslinius tyrimus ir mokslinius laipsnius, darbuotojus, studentus, pastatus, priemones, techninę įrangą, paslaugas visuomenei ir akademinę aplinką [10].

Aukštojo mokslo kokybės užtikrinimo sistemos įdiegimas sąlygoja aukštojo mokslo socialinį tinkamumą, o tai – finansavimo iš visuomenės pusės pritraukimą, kas lemia tolimesnį aukštojo mokslo teikiamų paslaugų ar atliekamų funkcijų kokybės augimą. Aukštojo mokslo

kokybė priklauso nuo daugelio elementų, kurie tarpusavyje yra glaudžiai susiję. Kokybės vertinimo kriterijų išskyrimas, kalbant apie aukštąjį mokslą, yra santykinis ir sunkiai apibrėžiamas dalykas. Nepaisant to, aukštojo mokslo kokybės siekimas ir vertinimas yra vienas iš veiksnių, sąlygojančių pozityvius pokyčius šalių ekonominėje, socialinėje, politinėje bei kultūrinėje srityse.

2. Kas yra universiteto teikiamų paslaugų vartotojai?

Atrodo, viskas aišku, kad tiesioginiai ir pagrindiniai mokslo įstaigos naudos gavėjai yra studentai, tačiau studentai vienu metu yra daugelyje vaidmenų:

- jie yra mokslo institucijos produktų po to, kai baigia mokslo įstaigą;
- jie yra mokymo proceso vartotojai;
- jie mokymo ir mokymosi proceso bendra - dalyviai.

Tačiau studentai nėra vieninteliai universiteto vartotojai. Studentų tėvai, firmos, busimi darbdaviai, universitetų dėstytojai ir darbuotojai, valdžios institucijos ir politikai, bendrąja prasme – visa visuomenė yra suinteresuota kokybišku mokymu [1]. Matome, kad universitete kokybės vadybos principus taikyti yra gana sudėtinga, kadangi nėra vienareikšmiškai aišku kas yra vartotojas, o kas yra prekė/paslauga. Išsiaiškinti visų šių suinteresuotų aukštojo mokslo institucijos veikla grupių interesus, poreikius ir patenkinti jų reikalavimus yra iš ties nelengvas uždavinys.

Universitetai turi tam tikrus šioms organizacijoms būdingus bruožus ir stengtis juos keisti yra sudėtinga, tuo labiau kad tai rodo ir užsienio šalių universitetų patirtis. Jaučiamas skepticizmas dėl kokybės sistemų kūrimo mokymo organizacijose. Mokymo institucijų darbuotojai bijo, kad kokybės sistema suvaržys jų kūrybiškumą ir novatoriškumą. Be to dėl tradicinio švietimo įstaigų konservatyvumo iškyla tokios problemos, kaip:

- nėra vieningos koncepcijos, kas yra mokymo ir mokslo kokybės objektas;
- nėra aiškios organizacijos vizijos, nesuformuluota misija ir konkreti kokybės politika;
- pripažįstamas tik abstraktus kokybės apibrėžimas;
- vengiama vartotojo suvokiamos kokybės supratimo;
- nėra sisteminio įvertinimo įstaigos mastu ir tarpinėje veikloje;
- nėra apibrėžtos strategijos “rinkai”;
- trūksta laiko, techninių ir finansinių resursų;
- nevertina studentų, kaip savo vartotojų [6].

Visa tai yra universitetų darbuotojų sąmonėje likęs pėdsakas nuo sovietinių laikų, kuris suformavo tam tikrus mastymo stereotipus, kuriuos pakeisti prireiks daugelio metų.

3. Kokiuose procesuose turi būti įgyvendinamos kokybes vadybos koncepcijos?

Kadangi universiteto veiklą apima daugelis tarpusavyje susijusių procesų, Amerikos kokybės vadybos specialistai mano, kad kokybės vadyba universitetuose turėtų būti privaloma keturiose pagrindinėse veiklos srityse:

- mokymo programose;
- švietimo administravime;
- dėstyme;
- moksliniuose tyrimuose [7,15].

