VILNIUS GEDIMINAS TECHNICAL UNIVERSITY

FACULTY OF MECHANICS

DEPARTMENT OF MECHANICS ENGINEERING

Diana Paškonytė

INVESTIGATION OF INDUSTRIAL INTELLECTUAL PROPERTY PROTECTION METHODS AND THEIR IMPROVEMENT

PRAMONĖS INTELEKTINĖS NUOSAVYBĖS APSAUGOS METODŲ IR JŲ TOBULINIMO GALIMYBIŲ TYRIMAS

Master ‘s degree Thesis

Industrial engineering and innovation management study programme, state code 621H77002

Industrial Engineering study field

Vilnius, 2018

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THE OBJECTIVES:

The purpose of the study is to provide possible solutions for development of existing Industrial Intellectual Property Protection methods.

In order to achieve that we need to analyze intellectual property protection methods more deeply, investigate exceptional cases and laws which already exists. In addition to analysis of scientific literature, international, regional and national intellectual property laws are going to be analyzed. After carrying out analysis and communicating with people associated to this topic, the point is to find main bottlenecks, model the process before and after suggested improvements' means and make conclusions.

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DECLARATION OF AUTHORSHIP IN THE FINAL DEGREE PAPER

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I declare that my Final Degree Paper entitled „Investigation of industrial Intellectual Property Protection Methods and their Improvement" is entirely my own work. The title was confirmed on November 24, 2016 by Faculty Dean's order No. 328me. I have clearly signalled the presence of quoted or paraphrased material and referenced all sources.

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Annotation

This thesis main purpose is to analyze the existing industrial intellectual property protection methods and to provide some suggestions for improvements. It gives insights on all possible protection methods, when it is best to use it and how to choose. Also informs about alternative protection methods and advantages of them. After theoretical research, a study of empirical research presents the results. This work shows a different approach taken to solve a complex and lengthy process. In this paper, Business Process Modelling techniques have been introduced and applied providing a different point of view to solve some of the issues. The main idea is to remove non-value adding processes and introduce ICT based software between different parties involved as that would simplify and improve the process.

Keywords: intellectual property, industry, protection, investigation, methods, improvement, patent, utility models, application, survey.

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Pavadinimas **Pramoninės intelektinės nuosavybės apsaugos metodų ir jų tobulinimo galimybių tyrimas**

Autorius **Diana Paškonytė**

Vadovas **Rūta Banelienė**

Kalba: anglų

Anotacija

Šios disertacijos pagrindinis tikslas yra išanalizuoti esamus pramoninės intelektinės nuosavybės apsaugos metodus ir pateikti keletą pasiūlymų patobulinimui. Tai suteikia įžvalgų apie visus galimus apsaugos metodus, kada geriausia juos naudoti ir kaip pasirinkti atitinkamą metodą. Taip pat informuoja apie alternatyvius apsaugos metodus ir jų pranašumus. Po teorinio tyrimo, pateikiami empirinio tyrimo rezultatai. Šiame darbe pasirinktas ir pritaikytas kitoks požiūris ieškant sudėtingo ir ilgo proceso sprendimo. Jame buvo įdiegti ir pritaikyti verslo procesų modeliavimo metodai. Pagrindinė idėja - pašalinti nereikalingus, vertės nepridedančius procesus ir įdiegti IRT grindžiamą programinę įrangą tarp skirtingų dalyvaujančių šalių, nes tai supaprastintų ir patobulintų procesą.

Prasminiai žodžiai: intelektinė nuosavybė, pramonė, apsauga, tyrimas, metodai, tobulinimai, patentas, naudingieji modeliai, pritaikymas, apklausa.

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INTRODUCTION

Object of research

In this research, the already existing methods of intellectual property is being analyzed and survey carried out. After, the results are being investigated and an approach is being chosen. Finally, the improvements are being suggested. An enhanced method should be designed and possibly be used for industrial intellectual property in any size of companies or individual researchers. The research will cover the analysis of people related to this field insight in respect of possible future changes.

Work goal and objectives

The purpose of the study is to provide possible solutions for development of existing Industrial Intellectual Property Protection methods.

In order to achieve that, we need to analyze intellectual property protection methods more deeply, investigate exceptional cases and laws which already exists. In addition to analysis of scientific literature, international, regional and national intellectual property laws are going to be analyzed. After carrying out analysis and communicating with people associated to this topic, the point is to find main bottlenecks, model the process before and after suggested improvements' means and make conclusions.

Scientific novelty

So far there are many different researches about how governments and responsible entities are trying to deal with separate problems arising in the field of intellectual property protection. One of the huge proceedings which is now in progress in making Unified Patent and Unified Patent Court. This should help with some of the issues like making patenting process faster and cheaper (in cases when inventor seeks for protection in more countries), but not all issues would be touched. In my research I will focus more on over viewing all possible causes of making intellectual property poorly protected and how all those issues affect researchers and inventors negatively as well as greatly influence innovation, competition and economy in general. Business Process Modelling techniques were also applied to analyze process before and after solutions were introduced.

Topicality/ relevance of the work

More and more people from different fields like business industries, companies, universities and countries itself are focusing and giving more attention to intellectual property (IP). Shortly, intellectual property refers to the creation of the mind like inventions, literary, etc. The rapid advance of the internet and e–commerce has created a whole new set of problems concerning intellectual property rights (IPR). The issues of intellectual property are continually with us and touch us probably more than we realize. Even many students are probably facing the intellectual property issues.

There are several compelling reasons why it is important to promote and protect intellectual property. First, considering well-being and future of humanity, we must create and invent new works in the areas of technology and culture. Moreover, the legal protection of new creations encourages the commitment of additional resources for further innovation. Lastly and significantly, it spurs economic growth, creates new jobs and industries, and enhances the quality and enjoyment of life.

Having assessed the growing importance of intellectual property and its protection methods, both globally and nationally, this theme for the final work has been chosen.

1. PROBLEM ANALYSIS AND FORMULATION

1.1. Problem definition

Currently, in intellectual property field used protection methods still have many disadvantages and loopholes where inventors are not protected. Those conditions are especially hard for small companies or individual inventors, because patents and other protection methods are very expensive and usually time consuming (can take up to 4 years) and by then market may have changed or technology may have overtaken your invention. Conditions are literally working against the inventors and scientists. Another thing is that even when a person patents his invention or product, it can still be stolen or copied, so the inventor has to consider his ability to defend his patent in case of infringement. And that has to be done even before applying for patent. It goes without saying that timing is very important in all stages of thinking about patent. These are the problems which are similar in all countries.

One more issue is that even though patenting and other methods are considered as a way of sharing technology, ideas and promoting scientists to do more and more in research field, statistics show that most firms use the patent system to prevent other firms copying their technology and blocking. It means that owners wish to prevent others from using the technology and creating. It is obviously a potential danger and concern because patents should be encouraging the innovation, not opposite.

Other concern is that intellectual property laws differ in different countries and it is especially visible between US and EU patent systems. There is long history with an issue of patent harmonization and it should not be forgotten.

1.2. Problem tree

After defining the problem, the problem tree can be made to visualize not only core problem, but also causes and effects which will help later to find a solution. It is shown in the figure below (Figure 1).

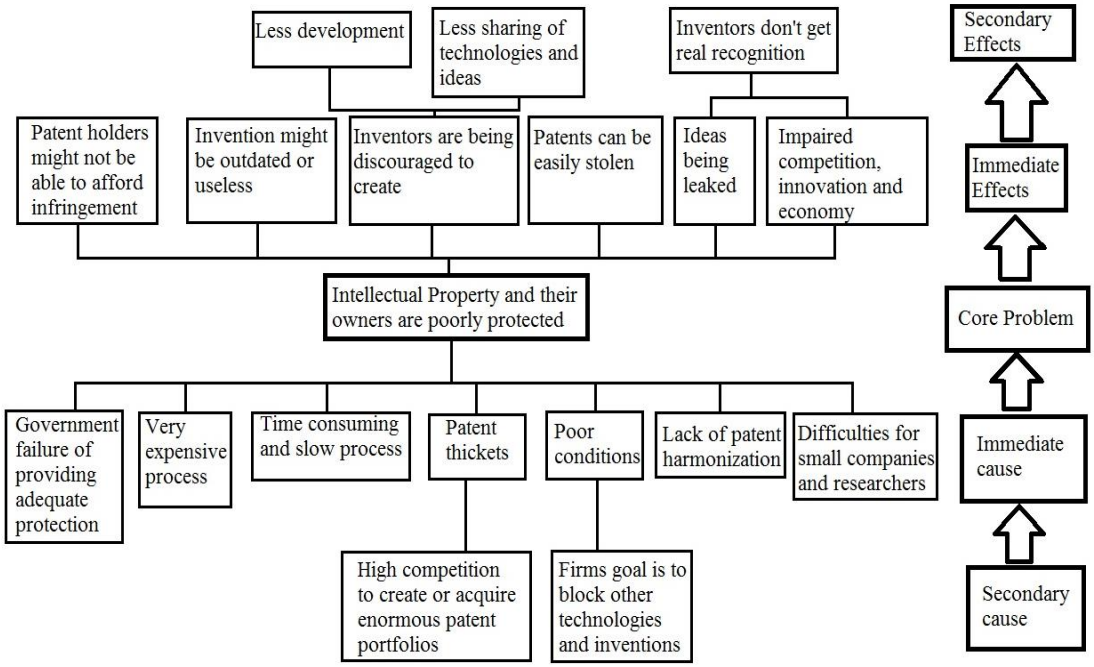

Figure 1. Problem tree

Note: created by author

In the middle of the tree there is a core problem which is formulated as a “Intellectual Property and their owners are poorly protected”. That is the consequence of immediate and

secondary causes like “poor conditions”, “patent thickets”, “government failure” and so on. All that leads to the problem and then to immediate and secondary effects like “patents can be easily stolen”, “ideas being leaked”, “impaired competition, innovation and economy”.

2. LITERATURE REVIEW

In the research a presumable problem tree has been already created by using different sources. As stated earlier the core problem is that intellectual property and their owners are poorly protected. And this is influenced by many factors. Those factors lead to creating the problem and then having negative impact on many businesses, researchers and anyone who has ever created or invented anything.

It is best to start by first analyzing what is intellectual property and overviewing the protection methods for industrial property used nowadays as well as some alternatives.

2.1. Main terminology and laws

Intellectual property (IP) is non-material property, which is the human creative spirit and mental work result, mind product, protected by law like any other form of property. Intellectual property concerns the legal rights associated with creative effort or commercial reputation and that is why it is also important to know laws very well. The subject matter is very wide. Even though the law is always trying to keep up with technology changes that suddenly allows firms to operate in ways previously not considered, they do not always succeed. Moreover, it is significant to correctly evaluate IP in your company and choose best methods of protecting it (WIPO).

There are several ways of protecting your creative efforts and mainly, according to the objects protected by the intellectual property right, two main types of intellectual property can be distinguished. These are copyrights and industrial property.

In this work the focus will be more on industrial intellectual property. It includes the following objects: Inventions, Utility models, Industrial designs, Trademarks, Service marks and Geographical indications.

For every specific object the correct and best protection method should be chosen. The most known and popular methods are:

- Designs (registered);
- Trademarks (registered);

- Patents & Utility models;
- Some of the alternative methods to patents (secrecy, accumulated tacit knowledge, lead time, after – sales service, learning curve, complementary assets, product complexity, standards, branding).

Most of those protection methods are covered by legal ground and appropriate organizations are responsible and dealing with the enforcement of intellectual property rights. In Europe there are European Patent Office (EPO), European Union Intellectual Property Office (EUIPO) and generally in the world there is World Intellectual Property Organization (WIPO). In Lithuania we have the following bodies:

- LATGA-A -Lithuanian Copyright Protection Association Agency;
- AGATA - Lithuanian Related Rights Association;
- The State Patent Bureau of the Republic of Lithuania;
- Ministry of Culture Copyright and Related Rights Board.

First, as registered designs name indicates that it is used to protect industrial design which is mass – produced objects and artistic construction projects. Design might be recognized product or just part of it, which can be composed of the product or its ornamentation specific character - the lines, contours, colors, shape and texture. It can be flat (textile, wall hangings or rugs) and three – dimensional shape (cars, electrical appliances, mobile phones, furniture or kitchen utensils). Industrial design must be new (no identical design to the filing (priority) date was not available to the public) and have individual character (if the informed user consists overall design impression is different from any other design impression, which became available to the public before the application (priority) date of filing).

Legal protection is granted by the Republic of Lithuania in the Design Register unless otherwise provided for in international treaties. The initial registration of the design is 5 years from the filing date. After this period, the design registration may be extended in a future four times (for 5 years) more to 25 years from the filing date. Without design owner's permission others have no rights to manufacture, import, export, sell or offer for sale, lease products that are (or just parts of them) registered as industrial design (Birstonas R., 2011).

Then we have registered trademarks which protection ensures that the owners of marks have the exclusive right to use them to identify goods or services, or to authorize others to use them in return for payment. The period of protection varies, but a trademark can be renewed

indefinitely upon payment of the corresponding fees. Trademark protection is legally enforced by courts that, in most systems, have the authority to stop trademark infringement. In a larger sense, trademarks promote initiative and enterprise worldwide by rewarding their owners with recognition and financial profit. Nonetheless, trademark protection also hinders the efforts of unfair competitors, such as counterfeiters, to use similar distinctive signs to market inferior or different products or services. The system enables people with skill and enterprise to produce and market goods and services in the fairest possible conditions, thereby facilitating international trade.

In order to register trademark, you have to fill an application with the appropriate national or regional trademark office. The application must contain a clear reproduction of the sign filed for registration, including any colors, forms or three-dimensional features. It must also contain a list of the goods or services to which the sign would apply. Certain conditions should be fulfilled if sign was protected as a trademark or other type of mark. It must be distinctive, so that consumers can distinguish it from trademarks identifying other products, as well as identify a specific product with it. It must neither mislead nor deceive customers nor violate public order or morality. To conclude, almost all countries in the world register and protect trademarks. Each national or regional office maintains a Register of Trademarks containing full application information on all registrations and renewals, which facilitates examination, search and potential opposition by third parties. The effects of the registration are, however, limited to the country (or, in the case of regional registration, countries) concerned. Finally, the rights applied for cannot be the same as, or similar to, rights already granted to another trademark owner. This may be determined through search and examination by national offices, or by the opposition of third parties who claim to have similar or identical rights (Birstonas R., 2011).

A patent is a form of protection of inventions. The state gives the inventor exclusive rights to his work, provides legal protection for inventions for a limited time and after that, the invention belongs to the public. The patent owner has the exclusive right to use the invention (to sell, import, export, and so on.) and to prevent third parties from using the invention without his permission. In addition, the patent owner may transfer to another party any or all of its exclusive rights or grant a license. It offers a 20 years monopoly.

In order to get a patent, the invention must meet the novelty, inventive step and industrial applicability criteria. The invention is new if it is unknown in technical level. Technical level is considered to be all things till the patent filing date or, if priority is claimed, before the priority

date has been publicly announced or used in the Republic of Lithuania or abroad. The patent act 1977, section 2 (1), stipulates that 'an invention shall be taken to be new if it does not form part of the state of art'. A state of the art is defined as all matter, in other words, publications, written or oral or even anticipation will render a patent invalid. The invention is considered for an inventive step, if, according to the technical level it is not obvious to a person skilled in that field. Solutions must be different from each other, it has to be obtained by finding ways unknown or obtained by those skilled in an unusual way. Under the Patent Act an invention shall be taken to be capable of industrial application if it can be a machine, product or process. Usefulness is required to be demonstrated or described. For example, penicillin was a discovery which was not patentable but the process of isolating and storing penicillin clearly had industrial applications and thus was patentable (Trott, 2012).

There are some exclusions from patents and in some cases, the patent protection may not be granted. Patent Act 1988 states that discoveries (as opposed to inventions), scientific theory and mathematical processes are not patentable. Similarly, literary artistic works and designs are covered by other forms of intellectual property such as trademarks, copyright and registered designs.

Patents are issued by the State Patent Bureau of the Republic of Lithuania. A person wishing to obtain a patent for the invention has to fill a patent application for this authority. Patent Office checks whether the application meets the formal requirements, or the object of the invention corresponds to the concept of the invention and may be granted a patent. The right to a patent belongs to the inventor or his successor in title or employer, if it is a service invention. If an invention is created in the company, institution or organization which carries out scientific research, design, development and other creative nature of the work under the contract with the customer, who financed relevant work, the right to a patent for the invention is determined by this agreement. If the employer refuses the right to a patent or within four months does not inform the inventor of its intention to use this right, the right to the patent goes to the inventor. Joint inventors shall have equal rights to the patent, unless they agree otherwise.

It is important to note that patents can be quite useful in some situations. For example, it can help to find out what already exists and build on it, to keep track of who's doing what, to avoid infringing other people's patent rights and to improve the quality of your patent applications. It is relatively easy to find the needed patent, because Patent Offices have classified all of them, for

that they use International Patent Classification (IPC) with its extension The Cooperative Patent Classification system (CPC). Both of those systems are divided into 8 sections and further to smaller classes and subclasses. It is shown in the table below (Table 1) how it looks.

Table 1. The eight IPC and CPC sections

A	Human necessities
B	Performing operations; transporting
C	Chemistry; metallurgy
D	Textiles; paper
E	Fixed constructions
F	Mechanical engineering; lighting; heating; weapons; blasting engines or pumps
G	Physics
H	Electricity

Source: WIPO website, IPC Publication

Another method is utility model which is similar to a patent, it is characterized by novelty and industrial application, but does not require strict inventive step or non-obviousness criterion. Utility models are generally subject to less demanding or shorter commercial life of inventions. Their receipt procedure is simpler than getting a patent, as well as cheaper. Utility models and national patents granted in Member States which do not conduct a thorough assessment of inventive step - faster route of protection. However, they can be seen as lower quality rights than examined patents, and can therefore increase legal uncertainty. Utility models are considered particularly suited for SMEs that make "minor" improvements to, and adaptations of, existing products. They are primarily used for mechanical innovations. But not all countries provide the option of this protection (including Lithuania). The leading country for getting utility models is China. It is followed by Russian Federation, Ukraine, Germany, Japan, Brazil, Italy and Australia (source WIPO indicators, 2015).

Invention patents and other intellectual performances becomes the object of civil rights from the moment they are intellectual performance results recognized under law. Each state defines intellectual property differently, e.g. according to its laws. So, if the business is carried out internationally, it is necessary to take into account the relevant state laws and practices. In addition,

the European Union Member States may choose to protect their IP rights at the national (regional) level or at EU level within the EU territory.

Also, there are many alternatives to patents which might be more suitable for specific cases or fields (Table 2).

Table 2. Alternative strategies to patenting

Alternatives	**Definition**
Secrecy	Relatively easy, no legal protection.
Accumulated tacit knowledge	Acquired through experience, it is an asset that is difficult to imitate.
Lead time	Market share and profits need to be secured quickly.
After – sales service	Market share acquired by the lead time advantages can be sustained through after – sales services. If a better and cheaper product is introduced, especially in business – to – business, customer loyalty can disappear very quickly.
Learning curve	Prior knowledge has made the process more efficient.
Complementary assets	Additional useful, extra products are offered to make an original product more desirable.
Product complexity	Helps to avoid imitation by increasing product complexity. The semiconductor industry is a good example of this, because expensive devices are needed to reverse engineer semiconductor products.
Standards	A highly effective (but risky) way of getting large returns on the investment on R&D. winners can take the whole market and losers get nothing.
Branding	It is an important way to appropriate returns from innovation; it can also create customer loyalty.

Source: Trott P. 2012. “Innovation Management and New Product Development. Fifth edition”

For example, in semiconductors industry there are two other methods considered to be more superior than patenting. It is namely secrecy and lead time or first mover advantage. It is especially more valued by small companies who are just using patents to acquire venture capital. A number of alternatives strategies to patents have been developed by the companies due to the fact that they felt other forms of IP protection were better suited to their needs (Leiponen and

Byma, 2009). Consequently, these developments were very useful for other companies and inventors, and therefore successfully applied in different industries.

