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Management and Evaluation of Patent Portfolio in the Context of Defensive Patent Strategy

Development of a Consistent Model for Collecting and Analysing Data Using a Modern Data Platform as a Tool

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Abstract

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This thesis focuses on improving the case company's patenting process and finding new ways of interactive communication by switching over to utilizing a new modern IP management system (IPMS) as a tool. The objective of the thesis was to develop a consistent model for collecting and analyzing data using a modern data platform as a tool in order to improve strategic management of the patent portfolio. Improving the process would contribute to the value gained from the case company patent portfolio.

The Current state analysis in the thesis was conducted based on qualitative research methods. Stakeholders were interviewed on the current process to find development points which would make patent portfolio management more efficient and interactive. According to the results, communication between stakeholders in the different patenting phases needed improvement and modernization. Also, there was a need for a consistent structure for the process. The Current state analysis together with inputs from the internal stakeholders and external IP experts, as well as existing knowledge and best practices from the literature made the basis for proposal building in the final stages of the thesis.

The outcome of this thesis was a proposal for a structured model for collecting and analyzing data using a modern IPMS as a tool. The model should facilitate management of the process and help collecting and analyzing the necessary data. The new IPMS will work as a platform for all the materials, decisions, and instructions, easily available for all stakeholders. The model developed in this thesis was validated by stakeholders and the implementation was approved to start as soon as possible.

Keywords Patent management, evaluation of patents, IP management system

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1 Introduction

Patents are a significant asset for technology companies to differentiate from competitors, get revenues from licencing and/or ensure company's freedom-to-operate in its own industry. There can be not only one but multiple patents protecting main technologies used in products. In addition to protecting the products and creating revenues from licencing, patents can be used as a shield to prevent competitors from developing and using certain technologies, even if the patent owner does not manufacture the certain technology itself. Finally, a wide patent portfolio can be seen as a significant asset when determining the value of a company.

This study will be conducted in a context of *preventative and defensive patent strategy* where a leading technology company aims to secure their own freedom of action. The goal is to prevent competitors from imitating their products and to gain competitive advantage in form of patented solutions or features (Gassmann 2021: 27-39). The challenges described relate to the internal, protection-related activities (Jell 2012: 115-116). One challenge with the strategic patent portfolio management in the case company is that there is no systematic way to collect data to determine the value of patents. The current database tool is out-dated and therefore it cannot be effectively utilized in data collection and analysis. The other challenge is that the patent portfolio is partly a result of acquisitions where the origin and management of patents have been scattered in different locations. In order to determine the value of the patent portfolio in a more strategic way, a model for data collection and analysis must be developed.

1.1 Business Context

The patent portfolio of the case company is mid-sized, containing approximately 2000 patents. The size of the portfolio brings challenges to its effective management. The management of the portfolio should align with the overall strategy of the company, and strategic decisions on maintaining and cancelling patents should be grounded on regular interaction with key stakeholders. However, valuation of patents is not a simple procedure, as contribution from market experts, technical experts, and patent experts still might result in an undesired outcome.

If an inventor invents something revolutionary which has a direct impact on sales, as customers are willing to pay more for the product because of the new solution or feature,

determining the value of the patent is easy. Usually this is not the case. Technology inventions usually relate to very small developments to the existing solution or to new features for which the value is difficult to assess. There are different aspects to take into account when assessing the value: Market value, business case value, technical value, strategic impact, legal value and monetary value (Gassmann 2021: 51). In addition to product managers and technical experts, also upper management level should be involved in value-determining process (Jell 2012: 121).

Patenting process is quite costly: a patent application must be filed separately in different countries and the process involves professional patent attorney services. In addition to the prosecution costs, annuity fees must be paid for each patent in each country on a yearly basis. Total costs of managing a wide portfolio of patents results easily in over a million Euros every year. In addition, transformation of new innovations into products can be quite a rocky road: costs can be significant and customer reactions cannot be fully predicted. Sometimes there is no business case for a patent, and it won't even be productized, but it can anyhow bring profits to its owner for example in form of licencing. All in all, to be able to manage the costs effectively, patenting strategy should be clear to all stakeholders. By systematically determining the value of each patent helps in patent portfolio management.

In order to gain benefit from patents, the possibility to utilize the patents should be carefully assessed. The value can be both overestimated and underestimated. When overestimating the value, the patenting process is taken too far and too widely to several countries with high costs and low value returned. When underestimating the value, a patent may remain unutilized with a high potentiality to bring in high profits. One aspect that should be considered also in companies operating with protection-related patent strategy, is the external exploitation for example in form of out-licencing (Gassmann 2014: 106-107). False judgments on the value of patents are many times a result of making decisions in a hurry or trusting the judgment of only one person in charge who might make the decision based only on his/her own experience.

There are several Immaterial Property Management Systems (IPMS) on the market which have been developed exclusively to make IP management smooth and easy. These new data platforms enable various types of interaction with stakeholders, generate reports, and make reporting and getting feedback easy. The database the case company is utilizing currently is one type of an IPMS but it is outdated and partly quite

rigid to use. It is a closed system and interaction with stakeholders is not possible. The need for the modern data platform has been recognized in the case company and the search for the most suitable IPMS is ongoing. This study will examine, how the modern data platform can be utilized as a tool when determining the value of patents.

1.2 Business Challenge, Objective and Outcome

The specific information about the value of patents usually comes from business units, i.e., from product managers and technical experts. These people usually have lots of other responsibilities and very limited time. This means that assessments and decisions on the patents are made in haste, and the quality of the outcome is low. Without a systematic method for collecting and analysing data about the value of the patents it is very difficult to manage a patent portfolio efficiently and strategically, as the information received is scattered and of poor quality. The lack of key information results in waste of IP assets in form of falsely allocated investments.

The objective of this study is to develop a consistent model for collecting and analysing data using a modern data platform (IPMS) as a tool in order to improve strategic management of the patent portfolio. The outcome of the thesis will be a consistent model for collecting and analysing data using a modern data platform (IPMS) as a tool. This will lead to improved strategic management of the patent portfolio.

1.3 Thesis Outline

This thesis was conducted within the patent management team in the case company. patent management team is working closely with different business units which have operations in Finland, Germany, the US, China, India and Sweden.

The study in this thesis was mainly conducted by interviewing internal stakeholders, but also a questionnaire to internal inventors and interviews with external IP experts were contributing to the development proposal and conclusion of the thesis.

This thesis consists of seven sections. Section 1 introduces the thesis topic and Section 2 describes the research methods used in the study of the thesis. In Section 3, the existing knowledge and best practices from literature, articles, and white papers are

explored to pull together a Conceptual framework for the thesis. Section 4 describes the Current state analysis (CSA) which was conducted via interviews and a questionnaire. In Section 5, a proposal for a model to collect and analyze patent data is built and in Section 6 this proposal is validated and finalized based on the feedback received from presenting the proposal to internal stakeholders and IP Board. Section 7 pulls the contents of the thesis together in form of executive summary and conclusion.