4. Kokiais principais galėtų būti įgyvendinamą kokybės vadybą universitetuose?

Švietimo institucijoms siūlomi šeši kokybės vadybos principai:

Vadovavimas. Vadovai turėtų sukurti bendrus tikslus, mokymosi kryptis bei vidinę aplinką, kurioje visi siektų šių tikslų. Vadovai turi užtikrinti, kad plėtros strategijos, sistemos ir metodai būtų pasirenkami kurti žinioms, lavinti sugebėjimams, kad požiūriai atitiktų švietimo tikslus.

1. Vartotojų poreikių supratimas. Mokyklos priklauso nuo visuomenės pasitikėjimo, todėl būtina suvokti esamus ir būsimus visuomenės poreikius.
2. Faktinis sprendimų priėmimas. Efektyvūs sprendimai ir veiksmai turi būti paremti duomenų ir informacijos analize. Kokybės vadyba grįsta studentų veiklos matavimu, vartotojų pasitenkinimu, duomenimis apie darbuotojų veiklą, mokymosi proceso įvertinimu.

3. Žmonių įtraukimas. Visi su švietimo sistema susiję žmonės yra švietimo sistemos matas. Nuo darbuotojų priklauso visos mokymo įstaigos sėkmė. Tai intelektualinis kapitalas, nuo kurio priklauso švietimo kokybės lygis.
4. Procesinis požiūris. Mokymas yra efektyvesnis, kai veikla valdoma kaip procesas.
5. Nuolatinis tobulinimas. Nuolatinis procesų tobulinimas ir veiklos rezultatų gerinimas tūrėtų būti vienas pagrindinių mokyklos tikslų [6,15].

Manau, kad norint pagerinti universiteto veiklos kokybę, kokybės vadybos koncepciją reikia įgyvendinti visuose be išimties, universitete vykstančiose procesuose.

Vienas svarbiausiu vykstančių procesų universitete yra dėstymas. Tai yra bet kokio mokymo proceso svarbiausioji sudedamoji dalis. Be to, į tai įeina studijų programos sudarymas, individualių studijų planų sudarymas, studijų tvarkaraščių sudarymas. Kartu su dėstymo procesu egzistuoja ir mokymosi procesas, tačiau jis yra sąlygojamas dėstymo proceso. Kaip matome, dėstymas gali būti traktuotinas kaip labai svarbus mokymosi proceso kokybei užtikrinti. Dėl to dėstymo kokybės užtikrinimas labai padidina universiteto galimybes įgyvendinti kokybės vadybą, nes nuolatinis dėstymo kokybės ir dėstymo proceso tobulinimas, užtikrina tai, kad visuomenė būtų nuolat tobulinama ir parengta naujiems pokyčiams.

5. Kas yra kokybiškas dėstymas?

Paskutiniu metu Vakarų Europoje, Didžiojoje Britanijoje ir JAV pasikeitė požiūris į mokymo procesą, pereinama nuo tradicinio dėstymo prie pažangių dėstymo metodų, kurie orientuojasi į studentą, kaip į pagrindinį vartotoją. Pagrindiniai gero mokymo elementai yra mokymo turinys, technika ir bendravimo menas, prie to dar reikėtų pridurti studentų motyvaciją, elgesį ir sugebėjimą laiku įvykdyti užduotis. Galima pateikti tokius kokybiško dėstymo kriterijus:

- aiškūs tikslai;
- dėstytojo pakankamas paruošimas;
- tinkamų mokymo metodų naudojimas;
- ženklūs mokymosi rezultatai;
- efektyvus mokslo žinių pateikimas;
- dėstytojo savęs įvertinimas [9].