2.2. Issues analysis

Knowing the situation of this field, causes which create already established problem will be analyzed. One of them are patent thickets which is the result of the companies competing to create or acquire enormous patent portfolios which gives the company advantages against others. Usually this happens in the industries where one product is covered by many different patents meaning there are many different patent holders. In this situation they need to negotiate with each other in order to get licenses. One very good example is smartphones which after deep analysis was estimated to be covered by more than 250 000 patents. And big manufacturers like Samsung needs licenses from both Motorola and Apple to produce smartphone as do an Apple. There is a mutual dependence since the other companies also need licenses and they end up granting cross licenses (Shapiro, 2001). But then if one company has a bigger patent portfolio, it can demand payment to make the deal work. This have a big impact on innovation and competition, because it is believed that patent thickets slow down the innovation as well as increase the costs of research and development. This might decrease the work of small companies and individual researchers, because large companies which hold many patents might not even allow those without patents (they do not have anything to bargain with) to enter the market. There is emerging literature that lays down empirically that thickets have a negative effect on entry into these industries. Additionally, there is a huge effect on transaction costs from thickets—filing fees, patent attorneys, everything associated with the drive to accumulate the biggest patent portfolio (Wagner, 2015).

Another cause is lack of patent harmonization. Looking at this from a wider perspective even countries like United States of America has some flaws at this aspect. Even though patent system itself is pretty harmonized through the WTO treaty, all the pillars and basic parameters are specified, lack of harmonization is seen on the implementation of the Trade Related Aspect of Intellectual Property (TRIPS) agreement and on the enforcement side in courts. Patent laws govern how patents are granted and what rights are associated with patents. When it comes to enforcement of those rights, then you're usually entering civil law and then you can see the variety of different treatments. Looking more deeply in European Economic Area, at the moment, there is still not a single European patent right. What you can get is a bundle of national patents. The previously used

example with Samsung and Apple can be used to represent this issue. In 2012 Apple was suing Samsung over tablets. The German court ruled that the Samsung tablet was in violation of intellectual property owned by Apple, whereas the Dutch court came to the opposite conclusion. In cases like this you have to litigate in national courts and it obviously can get complex (Wagner, 2015). If we compare The European and US patent systems, they do have many similarities, for example a monopoly is granted for 20 years under both systems. However, there is one key difference between those two. In US the patent goes to the researcher who can prove that they were the first to invent, and in Europe the patent goes to the one who is first to file for a patent. There are more very important differences between these patent systems. In Europe, a patent is considered invalid if the inventor has published the novel information before filling the form for patent protection. In the United States there are some provisions that allows inventors to talk first and file later. Also in Europe patent applications are published while pending. This allows the chance to see what monopoly an inventor is claiming and object to the Patent office if there are grounds to contest validity. Meanwhile in US the applications remain secret until it is granted (Trott, 2012).

Another factor is poor IP protection conditions. One of the things influencing this is that firms' goal is to prevent other technologies and inventions. These days patents are very valuable to researchers and scientists. They can use previous patents to see how the problems they face have been tackled in the past. Also they can identify how their current area of work fits in with those areas of science and technology that have been developed and patented previously. All this industrial intelligence can help research teams and companies to develop and modify their own strategy or to pursue a different approach to a problem (Trott, 2012). According to Professor William Haseltine, who has been working on deciphering the DNA of the HIW virus, the patents actually stimulates innovation. He also said "I can think of no case in which a patent has ever inhibited an academic scientist." But there is a different approach to this question too. In a table 3 which is shown below you can see the reasons why firms patent. It is clear that most firms use the patent system to prevent other firms copying their technology and blocking. When we mention blocking, it refers to owners of a patent preventing others from using the technology. It is obvious now that there is a potential danger and concern because there is increasing evidence that now firms use patents to prevent others from developing technologies even though the aim was to encourage the innovation (Quinn, 2011).

Table 3. Reasons why firms patent

	Products, %	Processes, %
Prevent copying	96	78
Patent blocking	82	64
Prevent suits	59	47
Use in negotiations	48	37
Enhance reputation	48	34
Licensing revenue	28	23
Measure performance	6	5

Source: Cohen, W. M. (2002) Patents: Their Effectiveness and Role, Carnegie Mellon University & National Bureau of economic research.

It is also important not to forget that the process is very expensive. There are high fees for obtaining the patent and keeping it. And even if entrepreneur can afford these costs, protecting a patent against possible infringement can simply be prohibitive. In case you would need to go to the court regarding the infringement you have to be able to finance the case, which many small companies cannot do. This is why many entrepreneurs consider the whole issue of IP as nothing more than a smokescreen (Greenhalgh, 2010). This has a huge impact on which measures are being taken in case of infringement and recent researcher was done in China showing that 38.2% of the patent owners do not take any actions probably due to high expenses. Among the no-action patent owners, 15.7% are universities, obviously lower than other three patentees (over 30.0%). The highest percentage of barely taking any actions are individual inventors and scientific research institute which is no surprise (Table 4).

Table 4. Enforcement measures taken by patent owners (%)

Measure	**Company**	**University**	**Scientific Research Institute**	**Individual**	**General**
Complaint before Administrative authority	11,5	**30,3**	5,8	16,9	13,8
Lawsuit before Court	16,5	3,8	16,8	8,8	13,2
Both complaint and lawsuit	11,2	**35,0**	7,6	3,9	8,0
No actions	32,9	15,7	35,3	45,1	**38,2**
Warning letter requesting stop of infringement	27,8	15,2	34,6	25,3	26,8

Source: SIPO Statistics Database, September 2016.

Note: Effective number of respondents: 2036 companies, 60 universities, 83 scientific research institutions, and 98 individuals, 2277 in total.

One more important factor is that the process of patenting (the most popular method of protecting intellectual property) is very time consuming. This includes the lengthy process to write and file for patent, then it typically takes around 3 years until it is granted. Moreover, obtaining and then defending the patent also consumes a lot of time (Colson, 2007). Figure 2 below depicts how many patents worldwide are still undetermined due to these reasons.

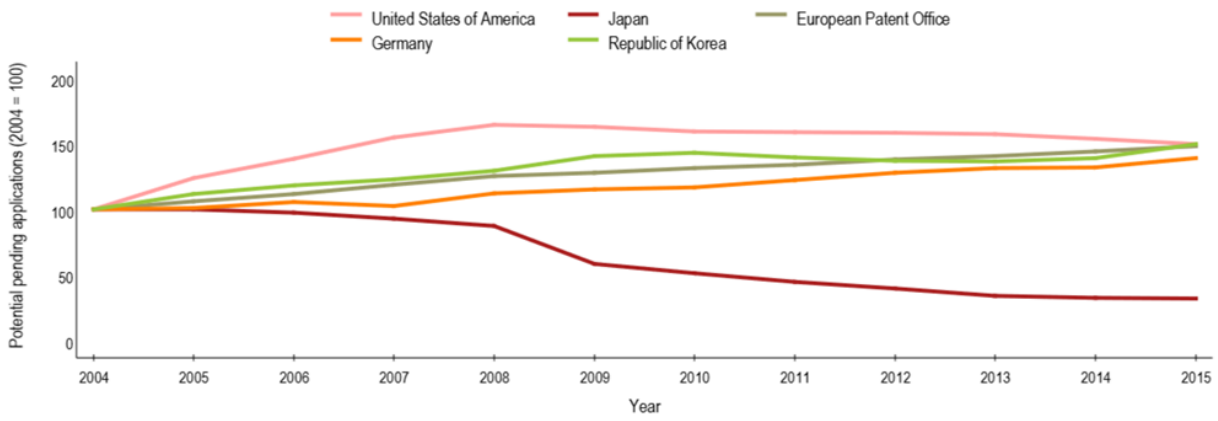

Figure 2. Potentially pending applications at the top offices

Source: WIPO Statistics Database, October 2016.

Note: Application processing varies across offices, making it difficult to measure pending applications. In some offices patent applications automatically proceed to the examination stage unless applicants withdraw them; in other applications do not proceed to the examination stage unless applicants file a separate request for examination. Data for the State Intellectual Property Office of the People's Republic of China, the office that receives the most applications, were unavailable.

Another concern is that governments are not providing adequate protection. Some of the inventors and entrepreneurs like Trevor Baylis (the inventor of clock – work radio) believe that their intellectual property (IP) is being stolen and the government and the courts fail to offer sufficient protection. If someone steals from you, that person is probably going to the jail, but if someone were to steal your IP, he might just be a civil case and that's if a victim can afford paying a lot of money to the lawyer. Even with a patent, copyright or trademark in place, IP theft is still very common. Gill Grassie, head of IP and technology at Maclay Murray & Spence says: "In the area of patents, it is more debatable whether the infringement should be a criminal offence as often there may be arguments regarding the validity of the patent or indeed whether there truly has been infringement in the first place." At least in UK, the Intellectual Property Office has shown no plans of making patent infringement into a criminal offence and it leads to immediate effects because in this case inventor is not getting a real recognition. Another inventor Baylis believes that the most important thing the nation has is knowledge and creativity and we should make society realize that (Greenhalgh, 2010). The studies done in China and mentioned before also shows the infringement cases which causes most damages to specific patent holders. It is shown in the table 5 below.

Table 5. Infringement cases causing most damages

Type	**Company**	**University**	**Scientific Research Institute**
Trade secret	**42,2**	3,0	**27,2**
Trademark	13,3	7,2	1,7
Patent	31,4	**52,4**	**37,3**
Copyright (book, software, movie, etc.)	0,8	**13,6**	5,0
Other IP rights (integrated circuit, new variety of plant, etc.)	1,6	5,6	7,2
Not big difference	10,8	18,1	21,6

Source: SIPO Statistics Database, September 2016.

Note: Effective number of respondents: 7468 companies, 438 universities and 459 scientific research institutions.

After exploring the area of intellectual property and possible protection methods, it is obvious that this is a dynamic area of business and innovation. The main immediate and secondary causes which creates problems concerning intellectual property have been over viewed. That evidently leads to slowing down the development of technologies and inventions. It also has a direct impact on competition and economy itself. Studies show that they have especially negative effect on small companies and separate researchers. It also creates ideas leakage and patents being stolen.

The operation of trademark law throughout the European Union is still controversial, as is the area of patents. Some industries, like pharmaceutical is getting ready for significant changes. Patent system is considered as a valuable source of technological knowledge and it is used by many companies. However, it also has some fierce critics, mainly because of the long and pricy process of patenting and even bigger expenses in case of infringement and its defense.

As the field is very wide improvement process of the intellectual property protection methods' takes effective time to obtain a free work flow. To acquire results, I will be using empirical method, communication with local patent attorney offices and the State Patent Bureau

of the Republic of Lithuania as well as official websites of World Intellectual Property Office (WIPO), European Patent Office (EPO). After, acquired data and changes will be documented, analyzed and used in future for further improvements.

2.3. Analysis of other authors suggested solutions (strengths and weaknesses)

At this stage when the problem is clearly defined, many sources and different authors, who are working on these problems, will be analyzed. Important articles, documents and information are being placed in two main websites. First is World Intellectual Property Organization (WIPO) and another is European Patent Office (EPO).

One of the solutions which is already in progress is creating Unitary Patent Protection (UPP) & Unified Patent Court (UPC). The aim of the reform is to offer business an alternative by simplifying the existing system and support a cost-effective route to patent protection and dispute settlement. With this being introduced there will still be possibility to use old patent system meaning that in the future there should be three routes to patent protection in Europe. Shown in the Figure 3.

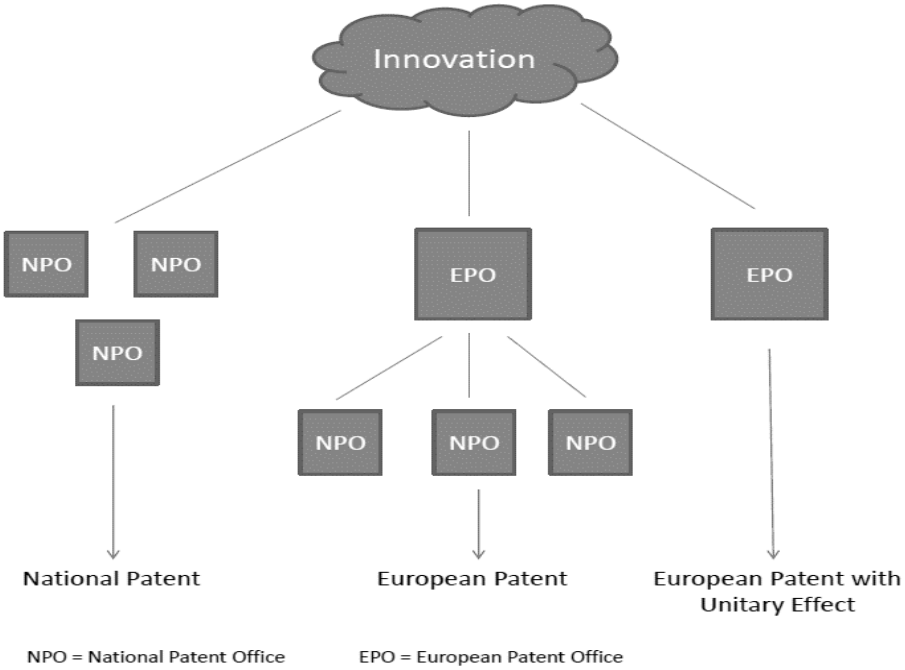

Figure 3. Routes of possible patent protection

Source: EPO, "An Enhanced European Patent System"

UPP has many advantages:

- It will be possible to get unitary effect for a European patent by one request.
- Validation process is much shorter.
- Just 2 translations are necessary (Article 14 (6) EPC).
- There will be a compensation for translation cost according to regulation (EU) No 1260/ 2012.
- Just one annual renewal fee which will be decided by EPC and it will have to follow the principles of reg. (EU) 1257/ 2012.
- Faster and cheaper hearing in UPC.
- It will be valid for 26 participating member states.

It is important to know that renewal fees will be set, taking into account, the situation of specific entities such as small and medium – sized enterprises, with the aim of facilitating innovation and fostering the competitiveness of European business. It should also reflect the size of the market covered by the patent, the renewal rate of current European patents and the number of requests for unitary effect. The process of UPP is shown in the figure below (Fig. 4).

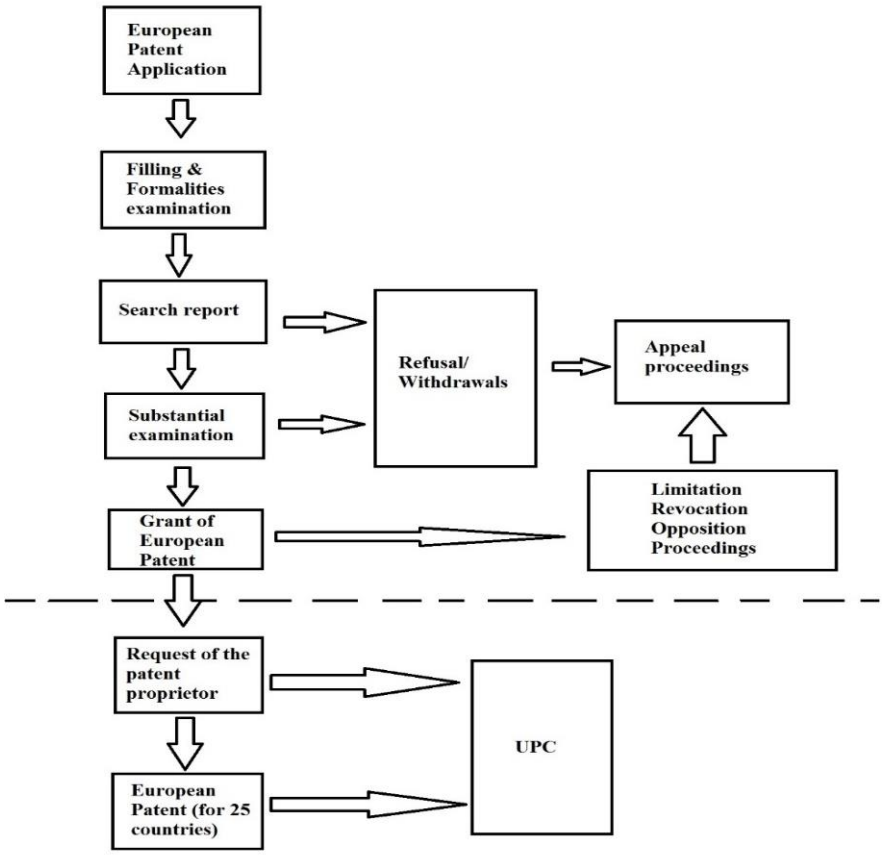

Figure 4. The process of UPP

Source: EPO, "An Enhanced European Patent System"

For UPP to work it is necessary to have a unified patent jurisdiction covering all the Contracting Member States that have ratified the agreement. So The Unified Patent Court (UPC) is being established. It will consist of a Court of First Instance, a Court of Appeal and a Registry. The scheme of it is shown in the figure below (Fig. 5).

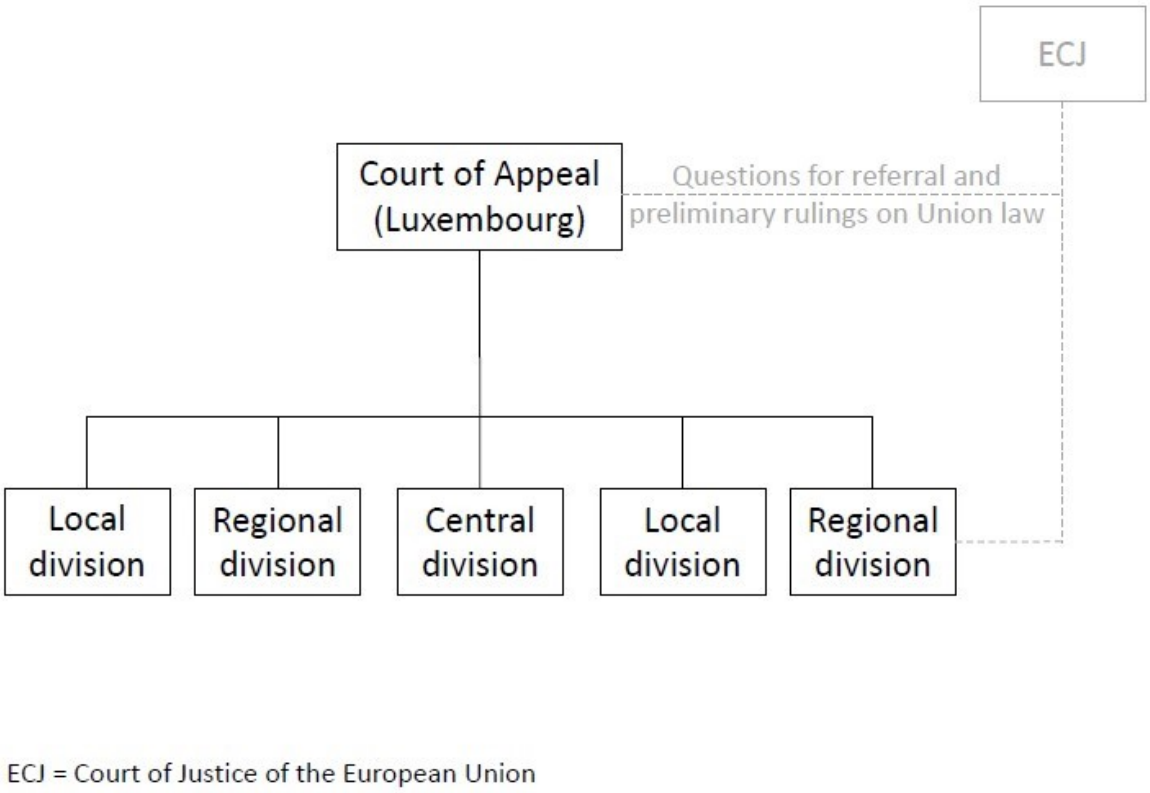

Figure 5. Structure of the Unified Patent Court

Source: EPO, "Unitary Patent and Unified Patent Court: State of Play"

Another source is "FT.com" where Greenhalgh, H. wrote an article about theft of intellectual property and whether it should be a crime. This issue is one of the few immediate effects which is caused by poor IP protection.

By some of the inventors and entrepreneurs it is believed that their intellectual property (IP) is being stolen and the government as well as the courts fail to offer adequate protection. It is believed that the ruling is not adequate, for example if someone steals from you, that person is probably going to the jail, but if someone were to steal your IP, it might just be a civil case and that's if a victim can afford paying a lot of money to the lawyer. Even with a patent, copyright or trademark in place, IP theft is still very common.

Advantages of the patent if you have your IP stolen:

- You can claim for damages since it is a civil matter. And they just have to prove the matter on the balance of probabilities, rather than beyond all reasonable doubt as in a criminal case.

Disadvantages:

- Sheer cost of registering a patent is very high for many inventors and entrepreneurs.
- The process is slow, expensive and time consuming.