2 Method and Material

This section reviews the theory of research approach, research design, and data collection and analysis methods used in business and management research, and the reasoning and details to research approach and strategy applied in this thesis.

2.1 Research Approach

In business and management, the aim of research is usually constant improvement and development of processes or products. First, the nature of business and management research is transdisciplinary, as the impact of sociology, psychology and economics is inevitable in research. However, these disciplines cannot be utilized separately, as new learnings require combining knowledge from multiple disciplines. Second, the result of business and management research must be a practical new solution to an existing problem. Otherwise, the time and money spent to the research is not justified. (Saunders et al. 2019: 1.3.)

Research in terms of *research family* can be divided into *basic research* and *applied research*. In basic research the researcher tries to understand a phenomenon and build a theory without so much attention given to practicality. The result of such research may or may not have practical implications. This is the case usually with academic research. In applied research a researcher wants to solve a problem or develop a process, and the result of such research is directly applicable in practice. Thus, the applied research is usually conducted in business management because it brings direct benefits to the business. When conducting applied research, the combination of theory and practice should be in balance and intertwine with each other, not remain separate units in the research process. (Saunders et al. 2019: 1.3.)

In general, there are two types of methods available when conducting research: *quantitative* or *qualitative* research. Depending on the *research philosophy*, and the topic researched, either one of these methods may be more suitable, but also *mixed method* may be chosen. Quantitative research method is usually used in the field of mathematics, chemistry, and medicine, but it is suitable for all research collecting or analyzing big amount of data in numerical form. In business and management, quantitative research methodology is used to get exact and quantified data from business operations.

Quantitative research methodology is suitable when researching phenomena which are already known and there exists prior research and theory on the subject. Thus, deductive or “from theory to practice” approach is usually used to test an existing theory. On the other hand, when research topic is something new and unknown, and contextual factors have great weight on the results, qualitative research methodology should be utilized. Qualitative research has usually inductive or “from practice to theory” approach. In general, business and management research use qualitative research methodology with abductive approach as the interpretation of the results cannot be totally objective, as interpretation of results depends on the researcher. Usually the aim is not to generalize the results, but emphasize the contextual factors. (Saunders et al. 2019: 5.3-5.5; Kananen 2013: 18-19, 26-36.)

Implementation of research must be carefully planned, and *research strategy* helps in achieving the goal. Research question(s) have influence on the research approach and research strategy, and together these three aspects should be in coherence with the research philosophy. Also, the existing knowledge, the time span for the research, and other resources must be considered when choosing research strategy. (Saunders et al. 2019: 5.8.) Options for an approach in applied research could be e.g. *case study*, *action research* or *applied action research*. These approaches are considered research strategies, as they utilize methodologies from quantitative and qualitative research, rather than having methodology of their own. Case study, action research and applied action research all aim to develop deeper understanding of real-life phenomena. The significance of contextual factors is notable in these three strategies. (Saunders et al. 2019: 5.8)

For example, case study aims to describe or explain a phenomenon in a real-life context, without trying to change or improve anything, as action research particularly tries to solve a practical problem or improve a process or a product. In case study, the researcher is external to the research topic, keeping her/himself impartial and unbiased to the research topic. In action research the researcher is an active participant involving in the practical research process. (Blichfeldt & Andersen 2006.) While case study is a linear process, action research is a cyclic process. The cycle starts from defining the context and purpose, proceeds to diagnosing the current situation, and after that planning and taking action. As a last stage of the cycle is the evaluation of the action taken. Thereafter the cycle is iterated, possibly multiple times. (Saunders et al. 2019: 5.8.) Applied action research has the same purpose and goal as action research, as it intends to solve a

practical problem or develop a process or a product to result in something better. In applied action research, organizational development turns into scientific research when the process is documented, and scientific methodology produces reliable knowledge. (Kananen 2013: 20-22.) Mixed methods can be used in all the research strategies described above. Quantitative research methods like surveys, questionnaires or structured interviews can be used to help the main research which is done using qualitative research methods like semi-structured or in-depth interviews with interaction with the participants.

In this thesis, pragmatism is the area of research philosophy upon which this research is conducted. The research strategy is applied action research. Pragmatic viewpoint is suitable, as the thesis addresses a practical problem, and the goal is to find a practical solution to improve the process management. This thesis uses semi-structured and in-depth interviews and discussions as research techniques, and a structured questionnaire to evaluate the proposed solution. Ontological questions like "Is a patent valuable as such?" or "Is a wide patent portfolio a significant asset or overrated expense?" are a basis for this study. There is no universal answer for these questions and the closest possible truth lies somewhere in between. The aim of this study is to utilize abductive logic to find the best answers and develop a consistent model to determine the value in this business context.

The quality of the results of this study must be considered already in the beginning, as there might be some ontological, epistemological, or axiological assumptions that influence the researcher. Although the researcher is an active part of the research process, the impartiality and neutral stance must be a starting point to be able to gain new insights. (Saunders et al. 2019: 4.2.) In addition to the researcher's existing assumptions, it is probable that the participants of the study have their own rigid assumptions on the situation. It is important to be able to have controversial discussion to engender new ideas.

The applied action research as well as the original action research have their problems in view of research quality. To ensure the quality, it is recommendable to start with *theoretical framework* to get the basis for the research crystallized. Without a framework, the research process might end up being idle and the target indetermined. (Blichfeldt & Andersen 2006.) The research must be transparent the whole way through the process. Transparency can be reached by rigorous documentation (Kananen 2013: 27) and

description of used methods, i.a. interview contents. Participants can be requested to verify summaries of interview and discussion contents afterwards to avoid misunderstandings. A reflection phase during the research process helps the thesis researcher and the other participants to understand and learn from the process. Utilizing triangulation, e.g., different data sources or multiple approaches in research is another way to improve the quality of the results. In this study, triangulation leads to using aspects from multiple organizational levels in interviews. (Näslund et al. 2010.) Although the results in applied action research are usually strictly context dependent, some part of the research theory might be possible to be generalized and thereby get a wider audience for the results (Blichfeldt & Andersen 2006).