Kokybės vadybos įgyvendinimo švietimo ir mokslo institucijose specialistai teigia, jog nuolatinis sėkmingas dėstymo proceso tobulinimas gali būti pasiektas nuolatinio grįžtamojo ryšio pagalba. Tai reiškia, kad reikia atlikti periodiškas studentų nuomonės apie dėstymą apklausas. Tačiau studentų supratimas apie kokybišką dėstymą dažniausiai skiriasi nuo dėstytojų supratimo. Suderinti tiek studentų tiek dėstytojų gero dėstymo kriterijų prioritetus yra labai sunkus klausimas, ir šiame straipsnyje nebus nagrinėjamas [10].

Užsienio universitetai turi patirtį atliekant dėstymo kokybės tyrimus. Tokių tyrimų tikslas, ištyrus esamą dėstymo kokybę, nustatyti tobulinimo galimybes, t.y. nustatyti kokybės vadybos įgyvendinimo perspektyvas. Dažniausiai, tai būna anketinė apklausa, kuri būna sukurta remiantis kokybės vadybos metodologija. Atlikus tokius tyrimus, yra apibrėžiami dėstytojų darbo trukumai ir pateikiamos rekomendacijos dėstymo tobulinimui. Tokie tyrimai yra atliekami ir Lietuvos universitetuose.

Šiandien akademinė aplinka susiduria su tokiom pat situacijom kaip ir kitos organizacijos bei įmonės. Tik kokybės užtikrinimas ir galimybė veikti naudingai leis universitetams išlikti. Tokioje situacijoje galėtų padėti kokybės vadybos įgyvendinimas pagal ISO 9000 šeimos kokybės vadybos standartus. Kokybės vadybos diegimas suteiktų galimybę realizuoti universitetuose vykstančius procesus, nustatyti žemos kokybės apraiškas, taisyti ir užkirsti joms kelią bei sistemiškai gerinti kokybę, atlikti vidinius kokybės auditus ir pritaikyti įvairius statistinius kokybės gerinimo metodus. Taip pat tai pagerintų ir studentų, jų būsimųjų darbdavių, tyrimų rėmėjų, vyriausybės ir kitų suinteresuotų šalių pasitikėjimą, kad jų reikalavimai kokybei bus patenkinti [15].

Nors kokybės vadybos sistemų diegimas švietimo ir mokslo institucijose yra sunkus, ilgas ir daug pastangų reikalaujantis procesas, tačiau kokybės vadybos metodų panaudojimas yra bet kuriuos srities organizacijos tobulėjimo ir lyderiavimo pagrindas [11].

Išvados:

1. Sėkminga kokybės vadybos principų įgyvendinimą universitetuose sąlygoja aukštojo mokslo įstaigų specifikos įvertinimas.
2. Aukštojo mokslo kokybė suprantama, kaip multi-dimensinė sąvoka, kuri apima visas aukštojo mokslo įstaigos funkcijas ir veiklos sritis.
3. Kokybės vadybos pagrindiniai principai: dėmesys vartotojui, nuolatinis tobulinimas bei visų darbuotojų įtraukimas į organizacijos veiklos gerinimą. Pirmas etapas yra pripažinti, jog švietimo institucijos taip pat turi vartotojus, kaip ir pramonės bei paslaugų įmonės.
4. Studentai nėra vieninteliai universitetų vartotojai (klientai). Visų universiteto vartotojų reikalavimų įvertinimas ir jų poreikių patenkinimas – sudėtingas aukštojo mokslo institucijos uždavinys.
5. Universitetai pasižymi konservatyvia švietimo įstaigos kultūra, kurią būtina keisti, norint įgyvendinti kokybės vadybą.
6. Dėstytojai ir studentai kartu gali apibrėžti kokybiškos veiklos standartus. Kokybiškas mokymas gali būti pasiektas tik abipusio įsipareigojimo tarp dėstytojų ir studentų dėka.
7. Nuolatinis mokymo proceso tobulinimas negali būti pasiektas, tinkamai neįvertinus grįžtamojo ryšio naudos. Reguliarios studentų nuomonės apie dėstymą apklausos ir apklausų rezultatų analizė turi būti panaudotos nuolatiniam dėstymo kokybės gerinimui. Greitas grįžtamasis ryšis, nustatant studentų žinių silpnas vietas pagal jų mokymosi rezultatus, gali žymiai pagerinti mokymo ir mokymosi kokybę.