And even if entrepreneur can afford these costs, protecting a patent against possible infringement can simply be prohibitive. In case you would need to go to the court regarding the infringement you have to be able to finance the case and many small companies cannot do. This is why many entrepreneurs consider the whole issue of IP as nothing more than a smokescreen.

One of the solutions of protecting your idea being leaked and gaining a trust with your colleagues is that all parties concerned on this matter would agree to sign a non – disclosure agreement. At least in UK, the Intellectual Property Office has shown no plans of making patent infringement into a criminal offence. And without this the inventor will not get a real recognition. Baylis says: "We have to make society realize that the most important thing the nation has is knowledge and creativity."

A non-disclosure agreement (NDA), sometimes called a confidentiality agreement, allows a company to share its IP with others, whose input it needs, without unduly jeopardizing that information. For example, if you have a new product or feature in development, but you need to consult an expert for advice on how to proceed, an appropriate NDA can ensure that the expert does not hand the details of your new product to a competitor of yours. It is a legal contract between you and the other party in which you agree to disclose certain information to them for a specific purpose and they agree to not disclose that information to anyone else.

Johns Hopkins University uses NDAs to preserve unfiled patent rights, trade secrets, business plans, and other confidential and proprietary information and requires them of their researchers.

There are certain cases when NDA should be used and obviously it is when inventor needs to share his information with someone and it must be ensured that important information will not be given to someone else. This might occur in situations like this:

- A prototype for a new widget or any kind of invention has been developed and before deciding if it is worth to produce it, a cost estimation from a fab shop is needed.

- A new business model has been developed which has to be presented to venture capitalists in order to receive funding, but certain protection has to be implemented so that others do not steal the idea and develop it separately.

- Specific form of sales (company's, product line's) when the buyer wants to know the details on operations. There is a concern that buyer can just use that secret information and do not go through the deal as agreed.

Another author who touches the issue of patent harmonization throughout the world is P. Trott. In his book "Innovation Management and New Product Development" he shortly talks about main similarities and differences of protecting your IP in Europe and US. One of the similarities is that a monopoly is granted for 20 years under both systems. However, there is one key difference between those two. In US the patent goes to the researcher who can prove that they were the first to invent, and in Europe the patent goes to the one who is first to file for a patent. There are more very important differences between these patent systems. In Europe, a patent is considered invalid if the inventor has published the novel information before filling the form for patent protection. In the United States there are some provisions that allows inventors to talk first and file later. Also in Europe patent applications are published while pending. This allows the chance to see what monopoly an inventor is claiming and object to the Patent office if there are grounds to contest validity. Meanwhile in US the applications remain secret until it is granted.

There is long history with an issue of patent harmonization. The Paris convention for the protection of IP was signed in 1883 and since then it has received many amendments. Right now its membership includes 114 countries. European countries have a degree of patent harmonization provided by the European Patent Convention (EPC) administrated by the European Patent Office.

US market dominance in many technology – intensive industries means that this difference in the patent system receives a great deal of attention from various industry and government departments in Europe and the United States.

Talking about legislation and European Parliament role in all this matter, it is important to know some laws. According to European Parliament IP includes all exclusive rights to intellectual creations. For many years the European Union has had an active policy in this area, aimed at harmonizing legislation between Member States. Since the entry into force of the Treaty on the Functioning of the European Union (TFEU) in 2009, the EU has had explicit competence for IPR

(Article 118). Legal basis is based on Articles 114 and 118 of the Treaty on the Functioning of the European Union (TFEU). The legislative activity of the European Union consists chiefly in harmonizing certain specific aspects of IPR through the creation of a single European system, as is the case for the Community trade mark and Community designs, and as will soon be the case for patents.

A short over view of achievements of legislative harmonization first in trademarks, designs and models is going to be displayed. On 25 February 2014 the European Parliament voted on the proposal for a regulation amending Council Regulation (EC) No 207/2009 on the Community trade mark, which sought to simplify and update national and EU trademark legislation and to make trademark registration in the EU cheaper, quicker, more reliable and more predictable, thus increasing legal certainty for holders. The proposed regulatory package includes: a recast of the Trademark Directive (2008/95/EC), aligning Member States' trademark legislation more closely; a revision of Council Regulation (EC) No 207/2009, which also contains provisions regarding the Office for Harmonization in the Internal Market; and a revision of Commission Regulation (EC) No 2869/95 on the fees payable to that Office. The draft regulation is still awaiting adoption.

Directive 98/71/EC of 13 October 1998 approximates national legislation on the legal protection of designs and models. Council Regulation (EC) No 6/2002 of 12 December 2001 (amended) institutes a Community system for the protection of designs and models. Council Decision 2006/954/EC of 18 December 2006 and Council Regulation (EC) No 1891/2006 of 18 December 2006 link the EU system for the registration of designs or models to the international registration system for industrial designs and models of the World Intellectual Property Organization (WIPO).

Now looking into achievements in patents field. A patent gives the owner the right to prevent others from making, using or selling the invention without permission. Patents encourage companies to make the necessary investment for innovation, and provide an incentive for individuals and companies to devote resources to research and development. In Europe, technical inventions can be protected either by national patents, granted by the competent national authorities, or by European patents granted centrally by the European Patent Office (EPO). The latter is the executive branch of the international organization, which now has 38 contracting states. The EU itself is not a member of the European Patent Organization.

After years of discussions among the Member States, in 2012 Parliament and the Council approved two regulations that provide the legal basis for a European patent with unitary effect (unitary patent). Through the 'unitary patent package', the EU legislature seeks to confer unitary protection and to establish a unified court in this area.

Following the Court of Justice's confirmation of the 'patent package' in its judgment of 5 May 2015 in Cases C-146/13 and C-147/13 (Spain v European Parliament and Council of the European Union concerning enhanced cooperation in the creation of unitary patent protection), the way is free for a truly European patent. The previous regime will co-exist with the new system until the Unified Patent Court (UPC), with branches in Paris, London and Munich, is established.

Once granted by the EPO, a unitary patent will provide uniform protection with equal effect in all participating countries. Businesses will have the option of protecting their inventions in all EU countries with a single unitary patent. They will also be able to challenge and defend unitary patents in a single court action through the UPC. This will streamline the system and save on translation costs. Unlike a bundle of national patents, which is what the EPO offers, a unitary patent will not require validation in each individual Member State.

While the protection of trade secrets is not always defined as an intellectual property right, the practice of keeping information confidential goes back centuries. Legal instruments to protect trade secrets, whether or not defined as part of IPR, exist in many countries. The level of protection afforded to confidential information cannot be compared to other areas of IP law such as patents, copyrights and trademarks. The protection of trade secrets varies more from country to country than other areas of IPR law, as do the approaches taken. There is a patchwork legal framework.

In 2013 the Commission presented a proposal for a directive on the protection of undisclosed know-how and business information (trade secrets) against their unlawful acquisition, use and disclosure. The first reading adopted by Parliament in April 2016 amended the Commission proposal substantially.

As differences in national systems for penalizing counterfeiting and piracy were making it difficult for Member States to combat these offences effectively, Parliament and the Council adopted Directive 2004/48/EC on the enforcement of intellectual property rights as a first step. The directive aims to step up the fight against piracy and counterfeiting by approximating national legislative systems to ensure a high, equivalent and homogeneous level of intellectual property protection in the internal market. Directive 2004/48/EC provides for measures, procedures and

compensation under civil and administrative law only. The Commission subsequently proposed that penal measures be adopted. These would supplement Directive 2004/48/EC and boost efforts at fighting counterfeiting and piracy.

Now it is important to know the role of the European Parliament on this matter. In its various resolutions on IPR, and particularly on the legal protection of databases, biotechnological inventions and copyright, Parliament has argued for the gradual harmonization of such rights. It has also opposed the patenting of parts of the human body. Parliament has similarly opposed the patenting of inventions capable of being implemented on a computer, its concerns here being to avoid obstructing the spread of innovation and to afford SMEs free access to software created by major international developers. Forthcoming challenges that can be expected include new issues relating to as yet unforeseen technological developments. An important new challenge may be that of ensuring the privacy, safety and security of software – the question arises as to whether free and open-source software is truly safer than proprietary software. On 27 February 2014 Parliament adopted a highly controversial own-initiative resolution on private copying levies (the right to make private copies of legally acquired content), as digital private copying has taken on major economic importance as a result of technological progress. Parliament has also played a very active role in the WIPO draft treaty on copyright exceptions for the visually impaired.

IPR are part of the discussions with the USA on the Transatlantic Trade and Investment Partnership (TTIP), and progress has been made in identifying the central issues to be discussed. Discussions have so far remained exploratory (i.e. without any substantive negotiations), although the USA has proposed an architecture for the text of this chapter, addressing a limited number of issues of interest to both parties.

3. STUDY OF THE EMPIRICAL RESEARCH

During this phase the purposes of research, stages and methods will be analyzed, the research extent which will be described by number of respondents will be presented and the volume of the monitoring will be prepared. Following that, necessary means for research (questionnaires, watch forms, statistical data sources list, etc.) will be prepared.

3.1. Research methodology

For this work qualitative research methodology was chosen. The human instrument applies appropriate data collection technique, complemented by tacit knowledge to the investigation. The emergent design of individual data collection techniques is based on analysis of preceding data and the identification of concepts and ideas that require further and deeper investigation.

Methods of judging value in research for qualitative methodology trying to establish trustworthiness are:

- Credibility. It is demonstrated by prolonged engagement with the research participants, persistent observation of those participants.
- Transferability. The goal is to allow for transferability of the findings rather than wholesale generalization of those findings. If sufficient similarities between the two contexts are identified then it is reasonable to apply the findings to the new context.
- Dependability. It is concerned with the way the study is conducted, evidence must be provided that demonstrates that the methods and techniques used were applied appropriately and with relevance to study.
- Confirmability. It is vital to limit investigators bias. The goal is to ensure that the results, accepted as the subjective knowledge of the researcher can be traced back to the raw data of the research.

The previously mentioned key elements are very important during the whole process of the experiment and should be considered while analyzing the results of the carried-out survey. Each of them brings something different to the final work.

3.2. Survey

As for research methods, the survey is going to be used. The purpose of survey research is to gather and analyze information by questioning individuals, to study relationships between specific variables, which are identified at the outset of the research.

Data collection techniques suggests a way of collecting empirical data. A single research design may include one or more data collection techniques. Data collection and data analysis often go hand to hand. One of the techniques is interview with the purpose to access what was in, and on, the interviewee's mind. It is usually used when we are seeking qualitative, descriptive, in depth

data that is specific to the individual and when the nature of the data is too complicated to be asked and answered easily. Other possible techniques – questionnaires, observation, diaries, focus groups, etc.

Surveys are done using instruments such as a questionnaire which are used to measure the opinions of specific events or an interview. Both instruments are based on a series of questions. The main differences between these two instruments are that questionnaires rely on written questions and can be administrated to a more numerous population. And interviews can be carried put face to face or also in a written manner.

In this research, specifically questionnaire-based survey will be used and sent to the chosen participants via email or other communication platforms. Questionnaires provide a relatively cheap (in many cases free), quick and efficient way of obtaining large amounts of information from a large sample of people. Data can be collected relatively quickly because the researcher would not need to be present when the questionnaires were completed. This is useful for large populations when interviews would be impractical. It can be an effective mean of measuring the behavior, attitudes, preferences, opinions and intentions.

One thing should be considered though, which is response rate because from it depends the effectiveness of survey. The aim is to have as high as possible response rate as it represents how well the study was developed. Since response rate is very important for our research, it will be discussed more deeply later.

Often a questionnaire uses both open and closed questions to collect data. This is beneficial as it means both quantitative and qualitative data can be obtained. It is important to well decide which questions should be open and which should be closed ones. Considering that most of the people prefer closed question because it requires less time, most of my questions were formulated in the closed type where possible answers were provided. This type of questions can also provide ordinal data (which can be ranked). This often involves using a rating scale to measure the strength of an attitudes or emotions.

Even though there is probability that not all participants will fill the questionnaire, the expected result is around 60 – 70 percent to get sufficient results.

3.3. Response rate of web surveys

After completing the survey development and distribution, it is important to check what is the response rate of your survey. This rate states the percentage of people who answered your survey and if the number is low, it means you should change or improve the survey. In general, you can expect a low response rate if your survey is long, language is complicated, or you send your survey to the wrong audience. But there are many factors and ways which we can use to improve the positive response of our respondents (Nulty, 2008).

- Check your survey design and format.

The length and tone of your survey dramatically impact your response rate. If survey is long and your questions are text heavy, respondents can feel overwhelmed and exit your survey. So, the survey should not be too long or heavy as well as the language should be simple and understandable. Use the fewest, shortest words possible to say what you mean. One of the key points is to let respondents skip some of open-ended questions, because if not, some of respondents who do not want to take the time to write a response might exit the survey instead of writing a response. The layout of the survey should be considered as well. It is important to make it look easy and not to put too many questions. There was a survey conducted by Vovici, a survey software company, about abandonment rate which showed a direct correlation between number of questions and survey abandonment. The results of survey are shown in Figure 6 below.

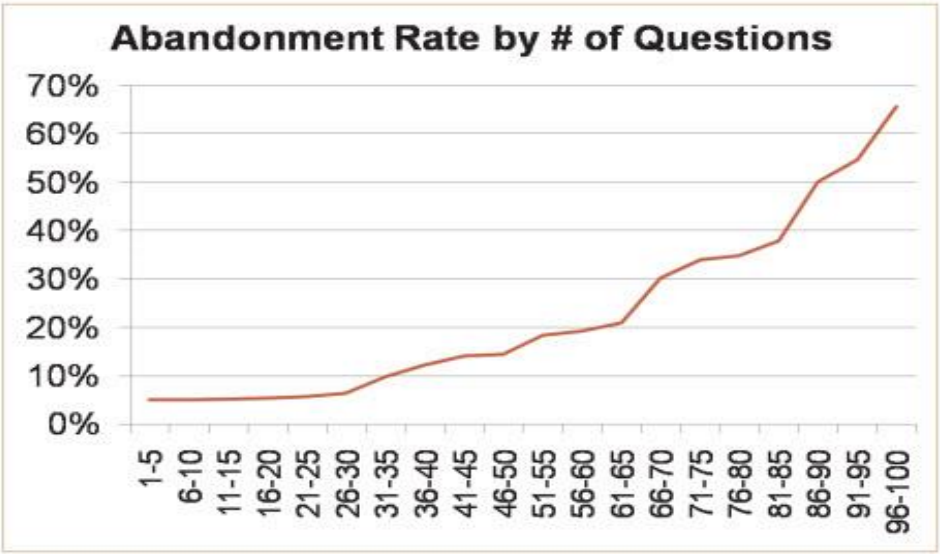

Figure 6. Correlation between number of questions and survey abandonment

Source: vovici.net

- Identify your audience.

Survey topics may not engage or interest all respondents, which causes respondents to exit the survey and lowers the response rate. Some qualifying question should be added to the survey to ensure that the correct respondents are being attracted. Targeting strategies should be used in order to reach the right audience for whom the topic is more relevant.

- Pre- notice.

Let respondents know that you're planning to conduct a survey, what it's about, when to expect it and the importance of it.

- Use multiple ways of distributing the survey.

If you use more than one collector to distribute your survey, you'll increase your chances of getting responses. In addition to emailing a list of contacts, consider posting a link to your survey in a Facebook, LinkedIn, or other web communities. The methods are shown in the Figure 7 below.

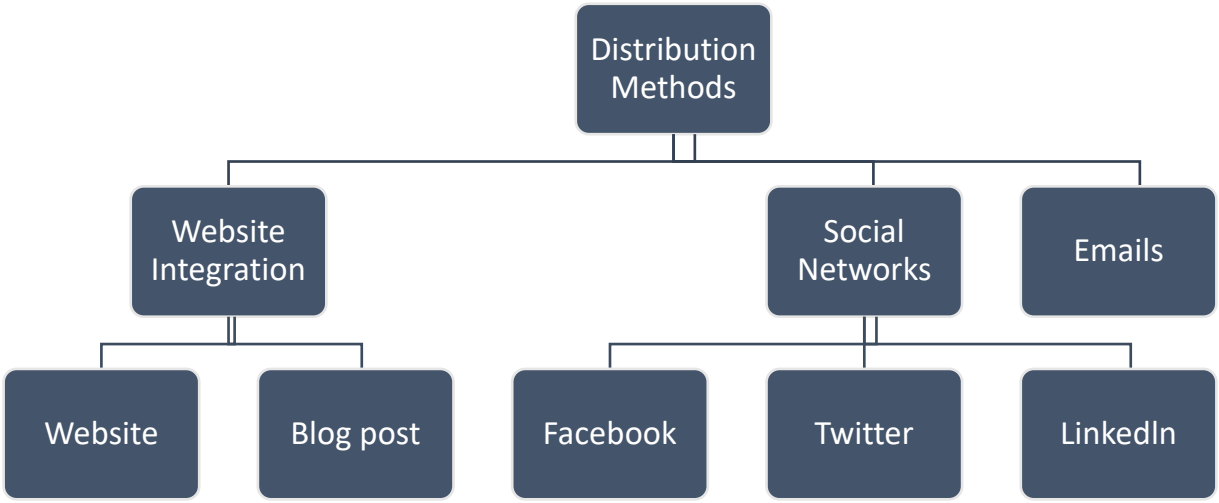

Figure 7. Web survey distribution methods

Note: created by author

- First impression.

To increase the probability of respondent filling the survey, it is important to represent yourself and the survey well. It is strongly recommended to insert a cover/ invitation letter explaining the depth and purpose of the survey as well as the length of how long it will take to

finish it. It also seems more trustworthy if you offer to provide a copy of results if respondent is interested.

Considering all these fact, the survey was sent with an explanatory/ cover letter representing the content and importance of it. Knowing that abandonment rate is higher when there are more questions, I tried to keep it as short as possible. As mentioned before, it consists of 19 questions which means that abandonment rate should be less than 10%. As for ethical reasons, to re assure the participant, each and every one was anonymous as well as they were informed that the results can be shared with them if there was a need or desire.

3.4. Phases of survey

To carry out a survey, there are 6 well known stages which should be followed and important advices should be known. For my research I am applying them as well.

1) **Needs analysis/ objective of the issue**

The objective for this survey is to know the current status of the industrial intellectual property methods and to find out if there is a need for analysis and improvements. Moreover, it is important to state how the survey will contribute to finding possible solutions which could be implemented.

2) **Questionnaire development**

In this stage it is important to clarify all words used, so that all participants would understand it. Select best data scales and very importantly to make a reasonable number of questions which will also increase the response rates. In my case there are 19 questions which includes some general ones and others more specific concerning current situation and possible solutions for improvements.

3) **Survey distribution**

It is important how you distribute your survey because it influences the rate and speed of response. For distribution of this survey web forms, more specifically – Google® forms are going to be used because it allows it to do it more faster and spread the survey around different countries.

4) **Data collection**

The expectations of response rates are around 70%. For data collection, as mentioned before, Google® Forms platform will be used for later analysis.

5) **Reporting and analysis of results**

All information obtained will be analyzed using software, in order to get more descriptive results. Also, it is possible to analyze it by crunching the data in tables or graphs, as well as breaking down results.

6) Recommendations and solutions

At this stage you should look back to stage one, making the decision or determining whether solutions and changes should be made. If yes, findings will be used to develop new solutions, refresh existing services and develop new activities if needed for enhancing the quality of protection methods.

3.5. Analysis of empirical research

After analyzing authors who work on IP protection methods' improvements, advantages and disadvantages of protection methods alternatives have been highlighted. Then the survey has been chosen to be carried out, possible questions for it with the extent of research of 70 people were created, response rate was 54 %. Main questions and answers are going to be overlooked below. First part of questionnaire contained general questions. As for age of participant it was mostly young people between ages of 21 and 31 and how it distributed is shown in Figure 8.