2.2 Research Design

The following Research Design visualizes how the study was planned to be conducted (Figure 1.):

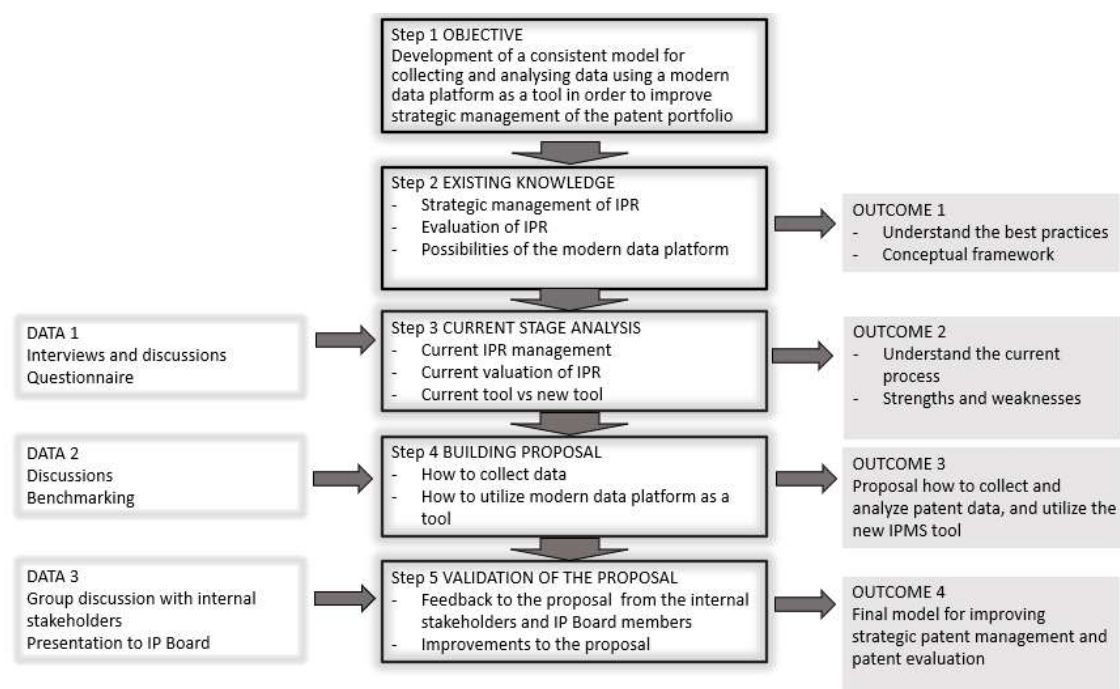


Figure 1. The Research Design of the study.

As shown in Figure 1, after defining the object for the thesis, existing knowledge in literature, articles, and white papers was studied as step 2. This included studying the existing knowledge on strategic management of IPR, evaluation of IPR, as well as studying white papers on modern IPMS tools. As a result, Conceptual framework was

made to collect the important topics on best practices. The Conceptual framework was thereafter utilized as a basis for developing a model to collect and analyze patent data in the case company. In step 3, the Current state analysis (CSA) was conducted by interviewing internal stakeholders (Data 1) on the current management and evaluation of patents and the use of current IPMS tool. The outcome was to understand the current process and its strengths and weaknesses. In step 4, a proposal for development was built based on the CSA and discussions with internal stakeholders and external IP experts. The outcome was to build a proposal, how the case company could improve its patent management processes for collecting and analyzing patent data by using modern IPMS as a tool. After the proposal was ready, step 5 was to validate the proposal in front of internal stakeholders and company IP Board. The final model for improving strategic management was thereafter made based on suggestions from the internal stakeholders and IP Board members during the validation discussions.

2.3 Data Collection and Analysis

This thesis draws from several data sources, and the data was collected in three data collection rounds. Table 1 below presents the data sources in different rounds.

Table 1. Details of Data Collections 1-3 used in This Study

	Participants / role	Data type	Topic, description	Date, length	Documented as
Data 1 Current state analysis					
1	Director, Patent Management	Face-to-face interview	Current state	May 2023, 60 min	Recordings & Field notes
2	Patent Team: Director, Patent Engineer, IPR Specialist	Face-to-face interview	Introduction and current state	May 2023, 60 min	Recordings & Field notes
3	Project Managers (2)	Online interview	Introduction and current state	May 2023, 60 min/each	Recordings & Field notes
4	Product Managers and Business Leads (8)	Online/face-to-face meetings	Introduction and current state	May-June 2023, 60 min/each	Recordings & Field notes
5	Inventors (110)	Questionnaire	Introduction and current state	May 2023	Questionnaire form
Data 2 Proposal building					
6	Director, Patent Management	Face-to-face discussion	Qualitative feedbacks & creative brainstorming	August 2023, 120 min	Internal report
7	Key stakeholders (same as Data 1)	Discussions	Co-creation	August 2023, 30 min/each	Recordings & Field notes
8	Benchmarking, other Finnish technology companies (3)	Online interviews	Introduction, evaluation process	September 2023, 60 min/each	Field notes
Data 3 Validation					
9	Group meeting with key stakeholders (same as Data 1)	Proposal presentation	Validation, evaluation, final improvements	October 2023, 60 min	Recordings & Field notes
10	Presentation to IP Board	Proposal presentation	Validation, evaluation, final improvements	October 2023, 60 min	Recordings & Field notes

As seen from Table 1, the first collection round, collecting Data 1, was conducted for the Current state analysis. During the collection of Data 1, an online questionnaire was sent to 110 internal inventors of the several hundred inventors in total in the company inventor register. The respondents were chosen by the activity in inventing during recent years. Inventors were asked about how well they were familiar with the patenting process, as well as the strengths as weaknesses of the patenting process in the case company. The questionnaire was conducted anonymous, and it received 64 responses in total. In addition, Data 1 collection consisted of semi-structured face-to-face and online interviews with the internal stakeholders, internal stakeholders meaning the patent management team, project managers, decision makers and product owners from different business units. The stakeholders were interviewed about the patenting process and its strengths and weaknesses. There were questions created beforehand for the interviews, but the discussion was free and concentrated on the points which the interviewee was considering important. Altogether, there were 12 interviews which were recorded in order to get all the important facts documented.

The second data collection round, Data 2, was conducted to go through results from the CSA and for building the development proposal. During the Data 2, same internal stakeholders were interviewed as in Data 1. In addition, external IP experts from three other Finnish technology and industrial companies were interviewed. The external IP experts brought insights and experience to how patenting processes are managed elsewhere. Based on all the interviews and discussions within the patent management team, a development proposal was built.

The third data collection round, Data 3, was conducted when the development proposal was presented online to internal stakeholders and IP Board. IP Board consists of upper management making high-level decisions concerning patent management. During the two presentations, internal stakeholders and IP Board members were giving feedback about the development proposal. Based on the feedback, final improvements were made to the proposal.

In the following Section 3, existing knowledge on patenting strategy and patent evaluation is reviewed. First, a patent strategy is closely linked with gaining value from patent portfolio and brings important aspects to patent evaluation process. Second, the Section 3 presents evaluation methods which can be utilized in the quantitative evaluation of patents. Third, the Section 3 gives an overview of IP managements systems. As a whole. the existing knowledge and best practices connect the patent evaluation with strategic management of patents and utilization of modern IPMS. Understanding the interconnection of these concepts helps in creating the model for evaluating patents in the case company.

3 Existing Knowledge and Best Practice on Strategic Management of the Patent Portfolio

This section discusses available knowledge and best practice on collecting and analyzing data using a modern data platform (IPMS) as a tool to improve strategic management of the patent portfolio. There exist multiple monetary valuation methods for patents which can be utilized especially in licensing of patents. This thesis focuses on the defensive patent strategy and qualitative evaluation of patents which concentrates on the internal subjective value rather than external fair market value. Therefore, the strategy of patent licensing and monetary valuation of patents play rather minor role in this study. In addition to patenting, there are several further aspects to innovation protection and management. This thesis reviews legal protection strategies only in view of patenting.