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Summary

Quality management in education and science institutions

Academic environment is impacted with the same situation of quality as other organizations and enterprises today. Only the quality improvement and possibilities of efficient work helps for universities to survived. In this situation will be helpful implementation of quality management systems. This will provide the possibilities to realize processes in inside of universities, estimate the manifestation of poor quality, correct and prevent its, implement quality systematically, perform the inside quality audits and arrange various statistical quality implement methods. Also to implement students, their future employer, research sponsors, government and other interested persons for satisfy their quality requirements.

In this article the science institution understands as universities. The successful implementation of quality management in universities depends on evaluation of science institution specification. The quality of higher education understands as multi dimension conception, which is involved in all science intuition functions and activities. The first stage for quality is to appreciate that the science institution has it own customers like manufacturing enterprises. Students are not the only customers (clients) of universities. To evaluate and satisfy all requirements of customers is very difficult goal for higher education institutions. Lectures and students together have to modify the quality standards. Qualified education may be achieved only by two-way deal between lectures and students.

INOVACIJŲ IR ŪKIO RAIDOS ĮTAKA VISUOTINEI KOKYBĖS VADYBAI

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Šiandien ir ateityje laisvosios rinkos sąlygomis, konkuruojant, dėl pasaulinių rinkų bei planuojant pramonės įmonių plėtrą, pasaulyje vyksta globalizacijos procesai, kurie tiesiogiai daro įtaką integracijos veiksniams Europoje. Tai yra labai svarbu visuotinės kokybės vadybos raidai Lietuvoje, nes Lietuvos Respublika jau yra bendroje Europos Sąjungos erdvėje. Lietuvos ūkio raida, bendras ekonomikos lygis ir nacionalinio produkto konkurencingumas yra susiję su visuotinės kokybės vadybos objektų valdymu. Lietuvos pramonės įmonės vis dažniau susiduria su Europos Sąjungos šalių įmonėmis ir vis labiau jaučia jų konkurencinį pranašumą, todėl Lietuvoje pradėtas ISO 9000 standartų serijos ir visuotinės kokybės vadybos įgyvendinimas. Lietuvai teks atlaikyti konkurencijos spaudimą ir rinkos jėgas, veikiančias Europos Sąjungoje. Analizuojant konkurencingumą svarbiausias dėmesys turėtų būti kreipiamas į pramonės konkurencinių pranašumų įgijimą (dėka inovacijų spartesnio pritaikymo ir lankstumo). Dabar Lietuvos įmonėse išryškėja tokios problemos: kokios kokybės produktus pateikti vartotojų grupėms ir kokias modernias technologijas būtina įsigyti numatomos kokybės produktams gaminti.

Šio straipsnio tikslas – atkreipti Lietuvos ūkio ir rinkos subjektų dėmesį į vis didėjančius produktų ir paslaugų kokybės reikalavimus, spartinti visuotinės kokybės raidą ne tik įmonėse bet ir visoje valstybėje.

Visame pasaulyje kainų ir gaminių kokybės apimčių nustatymo veiksniai tiesiogiai priklauso nuo nacionalinės ir tarptautinės rinkos struktūros, nes ją sudaro visų produkto realių ir potencialių pirkėjų bei analogų pardavėjų visuma [3]. Akivaizdu, jog tik įmonės adaptuojančios inovacijas turi technologinę pažangą bei potencialą augimui. Inovacijų naudojimas užtikrina įmonių ir nacionalinės rinkos konkurencingumą ne tik Europos Sąjungos bei tarptautinėse rinkose. Inovacinei plėtrai daug įtakos turi visuotinės kokybės vadybos sistemos apgalvotas adaptavimas ir visų jos inovacinių priemonių nenutrūkstamas monitoringas.