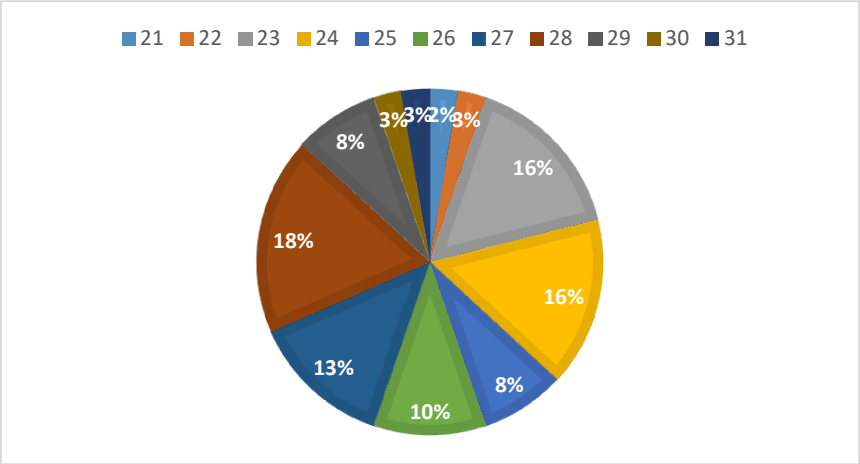

Figure 8. Age of survey 's participants

The gender distribution was equal for men and women which means that this topic concerns both genders equally and involvement is very similar. Unsurprisingly, all the participants have acquired higher education. More than 63% of people interviewed claimed to have post – graduate qualification, almost 16% belongs to undergraduate category and around 22% have

professional background as seen in Figure 9. That signifies that people related to the topic of this work and issues are well educated in general.

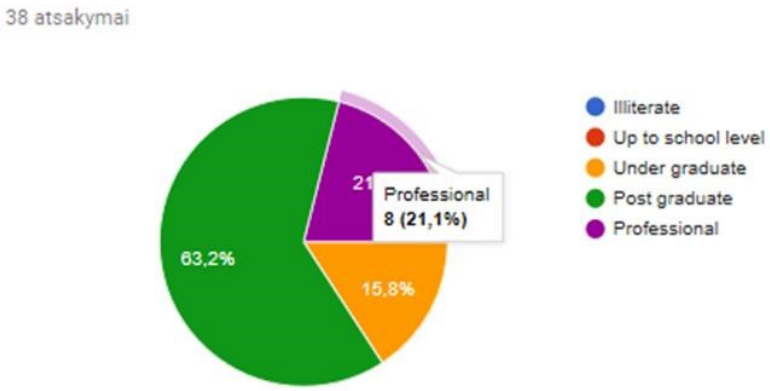

Figure 9. Educational qualification

Since the survey was distributed to many different people, the country where they work and create also differentiate. It is summed up in the Figure 10 and the majority of participants, around 63%, are located in Lithuania.

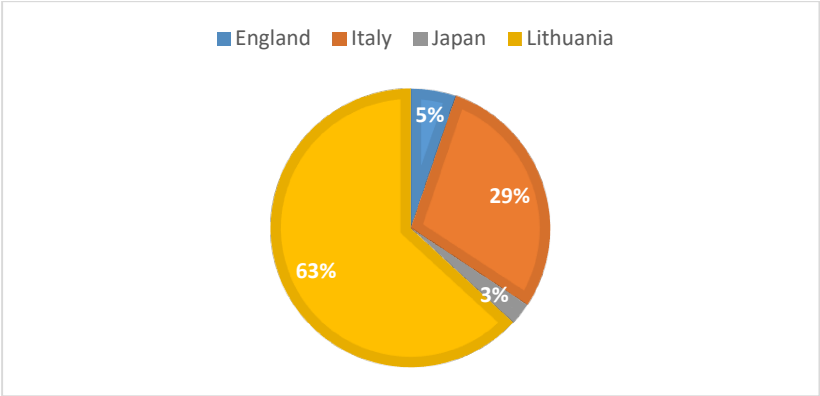

Figure 10. Distribution of countries, where participants work

Later it was very interesting and important to know what business/ field interviewed people represent. It includes: agriculture, engineering, innovation management, food technology, food and safety, industrial engineering, insurance, management engineering, manufacturing and mechanical engineering, physics, production of medical equipment, architecture, mechatronics and robotics, production management and so on. It is shown in Figure 11. It is also important to highlight that some of interviewee do not work on innovation at the moment.

and robotics, production management and so on. It is shown in Figure 11. It is also important to highlight that some of interviewee do not work on innovation at the moment.

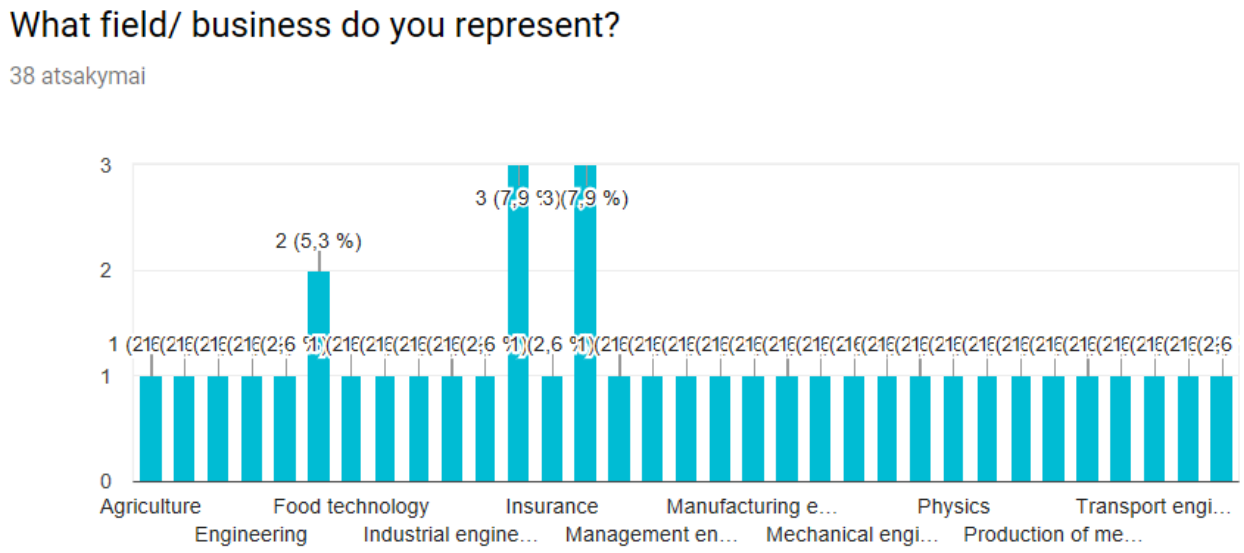

Figure 11. Business/ Field representation

From Figure 12 below it is known that bigger part of participants, almost 50% work is small – medium size enterprise or as individuals, which is good for the research since I focus more on SMEs on my research, due to the fact that they face more difficulties. There was only small part of participants who work as an individual inventor, nonetheless their opinion is very important too.

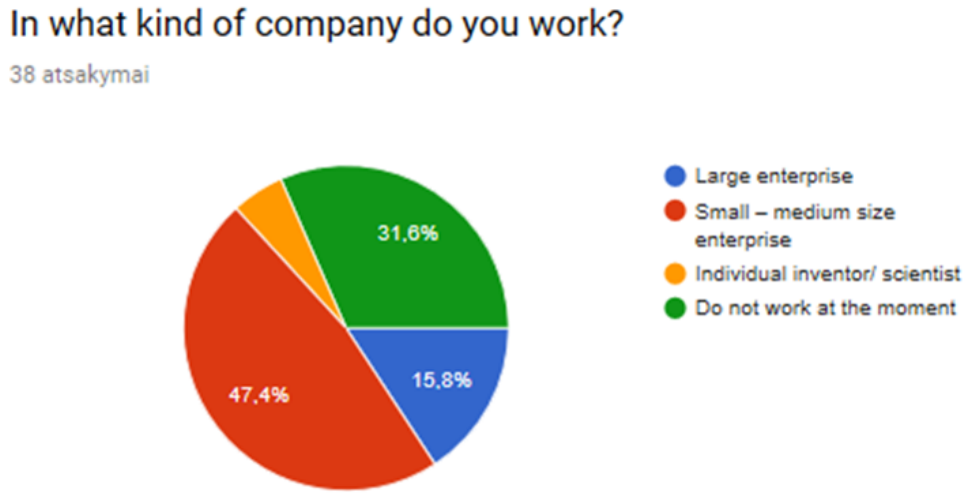

Figure 12. Type of company participants work in

Second part of survey was related to current situation of industrial intellectual property protection methods. First question was focused to get to know whether participants are familiar with Intellectual Property Protection methods. The majority of almost 82% of the people answered positively as seen in Figure 13. It means that more deep and sophisticated questions can be asked.

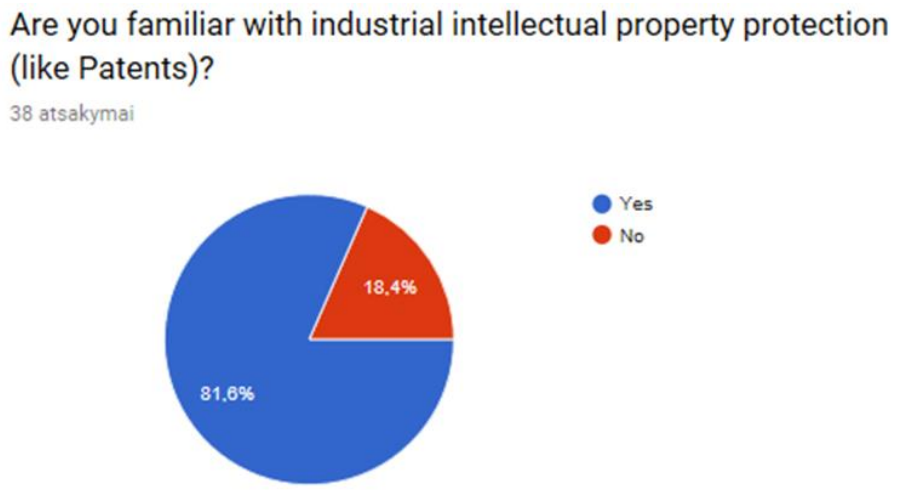

Figure 13. Participants familiarity with IP protection

The following question was made to find out if participants plan to use or already use IP protection. Around 80 percent of participants gave a positive answer which leads to understanding that this topic is relevant or might be in the future (shown in the Figure 14). Knowing this, the further investigation of the issues and possible solutions can be considered.

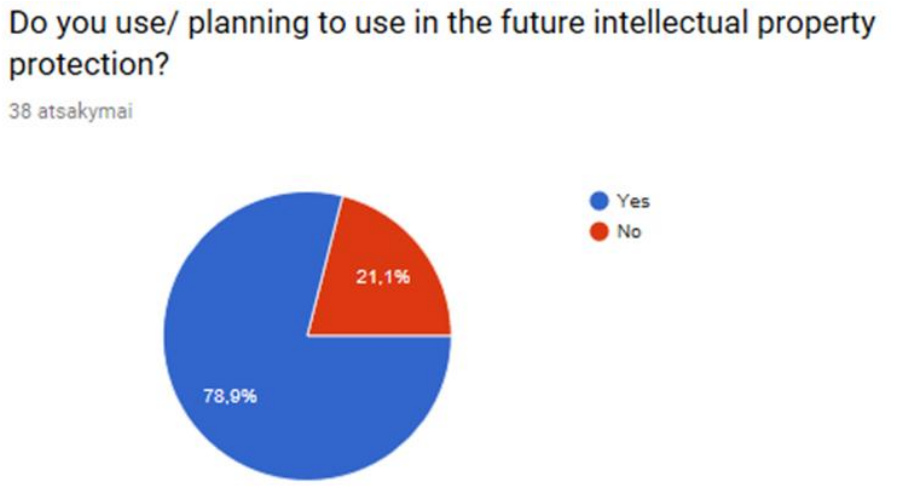

Figure 14. Usability of IP Protection methods

According to Figure 15, most of participants said that they use or planning to use intellectual protection methods in the country they live (majority is from Lithuania and Italy) or in Europe, meaning that it is most important to focus on legal aspects of it and methodology and procedures used in Europe. And even though these legal aspects extend to the issues of patents and other protection methods' lack of harmonization, due to the fact that bigger part of interviewed participants are more likely to use it only in Europe, this problem will not be touched anymore.

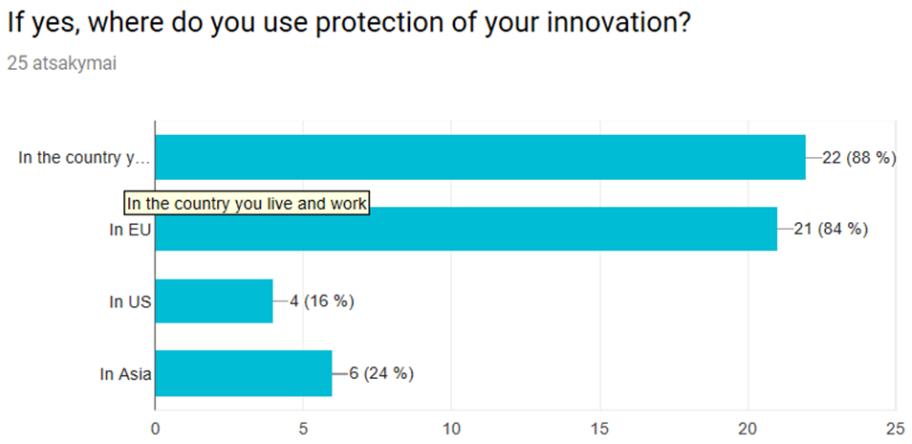

Figure 15. Protection of innovation usage

After analyzing Figure 16, it can be concluded that the most recognized and known protection method is still Patents. Gladly, alternative strategies were also known as they can be quite useful in some situations as it has been presented during theoretical research.

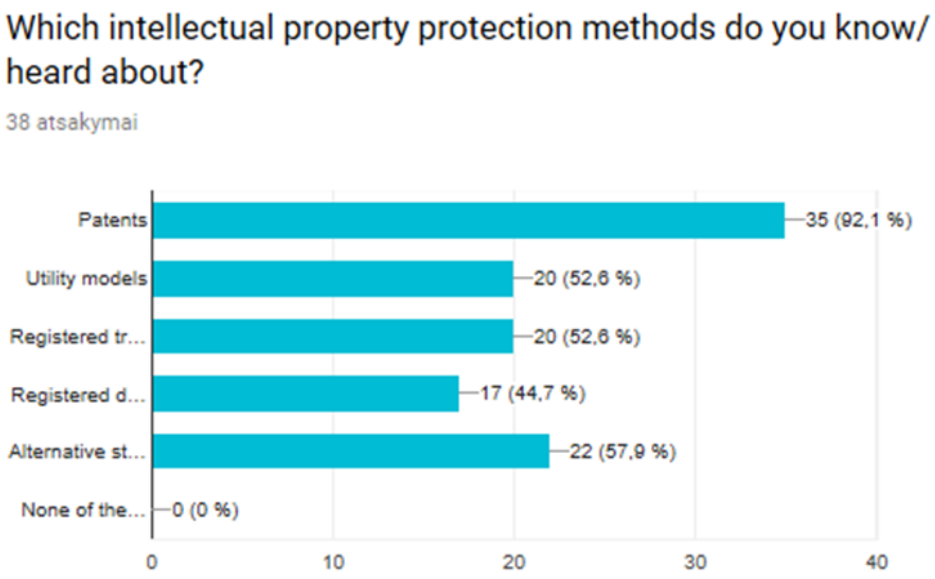

Figure 16. Knowledge of IP methods

For my project, it was very important to establish what patents and other protection methods means to participants and how they see it. In the Figure 18 below there are few sentences stated and participants were able to choose up to 3 options which, in their opinion best represents forms of protection. The top 3 ideas were:

- „It helps to protect your idea from being leaked “;
- „Patents can be easily stolen “;
- „Does not provide adequate protection for creators “.

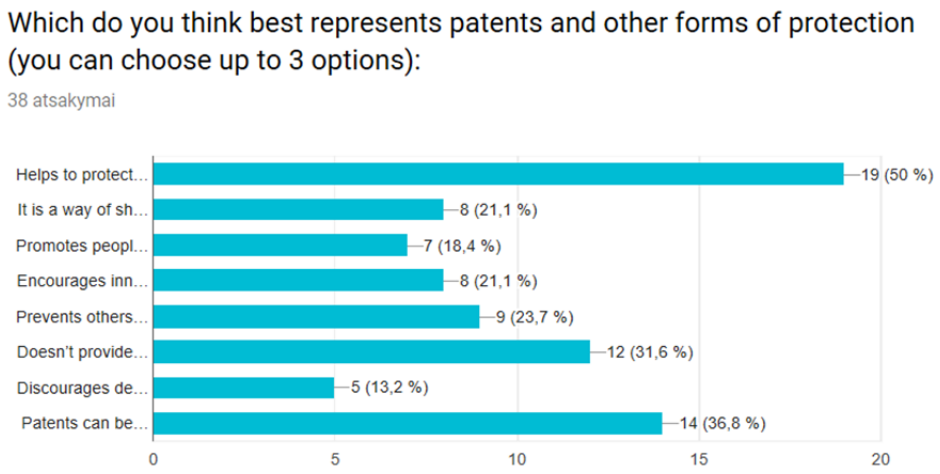

Figure 17. Representation of patents and other forms of protection

In the Figure 18 there are some of criteria which participants had to rate. From this it can be highlighted that the most important criteria while choosing protection methods were quality and speed. Price was relatively important too. And considering the facts about the process which are known from the theoretical analysis, it is understandable why these are the main criteria.

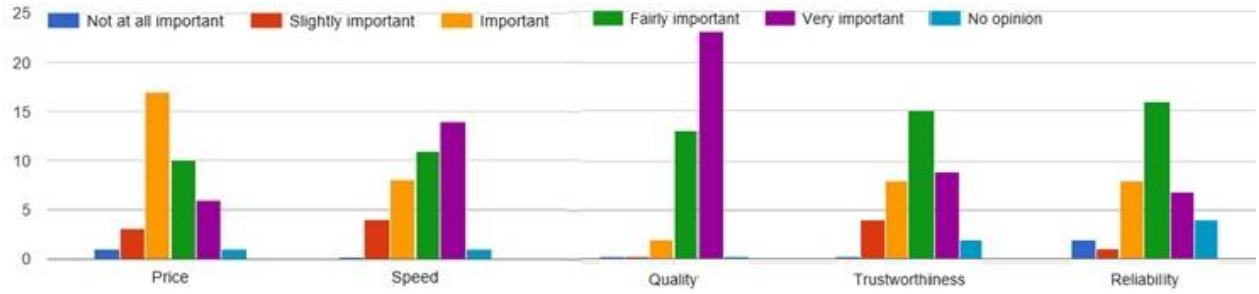

Figure 18. Criteria importance while choosing protection method

The participants were also asked about the role of their government towards IP protection in their country (shown in Figure 19). More than half of participants were unaware of its role,

meaning that people need to be more informed and educated about it. Other part of participants had answered negatively and for those reasons it could be assumed that government should be more involved and show more interest as well.

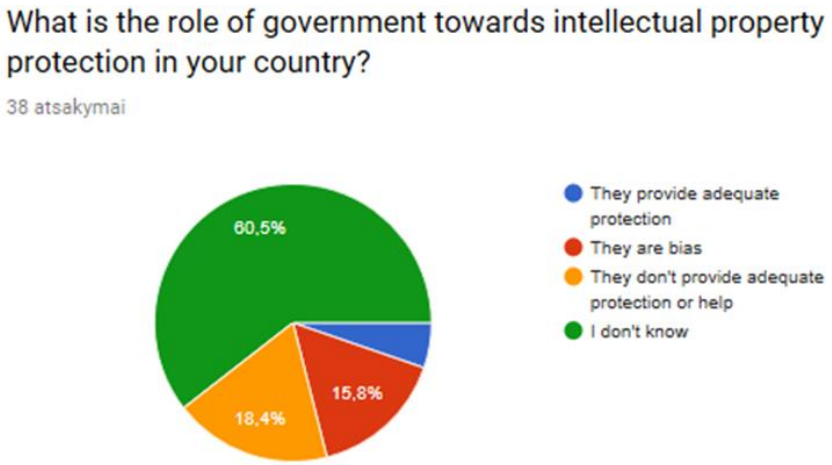

Figure 19. Government role towards IP protection

For making some conclusions later, one of the goals was to find out what in participants opinion are the bottleneck of existing methods. In the Figure 20 there are few of them, and most likely the most important are „Time consuming and slow process “, „Expensive process “. This again was not very surprising because from literature review these weaknesses could have been stressed already.