3.1 Key Concepts in Patent Portfolio Management

In this section, key concepts of intellectual property, patent, patent management, and strategic patent management are discussed.

Intellectual property means outputs of human mind and intelligence. These results of intelligence can be protected for example with patents, trademarks, copyrights, and undisclosed information. Intellectual Property Rights (IPR) are governed worldwide by World Trade Organization (WTO) with the Trade Related Intellectual Property Rights Agreement (TRIPS). IPR give an individual or a company an exclusive right to utilize the result of their intellectual work. (Prabu 2022: 3-4.) Many large international companies have the most valuable part of their assets in their IPR portfolios. Examples of these are Coca Cola and Nike as well as pharmaceutical companies owning rights to medicines. (George 2012: 1.) Broadly spoken, IPR is a description of all knowledge, capabilities, and skills in a company. All this intellectual property cannot be protected, rather it must be managed. (Palfrey 2011: 3-5.)

Protectable intellectual property can be divided into copyright (and copyright related rights) and industrial property. Further, industrial property can be divided into protection of distinctive signs, for example trademarks, which differentiate products and services from the equivalents of competitors, and into protection of technological innovation and design, which include for example patents, industrial designs, and trade secrets. With

contribution of IPR, investments can be protected and thereby encourage and inspire research and development. (Prabu 2022: 6-7.) Metaphorically, IPR can be seen as a sword and a shield in the battlefield of trade. As a sword, IPR can be used to attack competitors who try to move on to the market violating existing IPR, or as a shield, if competitors try to attack company operations. However, this traditional metaphor gives a too simplistic picture of the benefits of IPR: Court proceedings should be the last resort and the primary way of acting is around negotiation table. (Palfrey 2011: 2.)

Patent is a familiar term for most people, but details of the concept and the patenting system are often unclear or misinterpreted. Patent can be granted to an invention that is novel in comparison to existing technology or knowledge and which contains an inventive step so that the solution would not be obvious to an expert skilled within the field of the invention. In addition, it should be possible to utilize the invention in industrial scale. However, it does not mean that everything that fulfils these three requirements is patentable. For example, scientific discoveries, mathematical methods, or algorithms are not patentable as such, but the two latter ones can for example be a part of a patentable solution. (Prabu 2022: 9-11.) During the last decades, patenting possibilities have been extended to new fields of business by policymakers and authorities. Therefore, it is currently possible to patent for example software (Jell 2012: 1). Patents must be applied and maintained in each geographical area separately as there is no worldwide patent protection (Gassmann 2021: 39). Patents have a maximum validity term of 20 years (Prabu 2022: 14).

Patent management means managing and maintaining the company patent portfolio. The portfolio consists of pending patent applications which are filed in patent offices around the world and of granted patents which are actively maintained with annual maintenance payments. The size of the patent portfolio can vary from just a couple of patents to tens of thousands of patents. With help of internal audit, the patent application and granted patents are whether maintained or discarded according to the value that the patent application or the granted patent brings. (Prabu 2022: 19.) In addition, the prosecution of patent applications must be managed as patent offices constantly communicate with the patent applicant. Strategic patent management indicates that management decisions and maintenance of patents are done in a meaningful and rational way with the best value gained from the portfolio. (Gassmann 2021: 12.)

Costs influence managing patents and building clear patenting strategy. The next section introduces the cost structure of patenting.

3.2 Costs of patenting

There are several costs related to patenting which are examined in this thesis separately as three entities: first research & development (R&D) costs before the actual patenting starts, second the costs related to the patenting process from invention to granted patent, and third the possible costs of enforcement. The second entity of costs, patenting process itself can be divided into three phases (Gassmann 2021: 55) which each have their own costs involved. The first process phase is the invention phase where the company has received an invention notification from inventors and the discussion and development concerning the invention is ongoing. Thereafter the follows patent application prosecution phase when the patent application has been filed at least in one jurisdiction. The third and the last phase is the maintenance phase after the patent has been granted. From the three separate entities of R&D costs, patenting costs and enforcement costs, the costliest part is the enforcement of patents in case litigation proceedings are started.

Traditionally, patents have been seen as quite a costly investment especially for small and mid-sized companies. However, the value patents produce will probably exceed the costs in the long run, if managed well. Further, not investing in the protection of innovation might result in financial losses. (Prabu 2022: 9.)

3.2.1 R&D Costs

Costs of the research R&D phase are increasing as technologies are becoming more dynamic and requirements for research are increasing. At the same time, companies want to protect the results more actively to capture the value of R&D work. Global competition has made the innovation cycles become shorter and yet costs constraints become tighter: new products are expected in shorter time intervals and with competitive cost. Low-cost imitations of products follow shortly after a new product is launched which requires careful and instant protection of IP. As the technological and innovative leadership is very important on many fields, investing in IPR is becoming more and more important. (Gassmann 2021: 1-3.)

There is a clear correlation between the company expenditure in R&D work and the spent on patenting (Mishra 2021). It is difficult to assess which costs of the R&D are directly or indirectly related to an invention. Although R&D work is necessary for creating inventions and innovation, its costs are not necessarily taken into account when IPR costs are counted. Inventions are usually a result of R&D but inventions and patenting are only a relatively small part of R&D work, and counting costs of an invention may not start until the moment something is invented. With a clear strategy on what the company wants to protect with a patent it is possible to manage the patenting costs.

3.2.2 Costs of Patenting Process

Costs of patenting process become topical after an invention is identified and it is necessary to protect the invention with a patent. In this phase an external patent attorney may become involved in drafting application and filing the application in patent office(s). (Gassmann 2021: 39-42.) Four types of costs related to patenting process can be specified:

- external patent attorney costs if the application proceedings are handled by external patent agent
- official patent office fees and translations
- annual patent maintenance fees to national patent offices (Gassmann 2021: 39-42.)

When a company decides to apply for a patent, the application is drafted together with the inventors and patenting professionals. Many times, services of external patent attorneys are utilized, but there are also companies in which internal patent engineers take care of the drafting and applying process completely themselves. If external professional services are utilized, it makes the patent application drafting and prosecution phases the most expensive part of patenting as the cost of drafting can be several thousands of Euros. (Gassmann 2021: 39-42.) External patent attorney costs seem to be quite on a similar level all over the world. Second highest cost in the prosecution phase comes from the translations if they are needed. Some patent offices also have distinguishably higher office fees than others, for example the US patent office (USPTO) and European Patent Office (EPO). On the other hand, patent offices in for example Brazil, China and Russia have relatively low office fees. (Park 2010: 39.) However, the regular official fees for a patent application and a granted patent in regional and national patent offices can exceed several thousands of Euros (Gassmann 2021:

39-42). It is also notable that in relation to the gross domestic product (GDP), the US patent office costs are on a very low level as the market that the patent covers is huge (Park 2010: 41).