Lietuvoje šiuo metu sėkmingai inovacinei veiklai trukdo smukęs pramonės potencialas. Dėl lėšų stygiaus, dauguma verslininkų nesiveržia į modernias gaminių rinkas, o ieško neišrankių pirkėjų savo neaukštos kokybės prekėms parduoti. Todėl tokioms įmonėms vis sunkiau prisivyti savo konkurentus. Neišgalint gaminti aukštos kokybės produkcijos naudojant modernias technologijas, nekyla gamybinė būtinybė kurti bei adaptuoti atitinkamų inovacijų [10]. Lietuvos rinkoje sąlygos yra nepalankios naujam produktui realizuoti, o kainų svyravimai neigiamai veikia inovacijų naudojimo galimybes, nes į mūsų rinką įvežami prastos kokybės produktai iš Azijos bei kitų žemo ekonominio išsivystymo šalių. Tokiu būdu yra stabdoma visuotinės kokybės raida Lietuvoje. Visuotinės kokybės vadybos visuma daro įtaką įmonių modernizavimo spartai Lietuvoje [5]. Kita vertus, šalies ūkio ir pramonės įmonių raidos perspektyvas lemia konkurencingumas, o aplinka tampa vis palankesne, nes ekonomikos plėtrai įtaką daro Europos Sąjungos kiekybiniai ir kokybiniai veiksniai – ISO 9000 standartų serijos ir visuotinės kokybės lygmeniu: nauji produktai, medžiagos, technologijos, įrengimai, darbo našumas, kokybė, darbuotojų intelektas bei kompetencijos ir kompetentingumo atitikimas darbo vietose ir kt. [3].

Tačiau inovacijos yra brangios ir reikalauja didžiulių investicijų į įmonių modernizavimą ir veiklos plėtrą: gaminti naują produktą, kuris visapusiškai tenkintų vartotojų poreikius. Tai sudėtingas ir sunkus uždavinys, kurį išspręsti prireiks didelių valstybės, verslo, mokslo ir kt. organizacijų pastangų. Lietuvoje visuotinės kokybės vadybos procesas yra ilgalaikis, tačiau tiesiog būtina tobulinti esamas neefektyvias ir kurti naujas valdymo sistemas.

Integracijos ir globalizacijos procesų veiksniai nuolat kinta pasaulyje, Europoje ir Lietuvoje. Jiems itin didelę įtaką daro inovaciniai procesai, todėl gana sunku prognozuoti jų įtaką visuotinės kokybės vadybai, kuri veikia ir veiks nacionalinio ūkio raidą bei organizacijų modernizavimą. Lietuvos rinka Europos Sąjungos sudėtyje yra maža. Nuo to priklauso įmonių veiklos plėtra, jų

modernizavimas, inovacinių procesų aktyvinimas, kurį apibūdina pažangos kūrimas ir taikymas, naujų produktų gamyba bei realizavimas, susijęs su nuolatiniu tobulėjimu, vartotojų poreikių tenkinimu. [1]. Konkurencingumo kartelė kyla aukštyn,

- Konkurencija dėl rinkos dalies. Pramonės įmonės turi griežtai apsispręsti siekti kokybės, kad galėtų konkuruoti pasaulio rinkose ir užimti savo rinkos dalį;
- Troškimas būti tarp geriausių. Gerai suplanavus grupės pastangas paslaugas ir gaminius teikti kokybiškas reiškia žadinti žmogaus atliktos pareigos pojūtį. Apdovanojimas, sėkmė, kaip pastangų įvertinimas, akina toliau eiti tobulinimo keliu.Tai turi milžinišką reikšmę ir pačioms organizacijoms [2].