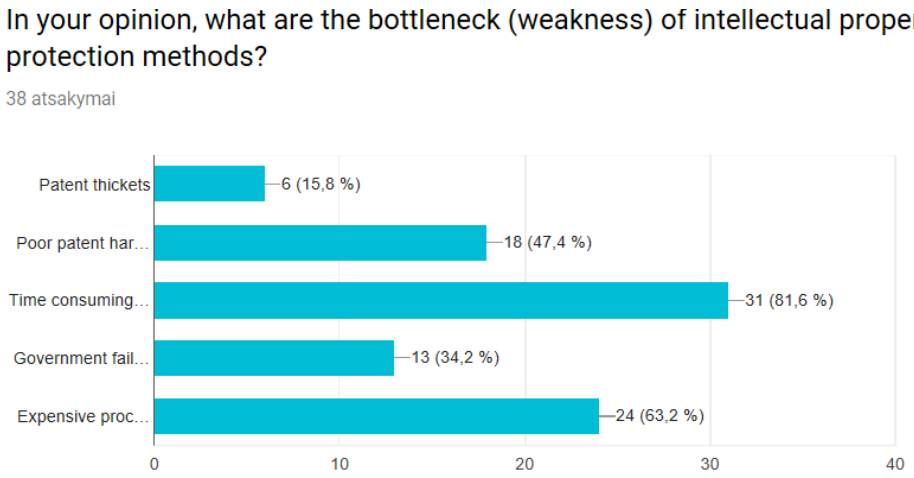

Figure 20. Bottleneck of intellectual property protection methods

Third part was focused only on Intellectual Property Protection methods’ improvements. For many reasons which were discussed before, most of the participants which is almost 80

percent, believe that intellectual property protection methods need improvements in the future (Figure 21). None of the participants gave negative answer, but small part of them were not sure about this statement. That could be due to the fact that not all of the participants have dealt with this issue in the past as known from previous survey's questions.

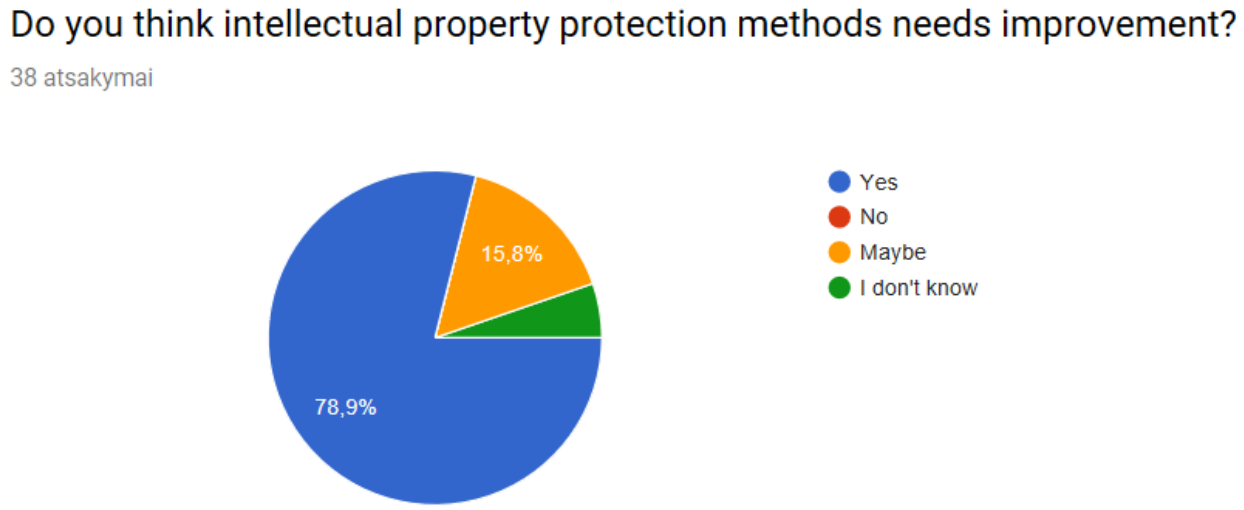

Figure 21. Need of IP protection methods'improvement

After analyzing and going through main questions, it is now possible to provide possible suggestions which will be useful for modelling and designing solution. Looking back at the carried-out survey, the last question should be considered one of the most important. In that question there were few possible solutions provided for improvement regarding different problems and aspects. Participant evaluated all of them in the scale saying which of them, in their opinion, would be most helpful and which would be least helpful (Figure 22). In this closed question the options were:

- Reducing the time required to acquire a protection for your innovation/ idea/ product;
- Promoting knowledge management in the companies/ society;
- Removing or reducing the gap between differences of intellectual property laws enforcement throughout EU and US;
- Changing the approach of companies which only use patents to block/ prevent other technologies and inventions;
- Making patent infringement (theft) into a criminal offence instead of just civil case;
- Cutting the cost of intellectual property protection methods or making a reasonable paying plan to help inventors, especially in case of infringement case;

- Creating a unified application processing system for all patent offices (instead of waiting for applicant to file a separate request for examination, the application should be proceeded to examination stage automatically in all offices unless applicant withdraw it);
- Establishing a separate national office or providing a separate service which would help patent holder in case he needs financial help or legal consultation while protecting his innovation (specially in courts in case of theft and ideas leakage).

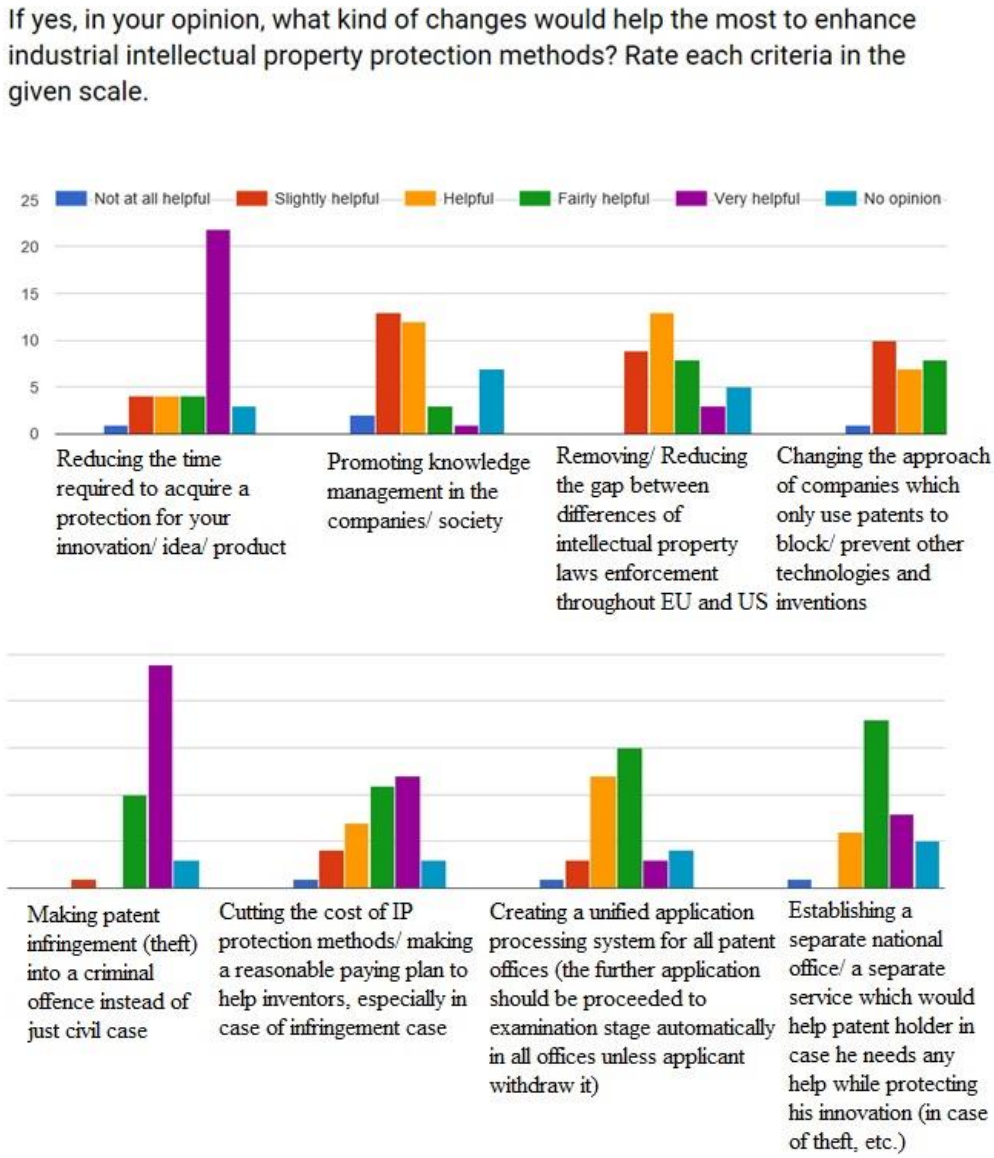

Figure 22. Changes which would help enhance methods of intellectual property protection

First of the options, which participant thought would be most helpful was about patent infringement. They agreed that in case of patent theft it should be a criminal offense and not a civil

case. The theft of idea/ innovation/ patent should be considered equally as a theft of physical goods (car, phone, money). This change could lead to great improvements in the future, but to prepare the plan and implement would be extremely hard, because many changes in laws should be made.

Another suggestion was to reduce time which is needed to acquire a protection for your idea/ innovation/ product. It is important for innovators because, for example patenting process may take up to 4 years and by then, the innovation might actually be irrelevant. Reducing time is closely related to another idea mentioned in the survey, which is "Creating a unified application processing system for all patent offices (instead of waiting for applicant to file a separate request for examination, the application should be proceeded to examination stage automatically in all offices unless applicant withdraw it)". It is one of the ways to reduce time and at the same time to reduce work load for workers in patent offices.

One more, helpful suggestions was to establish a separate entity/ service/ office which would help patent holder in case he needs financial help or legal consultation while protecting his innovation (especially in courts in case of theft and ideas leakage). This would most likely stimulate the development and innovators to continue to create because they would get recognition and courage to protect his intellectual property in court. Depending on the needs, it could be established in every Europe country or just in the most important countries concerning patenting.

After finalizing with survey and its results, some possible solutions were stressed out. The following step of this work is designing solution.

4. METHODOLOGY FOR DESIGNING SOLUTION

At this stage methodology for designing solution has to be prepared. The focus was to find the biggest bottleneck which influences used methods the most and which improvements would be considered most helpful.

The way the survey was designed should help to find out the performance gap between current and desired performance. After data collection and investigation, there will be improvements on the existing model of protection method. For this task, techniques like IDEF0 and BPMN will be used. These are qualitative analysis techniques for modelling business processes before (AS-IS) and after changes (TO-BE), making it easy to compare and make conclusions. These techniques are supported by software like Microsoft Visio and Bizagi. All

modelling possibilities are shown in the Figure 23. In each of them, process is represented through graphical notations as well as with explanatory text.

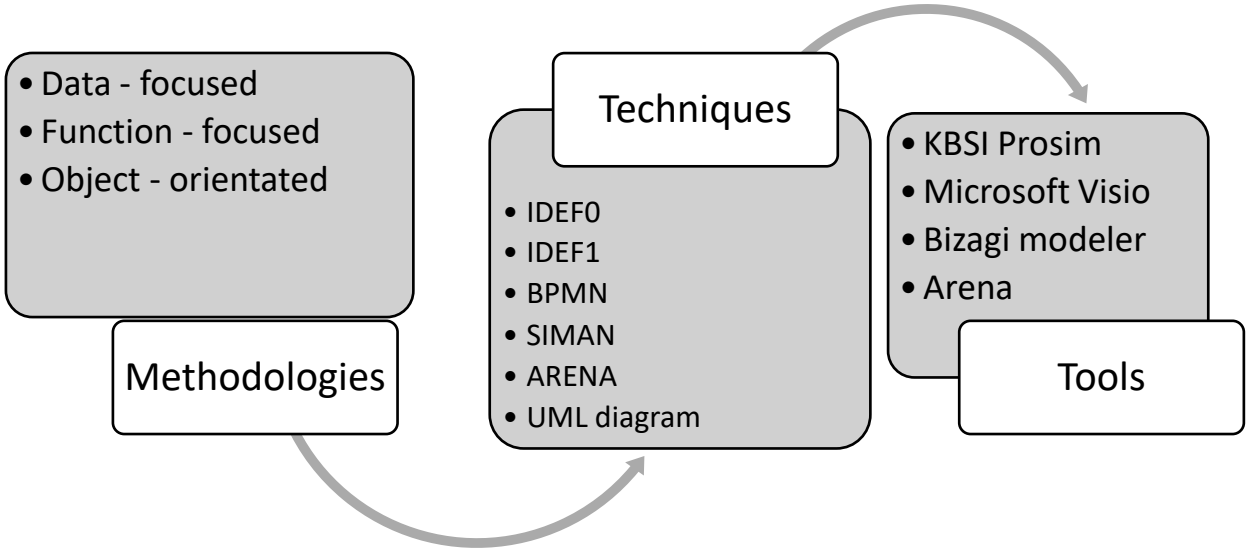

Figure 23. Process modelling steps

Note: created by author

After modelling, the next step will be to prepare an implementation method and suggestions. This step is very important and therefore should be well asserted. For that existing implementation techniques should be analyzed and used properly.

5. DESIGNING SOLUTION

At this phase “Management of Application and Issue of the Patent” process is going to be modelled. First step is to start with an existing model (called “AS-IS”) and then continue with an improved model (“TO-BE”). It will be done using two modelling techniques – IDEF-0 and BMPN known as a Business Process Modelling Notation. The difference between these two are that IDEF-0 modelling technique graphically represents "what" does a process through the conduct of its activities meanwhile BPMN modelling technique shows "How" these tasks are performed.

5.1. "Management of Application and Issue of the Patent" modelling (AS – IS)

While modelling with IDEF-0 technique, first step is to identify: context, purpose and point of view.

1) Context: Management of Application and Issue of the Patent.
2) Aim: to analyze the process and clarify the hierarchy among the tasks, in order to identify which steps of the process are the more critical (unnecessary) and how to change it.
3) Point of view: Patent applicant.

It was chosen the perspective of patent applicant to develop a model because it is a central figure in the process being analyzed, as it relates to all processes mentioned. This allows me to have a more objective vision of the entire process.

Once defined context, purpose and viewpoint, development of the context Diagram(A-0) (Figure 24) has been started. This, separating the problem being analyzed from the neighboring environment, automatically defines the context. The inputs are the actual request for patent by the applicant and the paper forms that during the process will be used to. The resources needed to carry out the process are the human resources (including Patent Office workers, examiners, Agent or Lawyer) and the supporting devices as phones, scanners, printers and computers.

As for restrictions, the diagram shows how the process is subject to the legal regulations, time and budget. Another constraint is the type of patent and application, because different type may require different documentation and way of doing it. First, according to the patent validation countries, patent's application might be National, Regional and International. It also depends on the product being patented, for example you can request for utility plant, plant patents and design patents. Finally, the output is the real issue of the patent.

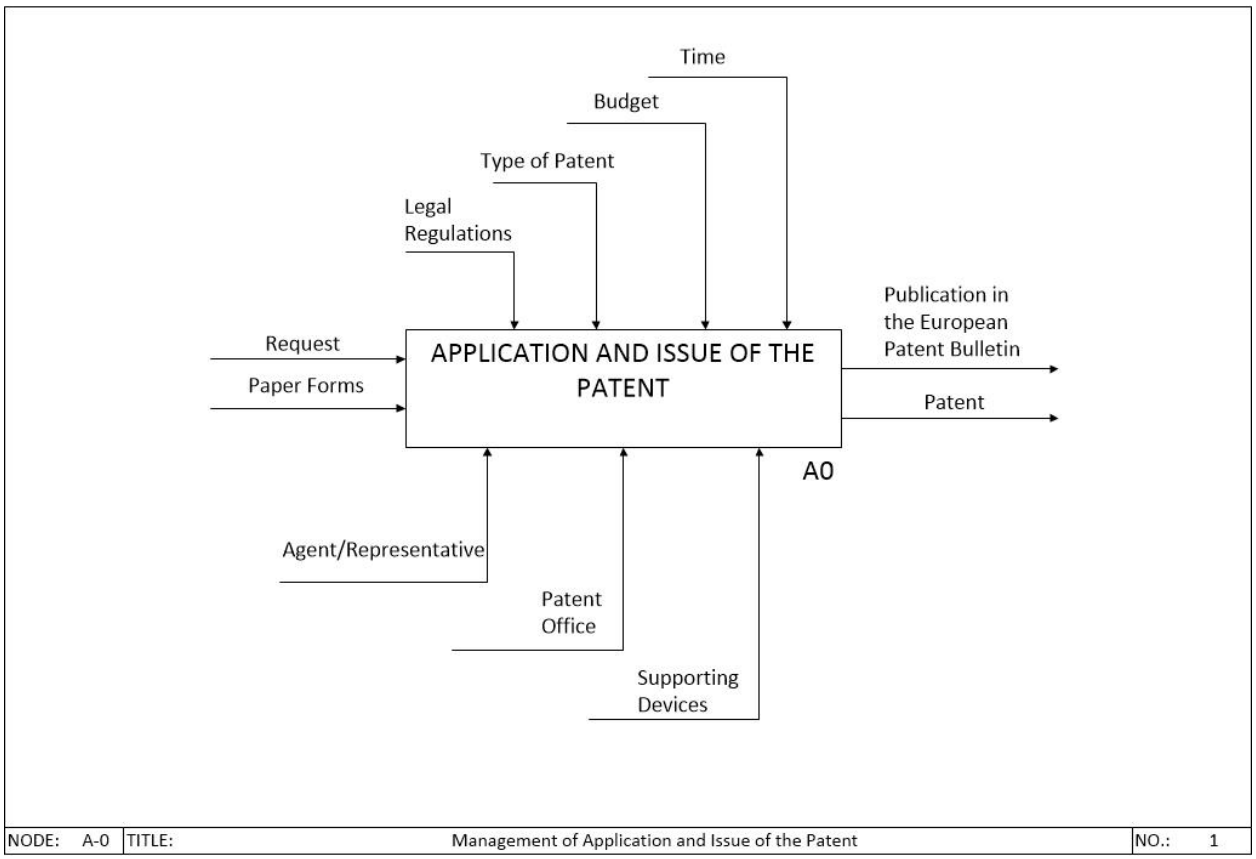

Figure 24. Diagram A-0, Management of Application and Issue of the Patent (AS-IS)

Note: created by author

Proceeding to the decomposition of the context diagram you see 3 main activities (Diagram A0) (Figure 25):

1. **Preparation of Patent Application.**

This activity is mostly influenced by such constraints as type of patent and standards. During this step the most needed resources are agent or representative and supporting devices. It is clear, that during this step working together with the agent, the patent applicant must do a thorough research, prepare all documentation which includes a request for a patent, details of the applicant, a description of the invention, claims, drawings, an abstract. The output is final and full application.

2. **Application Filing.**

This activity starts after application is submitted by applicant and his agent. The constraints are time, budget and legal regulations. This activity is further decomposed into four subtasks

(Diagram A2) (Figure 26). First is Submission of the signed documents and payment of application fee. After that, the application is given a filing date - also known as your priority date. After filing there is an examination for filling and formalities to ensure that your documentation is correct and complete. At any time in the next 12 months applicant can file for patent protection in other countries and have those later filings treated as if they had been filed on your priority date. In practice, this gives you a year to decide how many countries you wish to include in your patent protection. After this subtask, if there is no need for corrections they continue to "Search of patents". The output of this subtask is a search report which is sent to you. It includes listing, copies of all prior art documents found by an experienced examiner and regarded as relevant to your invention. The search is based mainly on your claims for novelty, but your description and any drawings will also be taken into account. The report will often include an initial opinion on the patentability of your invention. Next and final subtask of this activity is "Publication in database". The application is published 18 months after the filing date. The invention will appear in databases accessible to other people around the world. It will act as prior art against any future patent applications from other inventors or companies for similar inventions.

3. Prosecution.

This activity consists of six subtasks (Diagram A3) (Figure 27). The applicant has six further months to make two decisions. First is to decide which countries to include ('designate') in patent protection which is followed by designation fees payment. And another important decision is whether to continue with application. In this case applicant must request a more thorough ('substantive') examination and confirm application. If request of substantive examination is made, the Examining Division of Patent Office has to decide whether invention and application meet the requirements of the European Patent Convention. For maximum objectivity there are usually three examiners, one of whom maintains contact with your agent (patent attorney). This stage will often involve dialogue between the examiners and patent attorney, which may result in the re-drafting of key parts of application. Patent attorney will defend your application, and this is one more reason why it is essential to have professional representation. Later, corrections may be done if needed. After the patent is granted and applicant must pay all the fees and file claims translations. The output of this subtask is the final output which are publication in European Patent Bulletin and issued patent. The decision to grant takes effect on the date of publication.