The costs are very much dependent on the length of proceedings in patent office(s) as different patent offices have different resources to handle applications. Patents also differ greatly with relation to their contents. There can be one or several decisions, i.e. Office Actions from the patent offices which require responding. Every Office Action response indicates more costs in form of external attorney costs and in-house patent experts time dedicated to each response. As the proceedings go further in the patent office(s), also extra office charges for re-examination can occur. (Mishra 2021.) The costs must be covered before there are any certainty about the patent being granted or rejected, and possibly without any certainty about the patent ever bringing any revenue to its owner. (Park 2010: 41).

As the prosecution phase costs to obtain a granted patent are even 75 % of the accumulated total costs of one patent, the significance of the desired patent protection should be evaluated in good time to prevent the situation, where the costs are already occurred but the granted patent results to be of low or no worth. The application proceedings must be executed in all the desired countries separately, and the process in one country may exceed 10 000 Euros. (Gassmann 2021: 39-42.) Usually, the in-house patent department is responsible for the patenting budget and the target for patent application filings. The filing target should be divided for the different units in the company or even sub-divisions in the unit and be included in the units' /sub-divisions' Key Performance Indicators (KPIs). In addition to filing target for each unit or sub-division, the costs for the patent filings, prosecution and maintenance should be estimated for each year and the risk for surprises in patent examinations should be assessed. It is difficult to estimate the costs of patenting process and the one-year budgeting is not matching with the timespan of patent proceedings which can be anything from one year to eight years or more, varying in different countries and even within one country. Some years can bring in high amount of proceedings costs while other years can be quiet, resulting from the irregularity in patent office proceedings. Moreover, also the contents of the patent, for example the domain and the clarity of contents affect the timespan of patent proceedings. (Mishra 2021.)

The costs of patenting process also depend very much on the path how patent is sought. Initiating the process in one national patent office has the lowest cost, whereas the regional patent application is more costly, but several countries can be validated at relatively low cost. (Park 2010: 38-39.) Patent Cooperation Treaty (PCT) enables seeking patent protection in 148 countries with one application, but the examination result of patentability is not binding in the national patent offices: it is only directional and facilitates the national application proceedings. PCT application process gives a patent applicant 2,5 more years to decide to which countries the patent should be pursued, and the countries need to be decided only after the examination on the patentability has been received. Regional patent offices the *European Patent Office (EPO)*, the *Eurasian Patent Office (EAPO)*, and inter-governmental offices the *African Regional Intellectual Property Organisation (ARIPO)* and the *Organisation Africaine de la Propriété Intellectuelle (OAPI)* offer validation of patents in multiple countries with one application. (Gassmann 2021: 39.) The international PCT patentability examination and the regional patent applications are advantageous when wide geographical protection is desired or when there are several important countries in the certain region. If there is only one or few target countries for the patent, separate national patent applications are a reasonable choice.

In addition to the costs of patent application proceedings, maintenance of granted patents brings costs. Maintenance fees must be paid in most of the national patent offices separately every year. The annual maintenance fees vary in different countries and during the life span of patent which is 20 years. The fee increases yearly, with the first years being some tens or hundreds of Euros, and the last years varying from hundreds to thousands of Euros. Thus, patents become more expensive during the late years of their life span. (Gassmann 2021: 39-40.) Hence, the less valuable patents are let lapse earlier and only valuable patents are maintained the whole twenty years of life span. If maintenance costs are considered for the first 10 years vs. for the whole 20 years, there are different countries leading the most expensive position on ranking list. For example, Germany has relatively low fees during the first 10 years but has significant progression towards higher fees during the final years. Patents are usually maintained longer in larger economies because the possible higher income more probably compensates the costs. (European Commission 2014: 22.) Higher maintenance fees and possible translation costs make some countries more expensive than others. To optimize the value of the patent portfolio, the countries in which the patent protection is needed, must be carefully considered. In some countries, enforcement of patents may

be difficult due to local conditions. When determining the countries, the general company strategy must be taken into account. (Gassmann 2021: 39-40.)

As a result, a clear patenting strategy is the key to managing the costs of patenting process. There are several questions to be answered in connection with patenting process: Why is the patent sought and what are the expected benefits from the granted patent? What is the proportion of work done in-house/by external patent attorney? How many decision-response rounds in patent office(s) is the company ready to pay and what kind of restrictions are accepted in the scope of protection in order to get the patent granted? How wide geographical protection should be pursued and which filing path (national/regional) should be chosen? Making strategic decisions helps managing the somewhat unpredictable costs of patenting process.

3.2.3 Enforcement Costs

Unlicensed and unauthorized use of patents is probably quite pervasive in many fields. Especially it is common in research. There are a big portion of patents that are never enforced, either because the patent proprietor has no resources or interest to enforcement proceedings, or because the infringements are not detected. Lack of resources may also be the reason for not detecting infringements. (Eisenberg 2011: 54.) If infringement is detected and not ignored, the patent owner can contact and ask the infringer to stop using the patented solution or possibly negotiate a license agreement. This would be the lower-cost practice of handling infringement. If the infringer is not willing to negotiate, it can lead to litigation proceedings in court where the patent right is sought to be enforced. These enforcement proceedings can be extremely expensive and therefore, the significance and strength of the litigated patent should be carefully considered. In case the infringer has some useful patents, cross-licensing could be an option, too. If the patent is strong and the scope of protection is broad, court proceedings might end up in excluding a competitor from the market which could bring significant advantage for the patent owner. (Zullo & Karmas 2008: 276-277.) If an infringer is sued for the use of a patent, a common defense is for example a counterattack against the validity of the patent. In many cases, patent contents are not so straight-forward nor strong, and the result of court proceedings may be very unsure. Due to the uncertainty and high costs of litigation proceedings, they frequently end up with a settlement between the parties. (Gassmann 2021: 34-35.)

Patents can be enforced only in those countries, where the application has been filed and granted (Gassmann 2021: 39). Hence, litigation proceedings must be executed separately in those countries where the patent is granted. Of course, if a patent is kept in force in one jurisdiction after litigation process, it is a strong sign that the same verdict will possibly follow if litigated in other jurisdictions. The same applies to revocation verdict: it makes the patent vulnerable and weak in other jurisdictions, too. The European Unitary Patent (UP) which has applied since June 2023 is an exception with its court proceedings: if a patent is applied via European Unitary Patent system, infringement proceedings are conducted before Unitary Patent Court (UPC) and the validity of patent can be litigated simultaneously in all the European countries which are included in the Unitary Patent (EPO 2023).

3.3 Patent Management

The significance of innovations is notable in industrial countries nowadays as half of the economic growth derives from innovations. More innovation indicates more profits. In order to create more profits, it is not enough to innovate, but it is essential to protect the innovation to enable the capturing of the underlying value. Well managed patent protection and high-quality patent portfolio influences company success and market value in a positive way. (Gassmann 2021: 4, 8.) Investors are more and more aware of the significance of professional management of IP, and the significance of IP portfolio in due diligence procedures is increasing (Tanskanen 2011: 37). With effective and professional patent management the optimization of the value of patent portfolio is possible. (Gassmann 2021: 10.)