Šiuo metu tik nedaugelis mūsų šalies įmonių gerai ir savalaikiai adaptuoja inovatyvias technologijas. Todėl, kad pagrindinės problemos susijusios su inovacijų diegimu įmonėse yra tokios:

1) nėra nuolatinių rinkos tyrimų;
2) nėra mokslo ir technikos pažangos valdymo veiklos;
3) nėra inovacijų apskaitos sistemos [6].

Norėdamos panaudoti inovatyvias technologijas gamyboje, pramonės įmonės turi išspręsti senų įrengimų ir pastatų renovavimo problemas. Taip pat inovatyvių technologijų atėjimas susijęs su kiekybinio darbo jėgos mažėjimu ir privalomu kokybiniu jos kvalifikacijos pakilimu. Šioms ir daugeliui kitų problemų spręsti trukdo šalies ir įmonės teisinės bazės keblumai, darbuotojų pasipriešinimas, vadovų neryžtingumas, kapitalo stoka, informacijos trūkumas ir daug kitų priežasčių.[4]

Technologinis pirmavimas priklauso nuo nacionalinių investicijų pirmaujančioms mokslo sritims, nuo nacionalinių mokslininkų kadrų ir nuo mokslinių įstaigų būklės. Ekonominio augimo perspektyva priklauso nuo privataus sektoriaus novatoriškumo, todėl vyriausybė turi visokeriopai skatinti inovacijas.[9] Lietuvos Respublikos Vyriausybė 2003 m. patvirtino Inovacijų versle programą. Šios programos tikslas– skatinti Lietuvos pramonės ir verslo konkurencingumo augimą, t.y. steigti naujas modernias įmones, sudaryti veikiančioms įmonėms palankias sąlygas atsinaujinti, naudoti Lietuvos bei tarptautinį mokslo ir technologijų potencialą, kad jos kurtų didelę pridėtinę vertę ir sugebėtų konkuruoti pasaulio rinkoje. Ši programa įgyvendinama naudojant Lietuvos valstybinio mokslo ir studijų fondo, Europos Sąjungos struktūrinių fondų, kitų nacionalinių ir tarptautinių fondų (programų), privačių juridinių ir fizinių asmenų lėšas. 2004 m. LR Vyriausybė skirė lėšas (9 700 tūkst.litų) inovacijų ir konkurencingumo didinimui. Lėšos skiriamos: 1.nacionalinės inovacijų sistemos strateginiams pagrindams sukurti, įmonių bendradarbiavimui, įgyvendinant inovacijas, plėtoti; 2.inovacijų skatinimo infrastruktūrai sukurti, inovacinių projektų įmonėse įgyvendinimui remti; 3.Nacionalinės acquis priėmimo programos priemonėms derybiniame skyriuje "Pramonės politika" įgyvendinti; 4. PHARE. projektui "Inovacijų administraciniai gebėjimai" vykdyti; inovacijų teisinei bazei sukurti.[5,6,10].

	1995	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**
Iš viso, mln. Lt	114,9	164,9	217,2	244,5	220,3	269,9	326,8	344,7	381,8
iš jų, %									
fundamentiniams tyrimams	52,6	39,5	41,1	46,6	55,7	41,7	35,3	40,9	35,5
taikomiesiems tyrimams	39,6	41,6	44,1	43,3	34,5	36,3	29,8	36,3	38
Eksperimentinei plėtrai	7,8	18,9	14,8	10,1	9,8	22	34,9	22,8	26,5
Išlaidų mokslo tiriamajai veiklai santykis su bendruoju vidaus produktu (BVP), %	0,46	0,52	0,56	0,56	0,52	0,59	0,68	0,67	0,68*

*-išankstiniai duomenys.