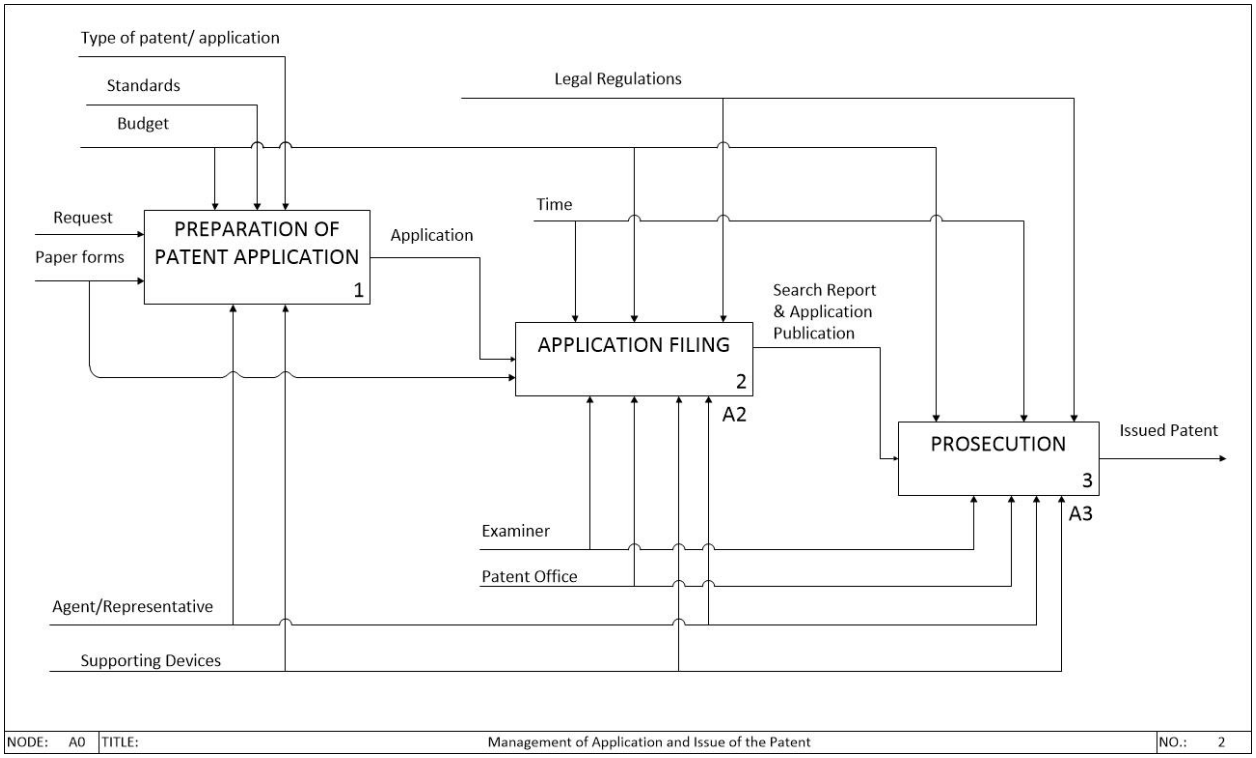

Figure 25. Diagram A0, Management of Application and Issue of the Patent (AS-IS)

Note: created by author

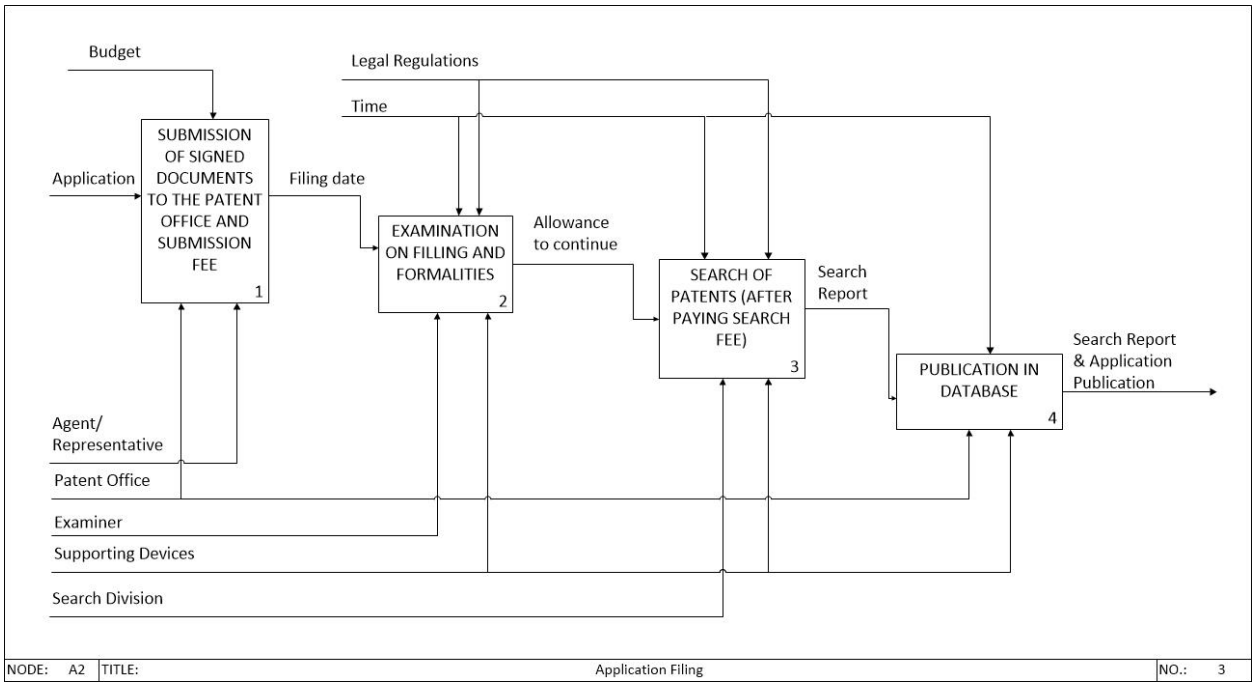

Figure 26. Diagram A-2, Application Filing (AS-IS)

Note: created by author

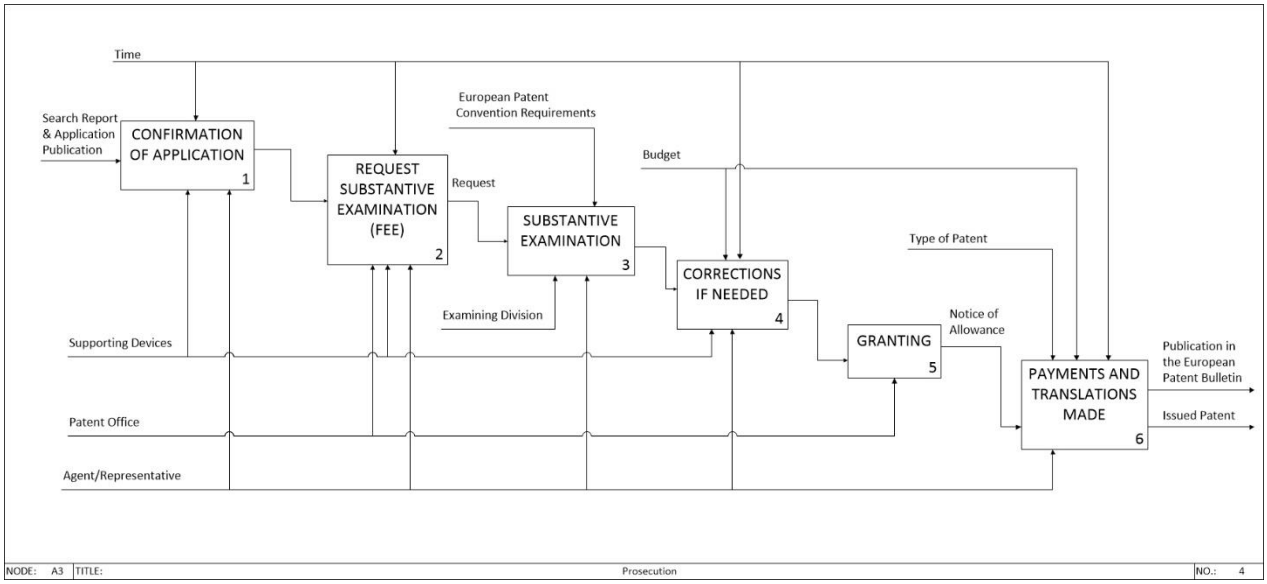

Figure 27. Diagram A3, Prosecution (AS-IS)

Note: created by author

After "Management of Application and Issue of the Patent" process has been modelled with the help of IDEF-0, I proceed with modeling using software Bizagi through BPMN to show how the process is done. First, the actors involved must be defined and presented with "pool". First pool is for patent applicant, second one – for agent/ patent attorney. Then there is a third pool Patent Office which consists of 5 lanes – one for accountant, second for committee, third for examiner, fourth – for search division and last for examining division. The whole process is shown in Annex 2.

The process starts with the need of patent by the applicant who first can acquire (if wanted) a legal help – patent attorney/ agent. It generates the start of activity. At that moment it can go two ways, first – applicant gets an attorney who takes care of all the documents, second – applicant works alone, which is highly unrecommended because many errors can occur and this process is long already as it is. If applicant gets an agent, from then on agent cooperates with the Patent Office and gives all relevant information to the applicant. In the Patent Office there is few departments, accountant is responsible for receiving and confirming all the payments for fees. Examining division, which consists of three examiners does a substantive examination.

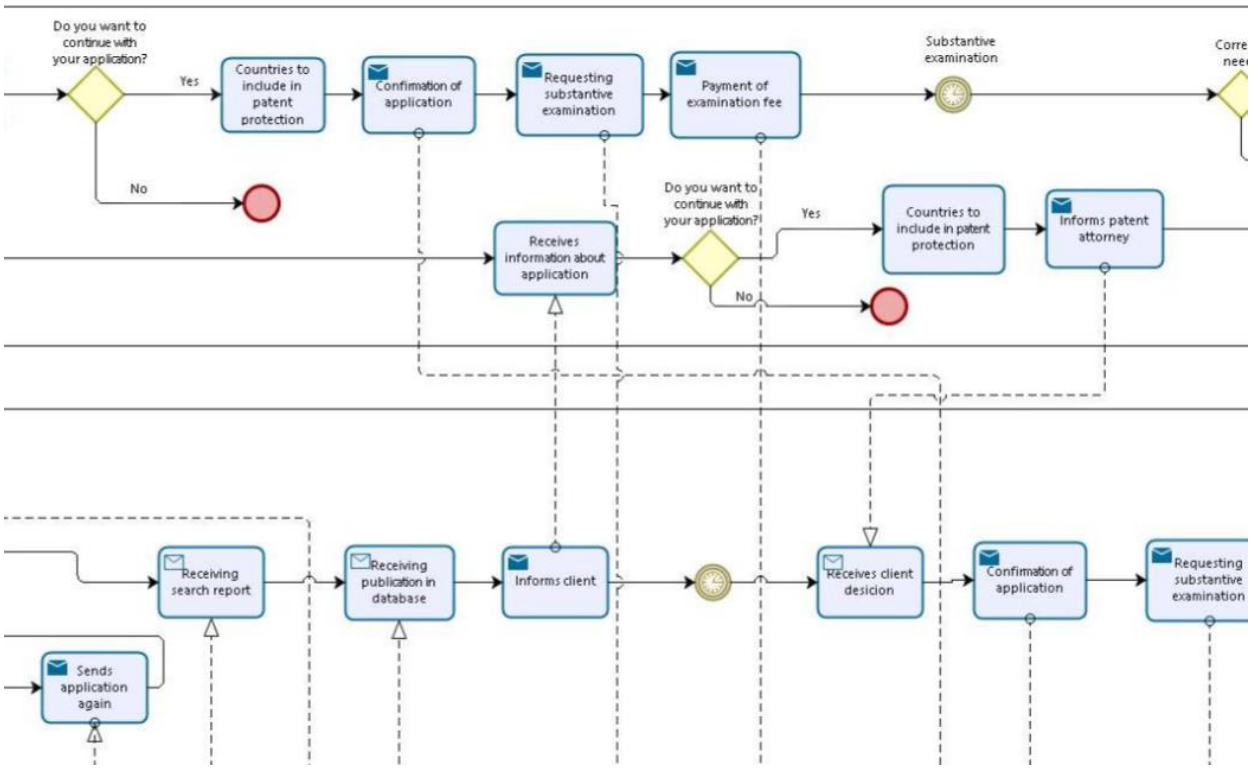

Figure 28. Critical phase 1 of BPMN Diagram

Note: created by author

In Figure 28 it is shown one of critical phases where are number of unnecessary processes like confirming your application and requesting further examination. Another critical phase, especially for reducing time needed could be introducing a special platform/ software by using ICT (Information and Communication Technologies), where all three parties – applicant, agent and Patent Office could upload, update, make corrections to application and cooperate to each other.

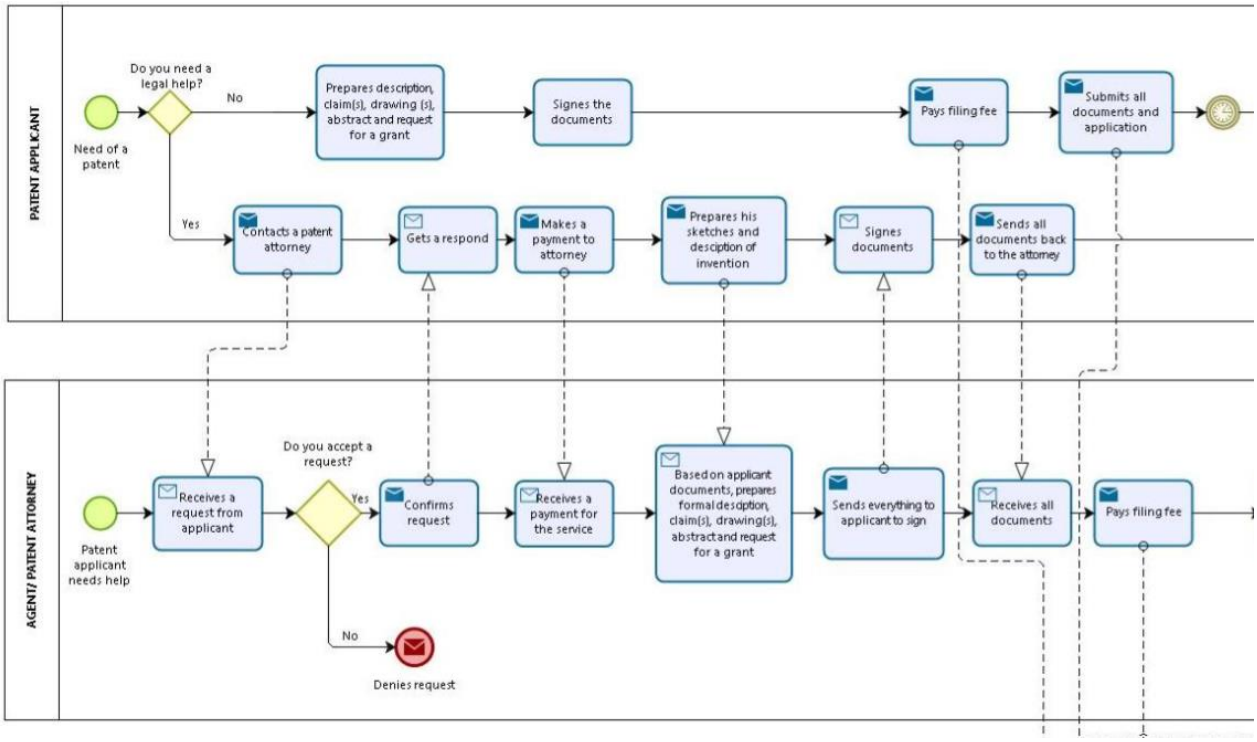

Figure 29. Critical phase 1 of BPMN Diagram

Note: created by author

It is illustrated in the Figure 29 how many times information has to be exchanged just at the tiny part of the process between agent and applicant. Then it produces a waiting time for responding and managing.

5.2. “Management of Application and Issue of the Patent” modelling (TO – BE)

After having thoroughly analyzed the Management of Application and Issue of the Patent process with modelling AS-IS and also carrying out the survey, I have suggested a few small improvements. The most critical and time-consuming sub process is prosecution. I have decided that “Confirmation of application” and “Request of substantive examination” are not necessary activities so it can be removed (Figure 31).

In this case after first examination and publication of search report, the examination should continue automatically, unless the applicant submits a withdrawal. The fee of examination would be paid together with the final fee. That would cut the time.

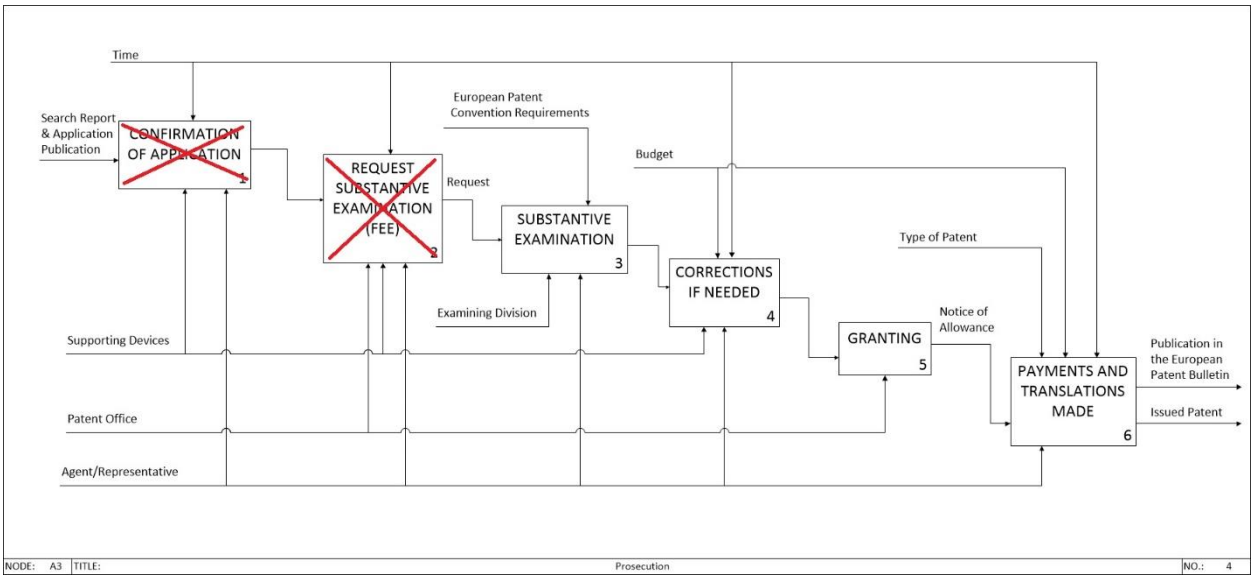

Figure 30. Diagram A3, Prosecution (TO-BE)

Note: created by author

As for modelling with Bizagi software the understandable outcome was that and ICT should be used to introduce a platform for all 3 parties to communicate easily and quickly. For businesses, advances within ICT can bring a slew of cost savings, opportunities and conveniences. ICT encompasses both the internet-enabled sphere as well as the mobile one powered by wireless networks. It could be an ICT based cloud/ platform providing user-centric services. That means content would be shared in a user-friendly and secured way. It would be able to give personalized service provision based on real time data. It would also notify all parties included immediately if any changes were to happen to the application (Rorís, 2016).

The platform should meet some conditions:

- Cost-effective and universal: the use of the platform should not require a relevant cost in effort or resources, no especial technological skills should be required.
- Reusable: the platform must be adaptable to changes in the procedures and applicable in different contexts.
- Security constraints: the system must ensure data will not be accessed without proper authorization.
- Flexibility: allow making changes, editing and managing application related fees.

All that would eventually lead to the better flow of messages and allow modifications to happen faster.

CONCLUSIONS AND PROPOSALS

The aim of this thesis has been to analyze existing industrial intellectual property protection methods and provide possible solutions for further development. It has been established that this is important subject as patent system and intellectual property in general, are valuable source of technological knowledge and it is used by many companies. It also encourages growth of innovation, economy and quality of life.