However, the complexity of patenting has increased during the past decades partially because of new technologies, partially because of the increased significance of intellectual property amongst private companies. It can be debated if the increasing amounts of patent applications have led to decreasing quality of patent applications. This could indicate that companies want to file more and more patent applications to widen the company patent portfolio without looking too much in the quality of the applications. Due to the increased complexity and increased amount of patent applications, the management of patent portfolios has become more complex in view of combining the patenting strategy with the company strategy. (Jell 2012: 1-6.)

3.3.1 Difficulty of Making Quality Decisions

In complex environment, management decisions should be based on facts to enhance the quality of the decisions. Many times, decisions are made purely based on earlier practice and experience, ideologies, perfunctory recommendations, or even hope and fear. If decisions are based on facts, it will have a clear impact on value creation of the company. (Pfeffer 2006: 5-6.) It is probably impossible to avoid conventional wisdom and accepted truths in any business field: usually data is incomplete or there are even no data available. However, companies should aim at gathering new and more useful information on which decisions can be based. (Pfeffer 2006: 14-18.) As humans are the ones who make decisions, the outcome is never totally predictable nor perfect. According to Larrick (Locke et al. 2011), decision frames are too narrow when there is not enough valid information. The target should be to broaden the decision frame: multiple objectives, alternatives, and outcomes as well as prospects should be considered, not just approve the first or obvious solution without a doubt. By engaging different experts with different perspectives, decisions can be made within a broader frame, and not get stuck into individual assumptions.

For example, it is notable that if decisions are always made within the same network of people, the quality of decisions becomes lower as the perspectives of the network come closer to each other. Therefore, it is recommendable to regularly seek different views from outside the network. When a decision needs to be made, all the people involved should think over the facts related to the problem to be solved before any proposals are introduced. This prevents the narrowed decision frame where everyone agrees to the first proposal without considering different objectives, alternatives, and outcomes. People tend to aim to reach consensus, but in view of quality decision making, a little bit of friction is beneficial. Engaging several people with narrow frames and combining the knowledge will also lead to broader understanding and more complete decision. (Locke et al. 2011: 461-471.)

Certain limitations to broader decision frames should be considered, too. First, one needs to consider the practicality of the actions to broaden the decision frame, as the actions take time and effort. The balance between the benefit of adding important attributes, alternatives, and perspectives, and the harm of overwhelming amount of information must be found in relation to the importance of the decision. Sometimes, if one attribute is clearly superior to others, or the significance of decision does not require

multiple perspectives, it might be reasonable to avoid lengthy discussions and make the decision quickly with a narrower frame instead. (Locke et al. 2011: 472-473.)

Thus, like in all management, a strategy behind decisions creates a base for quality outcome and capturing value. The next section discusses which strategic aspects effect patent management.

3.3.2 Patent Strategy

Companies can have several types of patent strategy. Depending on whether only the company's own operations want to be protected and competitors blocked, or whether technological leadership and competitive advantage or licensing revenues are the target, the strategy should be determined. Patent strategy determines the importance of patenting on different domains, production areas, and markets and the scope of expenses and risks approved for each, and what kind of methods are used in protecting patents against infringements. (Gassmann 2021: 27.)

In addition to determining the strategy, it needs to be implemented consistently. The perspective should not only be internal, as activities of other operators from own and other technological domains as well as activities of research institutions should also be followed. (Agostini, Nosella & Holgersson 2023: 1055-1056.) With contribution from IPR, it is possible to have notable influence on the company position and competitor activities on the market (Gassmann 2021: 27). However, many times patent application filings are solely considered as indicators of innovative activity without any specific strategy on the background (Jell 2012: 15), Thus, patenting decisions might be made in frame of budget given to IPR department without connection to the company strategy (Agostini, Nosella & Holgersson 2023: 1056).

If summarized from Gassmann (2021: 10) and Jell (2012: 11), six main advantages which patents have on companies' business make the basis for determining patent strategy, as listed below:

- Product-related patents bring in market revenues
- Blocking competitors from using the patented technology creates comparative competitive advantages
- Increasing the attractiveness of products in marketing

- Enhancing company reputation
- Direct licensing revenue
- Access to patent pools and cross-licensing (Gassmann 2021: 10, Jell 2012: 11).

According to Jell (2012), patent strategy should be aligned with general company strategy, and moreover, with detailed strategy of each patent related business unit or product line. The alignment of the strategies gives a clear boost to company success. (Jell 2012: 115.) Patent strategy tells which inventions and patents the company considers as key assets and where money should be invested in. To be able to align the patent strategy with the company strategy and set up a production- and product-oriented financial framework for patenting, contribution from several business units and managerial levels is required. (Gassmann 2021: 27-29.)

Different companies have different starting points for patent management and building strategy, as the company size and human capital have influence on the process development. What has even bigger effect on the successful patent management strategy implementation is the company culture. If the company culture does not represent the strategy, the strategy might remain on rhetoric level. (Agostini, Nosella & Holgersson 2023: 1056-1057.) For example, cooperation between Patent Management, R&D and Corporate Development departments and engagement of top management are essential in ensuring a strategic protection of innovations (Jell 2012: 116).

Effective management of patent costs might require that the costs are allocated to each business unit in order to get the full attention of the unit managers. When business units are responsible for the patent costs of their own technology, the interest for the patent management increases. However, this requires that all the patents are carefully associated with business units and product lines, and the business unit managers understand the contents and the value of the patents completely, otherwise very important patents may be abandoned just because of high costs. (Smith & Parr 2018: 179.) Key patents can have significant effect on company's market position by increasing the value of products, creating freedom-of-action or freedom-to-operate on the market, or bringing in licensing revenues. On the contrary, if competitors possess key patents for their products, or when freedom-to-operate does not exist and competitors block one's activities with their patents, there is a severe negative effect on the market position. Many times, attention is drawn to the nonexistent patent strategy, only when a company is blocked by its competitor for the first time. (Gassmann 2021: 27-29.)

To optimize the value of patents, patent department must find answers to the following strategic questions each time when patenting decision is made: Why is the patent sought? What are the costs vs. benefits? Which are the company's main operating markets related to the patent? Which are the main competitors on the patent-related market and on which other markets do they operate? What other specifications or support are needed from the business unit responsible for the patent, or from other areas of strategy? (Gassmann 2021: 28-29.)

The overall emphasis on the answers to the strategic questions marks the way towards either offensive or defensive patent strategy which are discussed in the following section.

3.3.3 Offensive and Defensive Patent Strategy

A patent strategy can be active or passive and anything in between. With active patent strategy, a company protects all innovations, even outside the scope of its own operations. Litigation possibilities are actively sought. With passive patent strategy, only the core innovations are protected. However, many companies do not have a patent strategy of any kind. (Tanskanen 2011: 40.) Those which have a strategy, can emphasize offensive or defensive strategy.