1 lentelė. Išlaidos moksliniams tyrimams ir eksperimentinei plėtrai (MTEP)

Iš 1 lentelės, matomos išlaidos moksliniams tyrimams ir eksperimentinei plėtrai Lietuvoje per paskutinius 9 metus. Lyginant, su 1995 m. bendromis išlaidomis tyrimams matome, kad 2003m. jos padidėjo daugiau kaip 3 kartus, bei kiekvienais metais vis auga. Todėl galima tikėtis, kad artimiausiu metu Lietuvoje gali padidėti naujų inovatyvių produktų, pramonės įmonių inovatyvumo lygių kitimo tendencijas ar net padaryti atitinkamas prognozes, kurios padėtų įmonėms lengviau formuoti inovacijų adaptavimą ir taip pasivyti ES valstybes. [11]

Lietuvos integracija į ES ir NATO svarbi tuo, kad pradės veikti ISO 9000 standartų serija ūkio ir rinkos bendroje erdvėje, veiklos efektyvumas ir kokybė atitiks bendrus vertinimo kriterijus, kurie spartins visuotinės kokybės raidą Lietuvoje [3]. Standartų ISO 9000- ISO 9004 serijos įdiegimas sudaro sąlygas eksportuoti produkciją į kitas šalis. Šie standartai aprėpia kokybės laidavimo modelį nuo produkto projektavimo iki galutinės kontrolės ir išbandymo. Lietuvos socialinė aplinka palanki plėtoti ir stambų, ir vidutinį bei smulkų verslą visuose šalies regionuose. Šie ūkio raidos principai garantuoja visuotinės kokybės vadybos taikymą.

Gaminio ar paslaugos kokybė suprantama kaip savybių visuma, atitinkanti vartotojo reikalavimus. Įmonės gaminio ar paslaugos kokybė užtikrina sėkmingą gaminio realizavimą, paslaugos teikimą. Tokiu būdu geros kokybės gaminys ar paslauga tampa konkurencingu rinkoje. Kokybė priklauso nuo gamybos ir ją remiančių procesų, vykdant vidinio ir išorinio vartotojo užsakymus, jų reikalavimus. Siekiant aukštos kokybės, įmonės procesai turėtų būti valdomi. [2]. Kokybės valdymo sistemos vienas pagrindinių tikslų yra orientavimasis į vartotojus, vartotojo poreikius ir lūkesčių tenkinimą. Orientacijos į vartotoją principo pirmasis ir paskutinis žingsniai yra bene patys svarbiausi. Pirmasis, vartotojo poreikių ir lūkesčių nustatymas, paskutinysis – duomenų rinkimas apie vartotojų pasitenkinimą. Taigi vartotojų poreikių tenkinimas neįmanomas be tų poreikių nustatymo ir, žinoma, patenkinimo įvertinimo. Lietuvoje nauja produkcija yra pakankamai aukštos kokybės nei Vakarų Europoje, nes naujos technologijos nuteikia teigiamai. Paskutiniais duomenimis, eksporto augimo tempai sudaro 40 proc. Jie džiuginantys, tačiau tai ne mūsų inovacijų rezultatas. Be to, verslo pasaulis labai mažai užsiima tyrimais. Žmonių, kurie dirba versle ir užsiima tyrimais, sudaro 5-6 proc.[10].

Inovacijos – tai ne tik naujų produktų ar technologijų kūrimas, bet ir gaminamos produkcijos ypatybių gerinimas, gamybos našumo didinimas, bei kaštų mažinimas. Galima sakyti, kad dabar inovacija kokybės vadybos srityje yra visuotinė kokybės vadyba. [1,3]. Šiuo metu inovacijų adaptavimui ypač svarbi yra kokybės sąvoka. Remiantis ISO standartais, kokybė – " tai savybių ir produkcijos arba paslaugos charakteristikų visuma, kurios suteikia galimybę tenkinti sąlygojamus arba numatytus poreikius." Kokybės garantijomis buvo rūpinamasi nuo senų laikų. XIX šimtmečio pradžioje pradėta plačiai įgyvendinti masinės gamybos produktų individuali kontrolė, tikrinimas, taip pat naudoti įstatymais apsaugoti prekių ženklai. Tačiau tik XX šimtmetyje buvo pereita nuo dažniausiai tiktai galutinio produkto tikrinimo prie gamybos procesų kontrolės ir reguliavimo. Žinoma, kad dabartinėje gamyboje pagrindinis vaidmuo, diegiant inovacijas, tenka kokybei ir patikimumui [3,8].