During theoretical analysis the main issues affecting protection methods were discovered. These included high expenses in case of infringement, impairment of innovation, time consuming and slow process, ideas leakages, lack of patent law harmonization. Literature review presented not only already main existing methods, but also alternative ways used to protect industrial intellectual property. In addition to that, many specific and exceptional cases were discovered, which was used for creating a better survey. Another finding from literature review was that one effective solution for patent harmonization and complex process is being created and implemented. It is called Unitary Patent Protection and would be specifically very useful when protection is needed in more than one country. Regarding this proposal and protection procedures, different national and international laws were discussed, since these aspects have big influence on how protection methods operate. According to authors analyzed, some legislations can create a barrier for innovation and discourage researchers small – medium size enterprises to work in this field.

After gathering information from different sources including main databases of European Patent Office (EPO) and World Intellectual Property Organization (WIPO), the questionnaire based survey was prepared allowing to carry out the empirical research. It is worth stressing out that date received from this research support theoretical issues discussed in the work which was done before. During this part of research, 38 participants were questioned, which is equal to 58% of the whole extent of the research. They were given 19 different questions.

Some of the findings from empirical research were that 78,9 percent of participants use or are planning to use intellectual property protection methods meaning that the problems are relevant to them. According to the results, higher number of questioned people are going to use it in the country their live, and due to the extent of questioned people, it is mostly in Europe. That brought attention to legal aspects of protection system and government role towards intellectual property. From the survey it was found out, that around 60 percent of participants were not aware of its role thus questioning involvement of government in general. Nonetheless 19 percent of the rest of the

people acknowledged that government do not provide adequate protection for creators. At this part some limitations were faced due to the fact that laws take effective time to be considered and changed. Other important data received from survey was that 78,9% participants believed protection methods require improvement. Also, according to participants, the most important criteria while choosing protection method was quality, speed and price, which lead to discover that the most helpful changes to these issues would be reducing time required to acquire protection thus speeding up the processes in general and minimizing the fees.

After empirical data was analyzed, the methodology for designing solution was prepared. The novelty of this part was, that a slightly different approach was chosen and Business Process Modelling techniques were applied. With the help of two qualitative analysis techniques IDEF-0 and BPMN, the process of protection acquirement was visualized, what and how happens currently and with suggested changes were presented. The main finding of the modelling part was that the application management process has some non – value adding activities which only lengthens the process. As suggested, the removal of such activities as "Confirmation of application" and "Request of substantive examination" would significantly reduce the time of the process, which was acknowledged in the survey as one of the key issues. Another factor influencing the length of the process was heavy and slow flow of information and documents between involved parties. Due to many people being involved, the process showed some delays which could be reduced by inserting ICT based platform and simplifying protection methods's system.

Improvements suggested in this research could lead to minimizing some of the issues raised in this thesis. The outcome of this research could stimulate positive implications in the companies and industry field, as well as promote innovations and fair competition between researchers.

For future work, a deeper analysis and modelling of other phases of the protection process could be done. From each part of the research, more critical stages of protection methods were highlighted. One of the options which could be pursued in the further work is focusing on the processes, which comes after acquiring protection and in cases of theft or ideas leakage. There are many possibilities for improvements, one of them establishing a separate national office or providing a separate service which would help protection holder in case he needs financial or legal help. This is only one of other mentioned issues and proposals for it, which would have positive output on the intellectual property protection systems. As it is very wide and complicated field, continuous improvements should be made.

GLOSSARY

Intellectual property (IP) – creations of the mind which can be inventions, literary and artistic works; symbols, names and images used in commerce. It is divided into two categories: Industrial property and Copyright, which includes literary and artistic work such as novels, poems and plays, films, musical works, artistic works such as drawings, paintings, photographs, sculptures and architectural designs. recordings,

Industrial property – part of intellectual property, includes patents for inventions, trademarks, industrial designs and geographical indications.

Applicant:

According to EPO it is the natural or legal person filing the patent application.

According to SIPO it is the natural person or entity filing the patent application.

According to USPTO it is the legal entity applying for a patent; prior to the adoption of AIA, the applicant always consisted of the name or names of the actual inventor or inventors.

Design patent:

According to SIPO it is any new design of the shape, the pattern or their combination, or the combination of the color with shape or pattern, of a product, which creates an aesthetic feeling and is fit for industrial application.

According to USPTO it is legal protection that may be granted for a new, original and ornamental design embodied in or applied to an article of manufacture. design embodied in or applied to an article of manufacture.

Plant patent – according to USPTO, it is a legal protection that generally can be granted for a new and distinct, invented or discovered asexually reproduced plant.

European Patent Office (EPO) – one of the two organs of the European Patent Organization, it grants European patents for the EPC contracting states.

Industrial applicability – it is fulfilled for any patent application if it can be made or used in any kind of industry, including architecture.

Inventive step – an invention shall be considered as involving an inventive step if, having regard to the state of art, it is not obvious to a person skilled in the art.

Novelty – an invention shall be considered to be novel if it does not form part of the state of the art, which comprises everything made available to the public by means of a written or oral description, by use, or in any other way, before the date of filing of the application.

International Patent Classification (IPC) – the IPC "is a hierarchical classification system used primarily to classify and search patent documents (patent applications, specifications of granted patents, utility models, etc.) according to the technical fields to which they pertain.

National application – a patent application filed with a national office under the national procedure.

National office – a national authority responsible for intellectual property matters in one country (e.g. patents, trademarks, copyright, utility models, designs).

Patent thicket – a dense set of overlapping intellectual property rights which requires innovators to reach licensing deals for multiple patents from multiple sources. It is also sometimes called patent floods or patent clusters and usually carries a negative connotation.

Paris Convention – and international convention, established in 1883, which is currently administrated by the World Intellectual Property Organization. It set up the basic characteristics of the modern international patent system, allowing in particular for subsequent filings, which claim the priority of the first filing, to be made at other patent offices within the following twelve-month period. The convention also concerns other matter such as equal treatment, territoriality of patents, and other sets of common rules.

Patent Cooperation Treaty (PCT) – an international treaty, established in 1970, administrated by the World Intellectual Property Organization, participated in by 148 contracting states (as of December 31, 2013), providing an alternative system whereby the applicant can file applications in foreign countries.

Patent granted – when the examining division or the examiner is of the opinion that the application and the invention to which it relates meet all requirements set, it decides to grant the patent. The grant is effective from the date it is mentioned in the European Patent Bulletin.

Publication – the event where the content of the patent application is disclosed to the public. In most jurisdictions, the patent applications are published promptly at 18 months after the earliest priority date (or filing date where no priority is claimed), subject to certain conditions. Another publication is made at grant.

Refusal – if an application does not fulfill the necessary requirement, it will be refused by the office.

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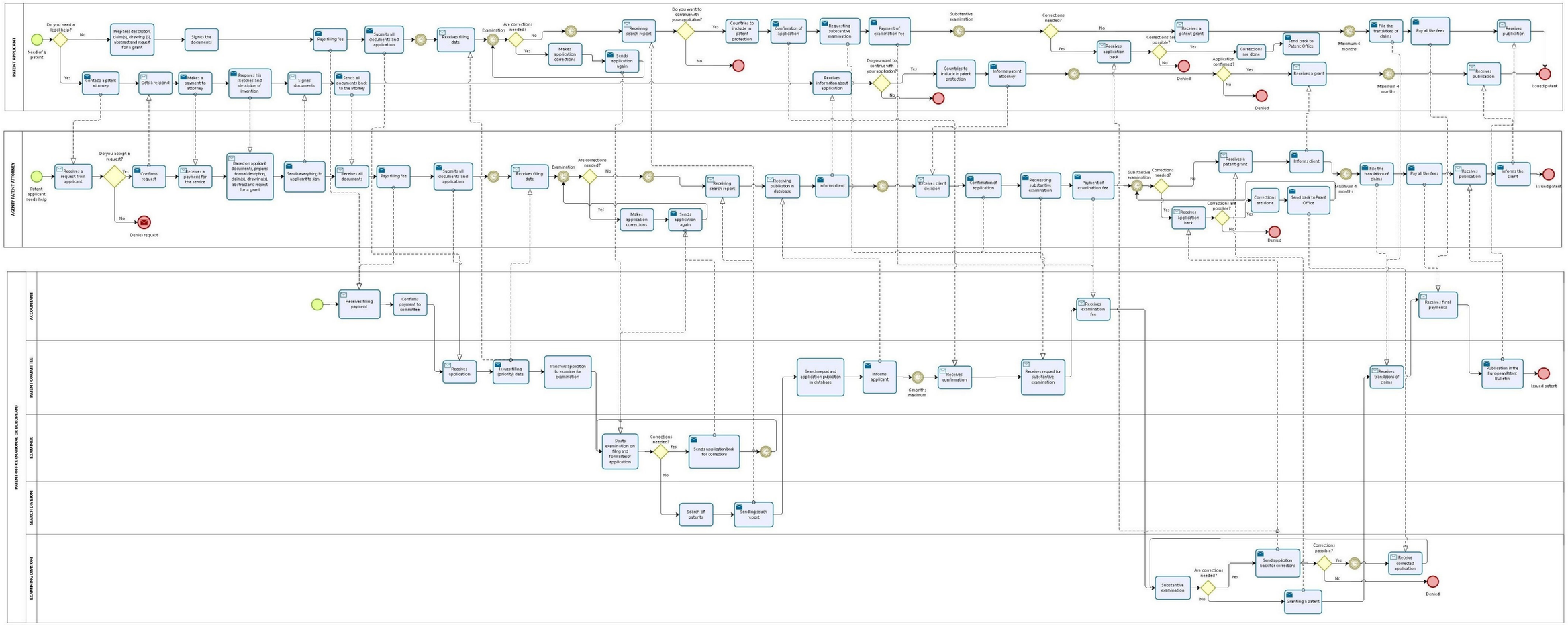
ANNEX 1: Survey: Industrial intellectual property protection methods and their improvement

All survey questions:

1. Your age
2. Your gender
3. Your educational qualification (illiterate, up to school level, under graduate, post graduate, professional).
4. In which country are you working/ studying/ creating?
5. Are you working on innovations/ development?
6. Which field/ business do you represent?
7. In what kind of company do you work?
8. Are you familiar with Intellectual Property Protection methods (like patents)?
9. Do you use/ planning to use in the future Intellectual Property Protection?
10. If yes, where do you use protection of your innovation (Which countries)?
11. Which intellectual property (IP) protection methods do you know/ heard about?
12. Which do you think best represents patents and other forms of protection?
13. What are the most important criteria while choosing protection method for your IP? (Multiple choices – price, speed, quality, trustworthiness, reliability…)
14. What are the most common problems you face while protecting your intellectual property (open question)?
15. What is the role of government towards IP protection in your country?
16. In your opinion, what are the bottleneck (weakness) of IP protection methods? (Multiple choices – patent thickets, poor patent harmonization throughout the Europe and world, time consuming process, government failure to provide adequate protection, expensive process…)
17. Are you familiar with/ heard of Unitary Patent Protection and Unified Patent court?
18. Do you think IP protection methods needs improvement?
19. If yes, in your opinion, what kind of changes would help the most to enhance Industrial Intellectual Property Protection methods? (Rate each criteria in the given scale).

ANNEX 2: BPMN Diagram, Management of Application and Issue of the Patent (AS-IS)



ANNEX 3: Article for the 21st Junior Researchers Conference „Mechanics, Material Science, Industrial Engineering and Management“

INVESTIGATION OF INDUSTRIAL INTELLECTUAL PROPERTY PROTECTION METHODS AND THEIR IMPROVEMENT

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Abstract. This article main purpose is to analyse the existing industrial intellectual property protection methods and to provide some suggestions for improvements. It gives insights on all possible protection methods, when it is best to use it and how to choose. This article shows a different approach taken to solve a complex and lengthy process. In this paper, Business Process Modelling techniques have been introduced and applied providing a different point of view to solve some of the issues. The main idea is to remove non-value adding processes and introduce ICT based software between different parties involved.

Keywords: intellectual property, industries, protection, investigation, improvement, patent, utility models, application.

Introduction

More and more people (business industries, companies, universities, even countries) are focusing and giving more attention to intellectual property (IP). First, it is important to know what is this intellectual property. It refers to creations of the mind like inventions, literary and artistic works, symbols, names and images used in commerce.

There are several compelling reasons why it is important to promote and protect intellectual property. For the well-being and future of humanity we must create and invent new works in the areas of technology and culture. Moreover, the legal protection of new creations encourages the commitment of additional resources for further innovation. Lastly and significantly, it spurs economic growth, creates new jobs and industries, and enhances the quality and enjoyment of life.

Having assessed the growing importance of intellectual property and its protection methods, both globally and nationally, I have chosen to examine this theme on the final work.

In this research, the already existing methods of intellectual property is being analyzed and survey carried out. After, the results are being investigated and an approach is being chosen. Finally, the improvements are being suggested. A new enhanced method should be designed and used for industrial intellectual property in any size of companies or individual researchers. The research will cover the analysis of people questioned and the models created by modelling techniques.

So far there are many different researches about how governments and responsible entities are trying to deal with separate problems arising in the field of intellectual property protection. One of the huge proceedings which is now in progress in making Unified Patent and Unified Patent Court. This should help with some of the issues like making patenting process faster and cheaper, but not all issues would be touched. In my research I will focus more on over viewing all possible causes of making intellectual property poorly protected and how all those issues affect researchers and inventors negatively as well as greatly influence innovation, competition and economy in general.

Problem analysis and formulation

Currently, in intellectual property field used protection methods still have many disadvantages and loopholes where inventors are not protected. Those conditions are especially hard for small companies or individual inventors because patenting or other protection methods are very expensive and usually time consuming (can take up to 4 years) and by then market may have changed or technology may have overtaken your invention. Conditions are literally working against the inventors and scientists. Other thing is that even when a person patents his invention or product, it can still be stolen or copied, so the inventor has to consider his ability to defend his patent in case of infringement. And that has to be done even before applying for patent. It goes without saying that timing is very important in all stages of thinking about patent. And these are the problems which are similar in all countries.

One more issue is that even though patenting and other methods are considered as a way of sharing technology, ideas and promoting scientists to do more and more in research field, statistics show that most firms use the patent system to prevent other firms copying their technology and blocking. It means that owners wish to prevent others from using the technology and creating. It is obviously a potential danger and concern because patents should be encouraging the innovation, not opposite.

Other concern is intellectual property laws distinction between many countries, it is especially visible between US and EU patent systems. There is long history with an issue of patent harmonization. And it is one of the things which should be tried to be solved. All the problems are shown in problem tree (Figure 1).

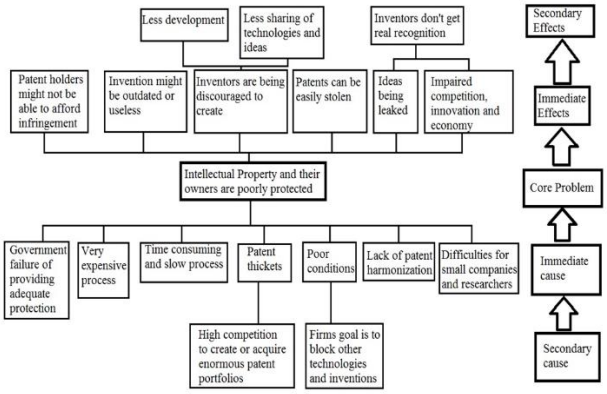

Fig. 1. Problem tree, created by author

Theoretical part of industrial intellectual property protection methods

It is best to start by first analyzing what is intellectual property and overviewing the protection methods for industrial property used nowadays as well as some alternatives.

Intellectual property (IP) is non-material property, which is the human creative spirit and mental work result, mind product, protected by law like any other form of property. Intellectual property law protects inventions, creativity and ingenuity. Looking at the industrial property protection there are 3 main ways:

- Registered designs.
- Registered trademarks.
- Patents and utility models.

It is important to note that patents can be quite useful in some situations. For example, it can help to find out what already exists and build on it, to keep track of who's doing what, to avoid infringing other people's patent rights and to improve the quality of your patent applications. It is relatively easy to find the needed patent, because Patent Offices have classified all of them, for that they use International Patent Classification (IPC) with its extension The Cooperative Patent Classification system (CPC).

Also, there are many alternatives to patents which might be more suitable for specific cases or fields. For example, in semiconductors industry there are two other methods considered to be more superior than patenting. It is namely secrecy and lead time or first mover advantage. It is especially more valued by small companies who are just using patents to acquire venture capital. A number of alternatives strategies to patents have been developed by the companies. These are secrecy, accumulated tacit knowledge, lead time, product complexity, standards, branding and many other. This was due to the fact that they felt other forms of IP protection were better suited to their needs (Leiponen and Byma, 2009).

Looking into an issue, one of the factor is poor Intellectual Property protection conditions. One of the things influencing this is that firms' goal is to prevent other technologies and inventions. These days patents are very valuable to researchers and scientists. They can use previous patents to see how the problems they face have been tackled in the past. Also, they can identify how their current area of work fits in with those areas of science and technology that have been developed and patented previously. All this industrial intelligence can help research teams and companies to develop and modify their own strategy or to pursue a different approach to a problem (Trott, 2012). According to Professor William Haseltine, who has been working on deciphering the DNA of the HIW virus, the patents actually stimulates innovation. He also said, "I can think of no case in which a patent has ever inhibited an academic scientist." But there is a different approach to this question too. In a table 1 which is shown below you can see the reasons why firms patent. It is clear that most firms use the patent system to prevent other firms copying their technology and blocking. When we mention blocking, it refers to owners of a patent preventing others from using the technology. It is obvious now that there is a potential danger and concern because there is increasing evidence that now firms use patents to prevent others from developing technologies even though the aim was to encourage the innovation (Quinn, 2011).

Table 1. Reasons why firms patent

	Products, %	Processes, %
Prevent copying	96	78
Patent blocking	82	64
Prevent suits	59	47
Use in negotiations	48	37
Enhance reputation	48	34
Licensing revenue	28	23
Measure performance	6	5

Source: Cohen, W. M. (2002) Patents: Their Effectiveness and Role, Carnegie Mellon University & National Bureau of economic research.

It is also important not to forget that the process is very expensive. There are high fees for obtaining the

patent and keeping it. And even if entrepreneur can afford these costs, protecting a patent against possible infringement can simply be prohibitive. In case you would need to go to the court regarding the infringement you have to be able to finance the case, which many small companies cannot do. This is why many entrepreneurs consider the whole issue of IP as nothing more than a smokescreen (Greenhalgh, 2010).

One more important factor is that the process of patenting (the most popular method of protecting intellectual property) is very time consuming. This includes the lengthy process to write and file for patent, then it typically takes around 3 years until it is granted. Figure 2 below depicts how many patents worldwide are still undetermined. Moreover, obtaining and then defending the patent also consumes a lot of time (Colson, 2007).

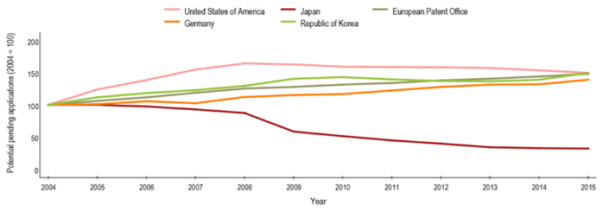

Fig. 2. Potentially pending applications at the top offices. Source: WIPO Statistics Database, October 2016

Background for suggested solutions

One of the solutions which is already in progress is creating Unitary Patent Protection (UPP) & Unified Patent Court (UPC). The aim of the reform is to offer business an alternative by simplifying the existing system and support a cost-effective route to patent protection and dispute settlement. With this being introduced there will still be possibility to use old patent system meaning that in the future there should be three routes to patent protection in Europe. Shown in the Figure 3.

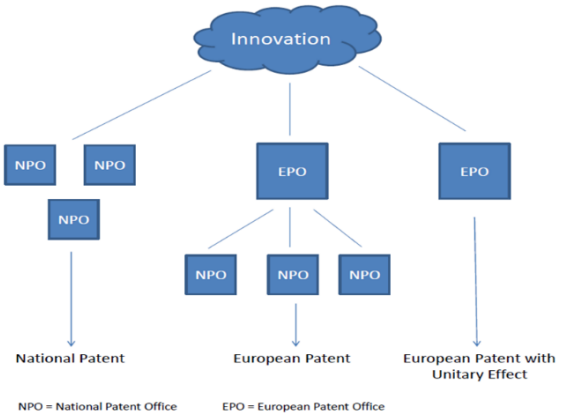

Figure 3. Routes of possible patent protection. Source: EPO Database

Another source is "FT.com" where Greenhalgh, H. wrote an article about theft of intellectual property and whether it should be a crime. This issue is one of the few immediate effects which is caused by poor IP protection.