Offensive patent strategy indicates active patenting and aggressive enforcement of patent rights. In this strategy of *patent flooding* (Jell 2012: 11), attacks on other companies are actively initiated to gain compensations for infringements of patent rights or reach licensing agreements. Some companies even have a business model, where the only business comes from owning patents, selling licenses, and suing others to get compensated. (Gassmann 2021: 30.) With offensive patent strategy, a company might build a "patent wall" by filing several patent applications with contents close to each other with no intention to start using all of these similar solutions. The aim is only to prevent competitors from using any solution that would be close to the solution which the patent owner is commercializing. (Blind, Cremers & Müller 2009: 429) With active patenting, competitors can also be bluffed to think that a certain technology path has been chosen. (Gassmann 2021: 30). Patent application might be left pending for a long period without actively pursuing the grant. For competitors, this means a long time of uncertainty because the grant, rejection or withdrawal of a patent application is not certain, and furthermore, the motives and views of the applicant company remain unclear. (Jell 2012:

16-17.) However, as professionals warn, misleading of competitors must be well planned and not utilized too frequently. (Gassmann 2021: 30.)

With *defensive patent strategy* or *patent fencing* (Jell: 2012: 11) a company tries to protect its own business with patents and the goal is to have as little counteraction as possible with third parties. Defensive strategy can be aggressive if patent rights are strictly monitored and enforced actively. The target is to protect company's own business operations and to prevent others from utilizing company's technologies or designs. (Gassmann 2021: 27-31.) For example, in information and communication sectors defensive strategy can be used actively when negotiating with other firms on technology access. The bargaining power of a company is stronger with a strong and wide patent portfolio (Blind, Cremers & Müller 2009: 429.) Defending and utilizing the company's patent portfolio are external protection-related activities (Jell 2012: 116) which are important for maintaining the value of the patent portfolio, because if a company does not monitor its patent rights, the value of the patents is considerably declining especially in the eyes of competitors (Gassmann 2021: 27-31).

Large companies may also entwine offensive and defensive strategy to a hybrid one where characteristics from both strategies are combined. For example, different units may have different strategies if operated in different domains. (Gassmann 2021: 31.) In addition to different companies having offensive or defensive patent strategy or a mixture of those, there can also be differences between industries in general way of acting. Some industries can have very aggressive operations on patenting field towards competitors as other industries can be very passive and there might even be general habit of not interfering with other companies patenting or infringing operations. In the next section, the defensive patent strategy is discussed further.

3.3.4 Main Characteristics of Defensive Patent Strategy

With defensive patent strategy, company's own products are actively protected with patents in order to ensure the company's operations. Patents are also defended against infringement, if necessary, but litigation activities are not actively sought. Many leading international technology companies have a defensive strategy to secure their own freedom of action and at the same time prevent others from using their solutions in products (Gassmann 2021: 32). When protection of innovation is essential in a company, three main goals can be distinguished:

- Ensuring Freedom-to-Operate (FTO)
- Differentiation from competitors
- Licensing revenues (Gassmann 2021: 32).

Freedom-to-Operate. When a company wants to protect its Freedom-to-Operate, the emphasis is to ensure that company operations do not infringe competitor patents and the own patent portfolio protects own products and technologies wide enough. To prevent third parties from blocking company operations, it is important to actively monitor third-party patents, analyze the possible future paths for product development and pursue to circumvent the third-party solutions. (Gassmann 2021: 32-39.) Building patent walls is an example of ensuring FTO, as filing several similar patent applications helps the company keep the possible technology solutions available to itself and simultaneously blocking the way from competitors (Torrise et al. 2016: 1375). Maintaining FTO requires also defending against possible infringement actions that third parties raise. The most effective defense action nowadays is counterattack where the validity of the attacker's patent is disputed. However, the high costs of litigation proceedings must be considered in good time. When a circumvention of a patent or litigation proceedings are not reasonable, licensing or acquiring the patent right offer a solution. As litigation and invalidation proceedings are usually ponderous and costly, for example European Patent Office, German Patent and Trademark Office and US Patent Office offer the possibility to oppose granted patents within a certain period. Opposition proceedings in patent offices are considerably more economical to execute than court proceedings. If the opponent of the granted patent has good enough justification for the opposition, it might result in narrower scope of protection for the patent or even revocation of the whole patent. This would be a success for the opponent's FTO. (Gassmann 2021: 32-39.)

Differentiation from competitors. Company's products and technologies can gain comparative competitive advantages in relation to competitor products and technologies if they have patented features. The value of patented features diminishes if the patents are not actively enforced in case of infringements. Preventive strategy is therefore not sufficient and active defense against infringement is necessary. Furthermore, disruption of competitors by aggressively attacking their patent rights might also increase the value of company's patent portfolio. (Gassmann 2021: 32-39.)

Licensing. Value of a patent can be multiplied with commercializing. The patented solution can be openly offered to third parties (enablement licensing), or license

agreement can be a settlement in connection with litigation proceedings (enforcement licensing). In general, the significance of licensing is increasing in company operations and there are even business models that are completely based on licensing. (Gassmann 2021: 32-39.)

The three goals of FTO, differentiation and licensing are essential also in less active, *preventative* patent strategy, and the more active, *offensive* patent strategy. Gassmann (2021) introduces these three different dimensions for a patent strategy and how the meaning of the goals differs in different stages. The dimensions are reflected in the below matrix:

Motivation for usage	III. Goal Value Multiplication through Licensing	Reputation	Enablement-licensing	Enforcement-licensing
	II. Goal Differentiation	Discourage potential imitators	Legal action against imitators	Disrupt competitors
	I. Goal Freedom-to-Operate	Develop products outside reach of 3rd parties	Defend against infringement action	Design access (licensing, legal objection, invalidation)
		Preventative	Defensive	Offensive
		Activity level		

Table 2. The core dimensions of a patent strategy (Gassmann 2021).

In Table 2, the two dimensions are the *motivation for usage of patents* and the *activity level* where the company operates. The motivation has three levels, freedom-to-operate representing the lowest level, differentiation with products the middle level and pursuing licensing revenues on the highest level. All the different motivation levels can have different levels of activity, ranging from preventative to defensive and offensive. On preventative level the activity is rather passive, just ensuring the own operations by carefully developing products that won't infringe competitor patents and hoping that company's own patents will courage competitors for the same. Licensing revenues are not actively sought. (Gassmann 2021: 32-39.)

The second level of activity contains already defending the company's freedom-to-operate against infringement accusations for example by counterattacks, and actively starting legal actions against imitators of own patents. Licensing on this level is

enablement licensing, where license is granted to parties that are interested to use the company's patented technology. (Gassmann 2021: 32-39.)