Daugelyje sričių inovacijos gali būti naudojamos tik nuodugniai išnagrinėjus jų poveikį aplinkai, žmonėms, ateities kartoms. Inovaciniai produktai turi būti pradėti gaminti ir naudoti tik visapusiškai juos patikrinus ir griežtai laikantis standartų, nustatytų normų, audito reikalavimų ir, žinoma, įvertinus galimas pasekmes. Pradedant gaminti inovacinius produktus reikia atlikti ne tik tradicinius kokybės bandymus, bet ir ištirti jų savybių pokyčius eksploatacijos bei naudojimo metu [1].

Šio straipsnio tikslas bus įgyvendintas, jeigu bus pagerinta inovacinę aplinką, nes inovacijų procesai yra susiję su politinėmis, ekonominėmis, socialinėmis transformacijomis, o ši sąvoka išreiškiama kokybinio pobūdžio pokyčiais, kuriuos ir analizuoja visuotinės kokybės vadyba.[5]

Išvados

1.Lietuvos pramonės įmonės patiria nuožmų konkurencinį spaudimą iš laisvojoje rinkoje veikiančių kitų įmonių. Tik inovacijų ir moderniųjų technologijų dėka, galima užtikrinti sėkmingą

produktų realizavimą rinkoje. Lietuvos ekonomikos plėtrai įtaką daro ISO 9000 standartų diegimas įmonėse.

2. Inovacijos yra brangios ir reikalauja didžiulių investicijų į įmonių modernizavimą ir veiklos plėtrą, todėl Vyriausybė skatina Lietuvos pramonės ir verslo konkurencingumo augimą, t.y. naudoti Lietuvos bei tarptautinį mokslo ir technologijų potencialą.

3. Lyginant, su 1995 m. bendromis išlaidomis tyrimams matome, kad 2003m. jos padidėjo daugiau kaip 3 kartus, bei kiekvienais metais vis auga. Todėl galima tikėtis, kad artimiausiu metu Lietuvoje gali padidėti naujų inovatyvių produktų, pramonės įmonių inovatyvumo lygių kitimo tendencijas ar net padaryti atitinkamas prognozes, kurios padėtų įmonėms lengviau formuoti inovacijų adaptavimą ir taip pasivyti ES valstybes.

4. Paskutiniais duomenimis, eksporto augimo tempai sudaro 40 proc. Jie džiuginantys, tačiau, tai ne mūsų inovacijų rezultatas. Be to, verslo pasaulis labai mažai užsiima tyrimais. Žmonių, kurie dirba versle ir užsiima tyrimais, sudaro vos 5-6 % [10].

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The influence of innovations and economy process to Total Quality Management.

Summary

The paper covers important factors of total quality development in Lithuania and the globalization and integration processes in the world, the European Union and NATO spaces work gives an analysis of ISO 9000 standard series focusing on the integral importance of the quality management in Lithuania, economic and market competitiveness, the optimizing the act of individual organizations. The strategic objective of the state, economic and market development, related to the total quality development in Lithuania are described. Currently the development of innovations in the country is being stopped by the significant decline of the national industrial potential, whereas its integral factors have an effect on the development of internal and external environment of the country, which is just unfavorable for the development of the total quality management development. The market of Lithuanian industrial Enterprises more and more often conflict with the Enterprises of EU countries and feel more their competitive advantage. By the desire to survive in struggle of this market they must concentrate their attention and turn their power to fast and fit adaptation of new technologies. To development of strategically optimum of enterprises innovativeness, suggest them a focusing attention in criterions of presenting products to users group of different purchasing power. Some of those criterions directly depend on adapted innovative technologies.