By some of the inventors and entrepreneurs it is believed that their intellectual property (IP) is being stolen and the government as well as the courts fail to offer adequate protection. It is believed that the ruling is not adequate, for example if someone steals from you, that person is probably going to the jail, but if someone were to steal your IP, it might just be a civil case and that's if a victim can afford paying a lot of money to the lawyer. Even with a patent, copyright or trademark in place, IP theft is still very common.

And even if entrepreneur can afford these costs, protecting a patent against possible infringement can simply be prohibitive. In case you would need to go to the court regarding the infringement you have to be able to finance the case and many small companies cannot do. This is why many entrepreneurs consider the whole issue of IP as nothing more than a smokescreen.

One of the solutions of protecting your idea being leaked and gaining a trust with your colleagues is that all parties concerned on this matter would agree to sign a non – disclosure agreement. At least in UK, the Intellectual Property Office has shown no plans of making patent infringement into a criminal offence. And without this the inventor will not get a real recognition. Baylis says: "We have to make society realize that the most important thing the nation has is knowledge and creativity."

A non-disclosure agreement (NDA), sometimes called a confidentiality agreement, allows a company to share its IP with others, whose input it needs, without unduly jeopardizing that information. For example, if you have a new product or feature in development, but you need to consult an expert for advice on how to proceed, an appropriate NDA can ensure that the expert doesn't hand the details of your new product to a competitor of yours. It is a legal contract between you and the other party in which you agree to disclose certain information to them for a specific purpose and they agree to not disclose that information to anyone else.

Empirical research for protection methods and improvements

For my work I decided to choose qualitative research methodology. The human instrument applies appropriate data collection technique, complemented by tacit knowledge to the investigation. As for research methods I am planning on using survey. The purpose of survey research is to gather and analyze information by questioning individuals who are either representative of the research population or are the

entire research population. The aim of survey research is to study relationships between specific variables, which are identified at the outset of the research and stated as either a hypothesis or a research question, or to describe certain characteristics of the population.

In my research I will use a questionnaire-based survey which we will send to the chosen participants via email or other communication platforms. Questionnaires provide a relatively cheap (in many cases free), quick and efficient way of obtaining large amounts of information from a large sample of people. Data can be collected relatively quickly because the researcher would not need to be present when the questionnaires were completed. This is useful for large populations when interviews would be impractical. It can be an effective mean of measuring the behavior, attitudes, preferences, opinions and intentions.

Starting from the beginning I will overlook the answers of the survey which show more importance.

So, first it is interesting and important to know what business/ field interviewed people represent. It includes: agriculture, engineering, innovation management, food technology, food and safety, industrial engineering, insurance, management engineering, manufacturing and mechanical engineering, physics, production of medical equipment, architecture, mechatronics and robotics, production management and so on. It is shown in Figure 4. It is also important to highlight that some of interviewee do not work on innovation now.

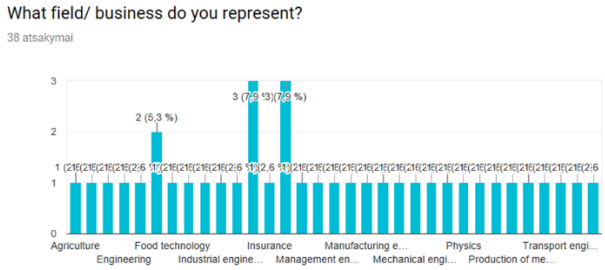

Figure 4. What field/ business do you represent?

For my project, it was very important to establish what patents and other protection methods means to participants and how they see it. In the Figure 5 below there are few sentences stated and participants were able to choose up to 3 options which, in their opinion best represents forms of protection. The top 3 ideas were:

„It helps to protect your idea from being leaked "

„Patents can be easily stolen "

„Does not provide adequate protection for creators "

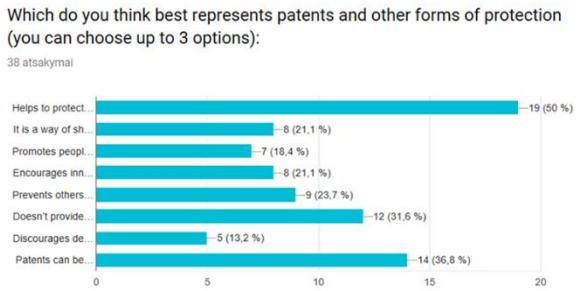

Figure 5. Representation of patents and other forms of protection

In the Figure 6 there are some of criteria which participants had to rate. From this I can highlight that the most important were quality and speed. Price was relatively important too.

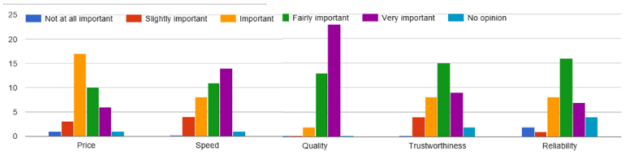

Figure 6. Rating of criteria while choosing protection method

For making some conclusions later, I wanted to find out what in participants opinion are the bottleneck of existing methods. In the Figure 7 there are few of them, and most likely the most important are „Time consuming and slow process ", „Expensive process ".

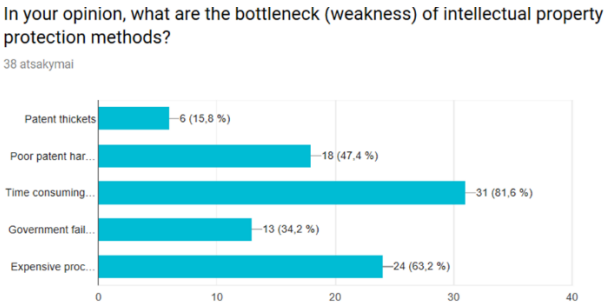

Figure 7. Bottleneck of intellectual property protection methods

For these and many other reasons, most of the participants believes that intellectual property protection methods need improvements in the future (Figure 8).

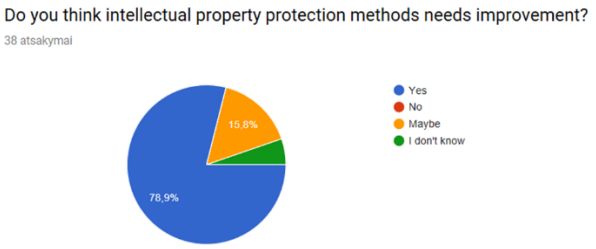

Figure 8. Need of intellectual property protection methods'improvement

Recommendations

Looking back at the carried-out survey, the last question should be considered one of the most important. In that question there were few possible solutions provided for improvement regarding different problems and aspects. Participant evaluated all of them in the scale saying which of them, in their opinion, would be most helpful and which would be least helpful (Figure 9). In this closed question the options were:

- Reducing the time required to acquire a protection for your innovation/ idea/ product;
- Promoting knowledge management in the companies/ society;
- Removing or reducing the gap between differences of intellectual property laws enforcement throughout EU and US;
- Changing the approach of companies which only use patents to block/ prevent other technologies and inventions;
- Making patent infringement (theft) into a criminal offence instead of just civil case;
- Cutting the cost of intellectual property protection methods or making a reasonable paying plan to help inventors, especially in case of infringement case;
- Creating a unified application processing system for all patent offices (instead of waiting for applicant to file a separate request for examination, the application should be proceeded to examination stage automatically in all offices unless applicant withdraw it);
- Establishing a separate national office or providing a separate service which would help patent holder in case he needs financial help or legal consultation while protecting his innovation (specially in courts in case of theft and ideas leakage).

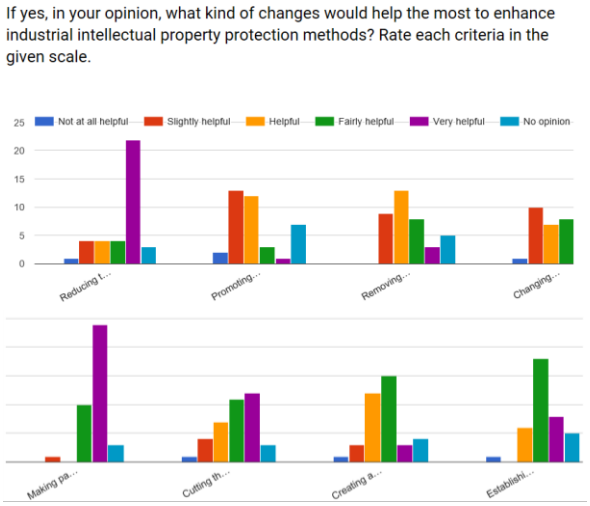

Figure 9. Changes which would help enhance methods of intellectual property protection

First of the options, which participant thought would be most helpful was about patent infringement. They agreed that in case of patent theft it should be a criminal offense and not a civil case. The theft of idea/ innovation/ patent should be considered equally as a theft of physical goods (car, phone, money). This change could lead to great improvements in the future, but to prepare the plan and implement would be extremely hard, because many changes in laws should be made.

Another suggestion was to reduce time which is needed to acquire a protection for your idea/ innovation/ product. It is important for innovators because, for example patenting process may take up to 4 years and by then, the innovation might actually be irrelevant. Reducing time is closely related to another idea mentioned in the survey, which is "Creating a unified application processing system for all patent offices (instead of waiting for applicant to file a separate request for examination, the application should be proceeded to examination stage automatically in all offices unless applicant withdraw it)". It is one of the ways to reduce time and at the same time to reduce work load for workers in patent offices.

One more, fairly helpful suggestions was to establish a separate entity/ service/ office which would help patent holder in case he needs financial help or legal consultation while protecting his innovation (especially in courts in case of theft and ideas leakage). This would most likely stimulate the development and innovators to continue to create because they would get recognition and courage to protect his intellectual property in court. Depending on the needs, it could be established in every Europe country or just in the most important countries concerning patenting.

Methodology for designing solution

After the implementation of a survey research among people who work in innovation and development field in any size of companies or as an individual researcher I need to prepare methodology for designing solution. The focus was to find the biggest bottleneck which influences used methods the most and which improvements would be considered most helpful.

The way I designed the survey should help to find out the performance gap between current and desired performance. After data collection and investigation, I will improve or create a new possible model of protection method. For this task I am going to use techniques like IDEF0, BPMN and possibly UML which are qualitative analysis techniques for modelling business processes before (AS-IS) and after changes (TO-BE), making it easy to compare and make conclusions. These techniques are supported by software like Microsoft Visio and Bizagi. All modelling possibilities are shown in the

Figure 10. In each of them, process is represented through graphical notations as well as with explanatory text.

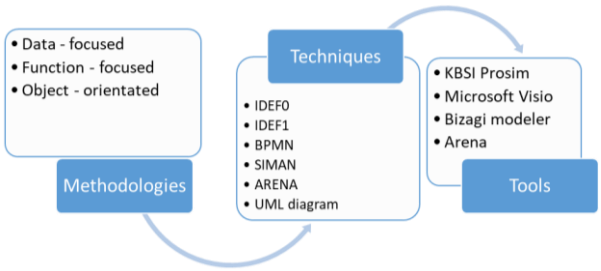

Figure 10. Process modelling steps. Created by author

After modelling, the next step will be to prepare an implementation method and suggestions. This step is very important and therefore should be well asserted. For that existing implementation techniques should be analyzed and used properly.

Designing solution using business process modelling techniques

At this step I will model a "Management of Application and Issue of the Patent" process. First, I am going to start with an existing model (called "AS-IS") and then continue with an improved model ("TO-BE"). I will do it using two modelling techniques – IDEF-0 and BMPN known as a Business Process Modelling Notation. The difference between these two are that IDEF-0 modelling technique graphically represents "what" does a process through the conduct of its activities meanwhile BPMN modelling technique shows "How" these tasks are performed.

While modelling with IDEF-0 technique, first step is to identify: context, purpose and point of view.

- Context: Management of Application and Issue of the Patent.
- Aim: to analyse the process and clarify the hierarchy among the tasks, in order to identify which steps of the process are the more critical (unnecessary) and how to change it.
- Point of view: Patent applicant.

It was chosen the perspective of patent applicant to develop a model because it is a central figure in the process being analyzed, as it relates to all processes mentioned. This allows me to have a more objective vision of the entire process.

Once defined context, purpose and viewpoint, development of the context Diagram(A-0) (Figure 11) has been started. This, separating the problem being analyzed from the neighboring environment, automatically defines the context. The inputs are the actual request for patent by the applicant and the paper forms that during the process will be used to. The resources needed to carry out the process are the human resources (including Patent Office workers, examiners, Agent or Lawyer) and the supporting devices as phones, scanners, printers and computers.

As for restrictions, the diagram shows how the process is subject to the legal regulations, time and budget. Another constraint is the type of patent and application, because different type may require different documentation and way of doing it. First, according to the patent validation countries, patent's application might be National, Regional and International. It also depends on the product being patented, for example you can request for utility plant, plant patents and design patents. Finally, the output is the real issue of the patent.

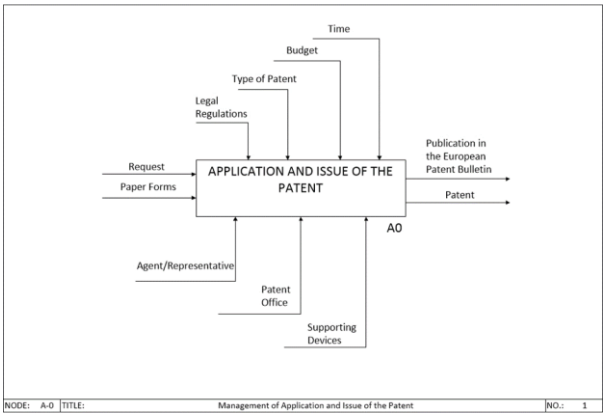

Figure 11. Diagram A-0, Management of Application and Issue of the Patent (AS-IS). Created by author

Proceeding to the decomposition of the context diagram you see 3 main activities (Diagram A0) (Figure 12):

Preparation of Patent Application. This activity is mostly influenced by such constraints as type of patent and standards. During this step the most needed resources are agent or representative and supporting devices. It is clear, that during this step working together with the agent, the patent applicant must do a thorough research, prepare all documentation which includes a request for a patent, details of the applicant, a description of the invention, claims, drawings, an abstract. The output is final and full application.

Application Filing. This activity starts after application is submitted by applicant and his agent. The constraints are time, budget and legal regulations. This activity is further decomposed into four subtasks (Diagram A2) (Figure 13). First is Submission of the signed documents and payment of application fee. After that, the application is given a filing date - also known as your priority date. After filing there is an examination for filling and formalities to ensure that your documentation is correct and complete. At any time in the next 12 months applicant can file for patent protection in other countries and have those later filings treated as if they had been filed on your priority date. In practice, this gives you a year to decide how many countries you wish to include in your patent protection. After this subtask, if there is

no need for corrections they continue to “Search of patents”. The output of this subtask is a search report which is sent to you. It includes listing, copies of all prior art documents found by an experienced examiner and regarded as relevant to your invention. The search is based mainly on your claims for novelty, but your description and any drawings will also be taken into account. The report will often include an initial opinion on the patentability of your invention. Next and final subtask of this activity is “Publication in database”. The application is published 18 months after the filing date. The invention will appear in databases accessible to other people around the world. It will act as prior art against any future patent applications from other inventors or companies for similar inventions.

Prosecution. This activity consists of six subtasks (Diagram A3) (Figure 14). The applicant has six further months to make two decisions. The applicant has six further months to make two decisions. First is to decide which countries to include (‘designate') in patent protection which is followed by designation fees payment. And another important decision is whether to continue with application. In this case applicant must request a more thorough (‘substantive') examination and confirm application. If request of substantive examination is made, the Examining Division of Patent Office has to decide whether invention and application meet the requirements of the European Patent Convention. For maximum objectivity there are usually three examiners, one of whom maintains contact with your agent (patent attorney). This stage will often involve dialogue between the examiners and patent attorney, which may result in the re-drafting of key parts of application. Patent attorney will defend your application, and this is one more reason why it is essential to have professional representation. Later, corrections may be done if needed. After the patent is granted and applicant must pay all the fees and file claims translations. The output of this subtask is the final output which are publication in European Patent Bulletin and issued patent. The decision to grant takes effect on the date of publication.

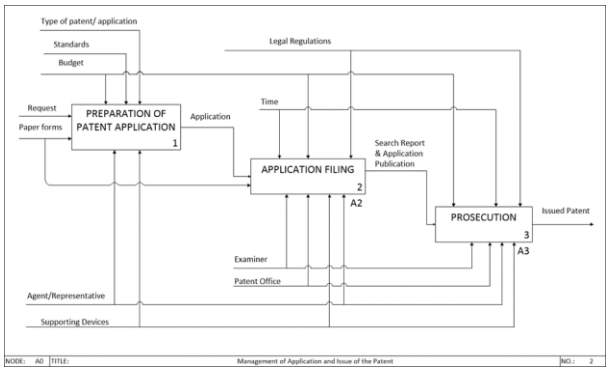

Figure 12. Diagram A0, Management of Application and Issue of the Patent (AS-IS). Created by author

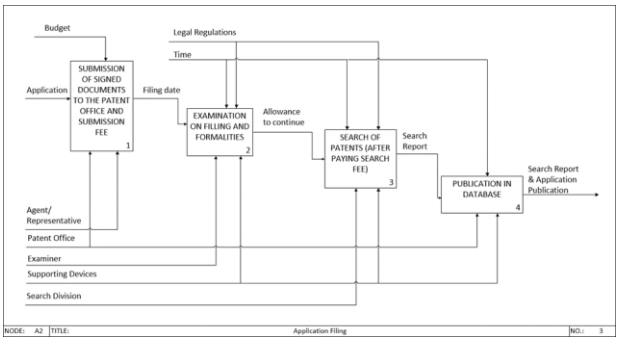

Figure 13. Diagram A-2, Application Filing (AS-IS). Created by author

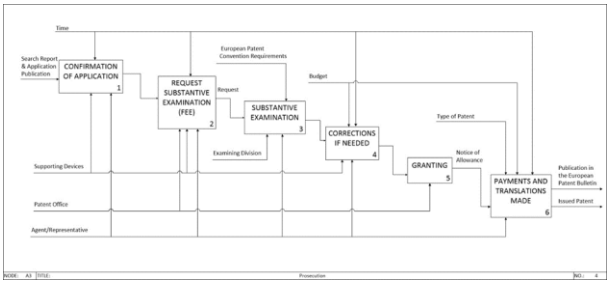

Figure 14. Diagram A3, Prosecution (AS-IS). Created by author

After having thoroughly analyzed the Management of Application and Issue of the Patent process with modelling AS-IS and also carrying out the survey, I have suggested a few small improvements. The most critical and time-consuming sub process is prosecution. I have decided that “Confirmation of application” and “Request of substantive examination” are not necessary activities so it can be removed (Figure 13). In this case after first examination and publication of search report, the examination should continue automatically, unless the applicant submits a withdrawal. The fee of examination would be paid together with the final fee. That would cut the time.

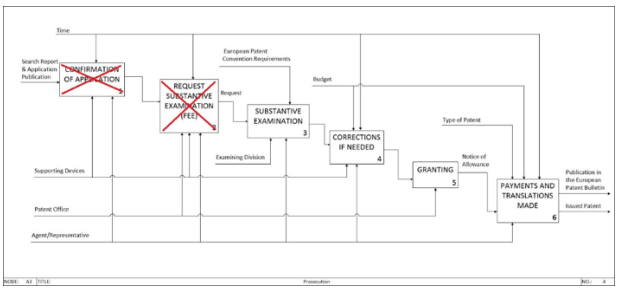

Figure 13. Diagram A3, Prosecution (TO-BE). Created by author

This is only first of the suggested improvements which would help to reduce the time needed.

Conclusions and proposals

During this work I had a chance to get some insights about current situation of industrial intellectual property protection methods and whether my

provided possible solutions could be helpful in the future. It is obviously very important topic because patent system is considered as a valuable source of technological knowledge and it is used by many companies. It is no secret, and my survey just proves that the whole system still has some big flaws mainly because of the long and pricy process of patenting and even bigger expenses in case of infringement and its defense. Due to the extent of this field and many legal aspects, the improvement process of the intellectual property protection methods' most likely takes effective time.

In my work I have modelled the process using IDEF-0 and later with BPMN techniques. I've decided to remove few processes which was giving no value to the process as well as introduce ICT. Both of those would reduce the time needed for the whole application process as well as make it easier to do.

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