On the third level of activity, freedom-to-operate is actively sought by trying to find ways to circumvent patented solutions, licensing patented solutions or trying to nullify other parties' patents through invalidation claims. Differentiation on the market is aiming to disrupt competitors instead of only enhancing own competitive advantage. Licensing is started via enforcement, forcing parties who are unwittingly or intentionally infringing a patent to license negotiations. (Gassmann 2021: 32-39.)

Defensive patent strategy can be practiced without deeply considering the quality and significance of each patent in a patent portfolio. A company with a defensive patent strategy may just patent everything that seems patentable and monitor possible patent infringements actively. However, if a company wants to level up with patent strategy to the cost control level, a detailed patent evaluation must be conducted. (Smith & Parr 2018: 177-178, Soranzo et al. 2017.) Patent management processes should be implemented and structured in a way that they correspond to the needs, capabilities, and innovation strategy of a company (Soranzo et al. 2017).

Companies should determine where they stand in connection with the dimensions of patent strategy. What is the motivation for patenting and what is the applied level of activity? Although there should be a general and all-encompassing strategy at least on a business unit level, sometimes there might be a need to review patent strategy for an individual patent separately, as some particular patent might require examining or changing patent strategy completely.

3.3.5 Alternative Strategies for Patenting

It is important to understand that patenting is not always the best way to protect company innovation. After considering cost-benefit-ratio, there are also further aspects to take into account.

Sometimes it is not advisable to disclose too many details of a design or technology to competitors. When applying for a patent, the details of the innovation are published for anyone to see. Patent publication might lead to further similar or better innovations by third parties. Thus, it might be a better solution to keep an innovation a trade secret, if

secrecy is possible and third parties cannot investigate the solution for example by disassembling a product. (Gassmann 2021: 42-48.) Patent gives an exclusive right to use and produce a patented solution, but only for limited time of 20 years. Trade secret conversely can be maintained forever if secrecy is successfully kept. (Daizadeh et al. 2002: 1053.)

Further reasoning for not applying for a patent is when it is difficult to monitor, whether a third party is infringing the patent or if enforcement is difficult. Monitoring infringements might be difficult for example with some software solutions. Enforcement might be difficult in certain geographic areas due to country specific conditions. In case of difficulty of monitoring or enforcing patent right, the solution could be a *defensive publication* of the innovation in order to prevent anyone else patenting the same solution: published innovation is not novel anymore and thus cannot be patented by a third party. (Gassmann 2021: 42-48.) Defensive publication could be suitable for example if the innovation is not inventive enough or valuable enough to pursue for a patent, but third-party patent applications on the same topic need to be prevented (Jell 2012: 26-27).

If product cycle on the company's operating market is fast, patenting is not reasonable as the solution would be outdated already by the time the patent would be granted. Then it is strategically wise to rely on the speed and offer the solution as one of the first ones on the market. (Gassmann 2021: 42-48.)

Designed complexity is also one way to prevent competitors from imitating company technology and solutions. Example of designed complexity is the tacit knowledge of the complex processes behind the technology, which enables a company to produce its products in the most effective way. Important aspect related to tacit knowledge is the significance of skilled and loyal personnel in a company. (Gassmann 2021: 42-48.)

The strategic decision-making process concerning the alternative strategies for patenting is described in Figure 2 below. It illustrates if a decision should go towards trade secret, defensive publishing or filing a patent application in a situation where patentable idea has been identified. The letter Y in the flowchart indicates answer "yes" and letter N indicates answer "no":

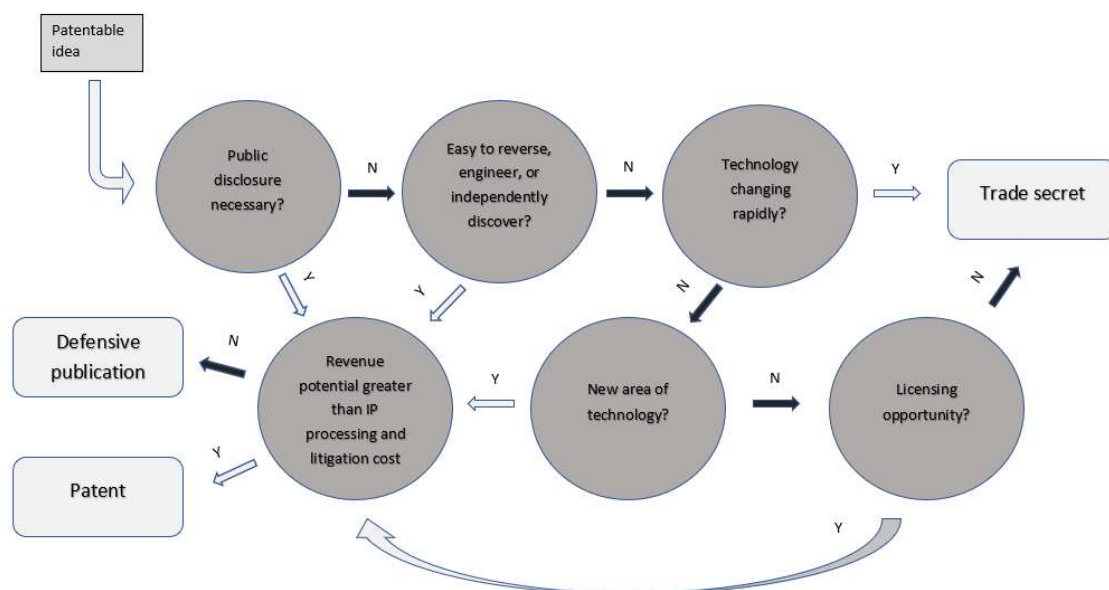


Figure 2. Decision making between patenting and alternative strategies. (Daizadeh et al. 2002: 1054).

The general patent strategy should also contain the framework for not-patenting decisions. Depending on the industry, the alternative strategies for patenting can be extremely important and more widely used than patenting itself. For all the stakeholders of patent management to understand the impacts of patenting and not-patenting decisions, it is important to clearly communicate the reasoning and the strategy.

3.4 Evaluation of Patents

The value of a patent varies greatly depending on licensing potential, operating location, quality of the patent, and significance of the market covered by the patent as well as success factors of patent enforcement (Lang 2001: 8). It is important to start evaluating a patent already in early phase and continue with evaluation check-ups throughout the patent's lifecycle (Gassmann 2021: 11). Value of patents is usually context bound and there are multiple factors affecting the value. Value can be measured with qualitative methodology by determining the strengths and weaknesses of the patent, or with quantitative methodology by determining the monetary value. Gassmann (2021) points out the difference between evaluation and valuation of patents: Evaluation refers to the qualitative analysis of patent's strengths and weaknesses. Valuation on the other hand refers to monetary appraisal. This thesis concentrates on the qualitative evaluation aspects. (Gassmann 2021: 51-52.)

To ensure the optimal utilization of resources, it is significant to measure the value of patents. In most cases, patents can be ranked somewhere between high-value and low-value, which makes the valuing process hard. Initial evaluation process is necessary already when a company receives an invention notification from inventors, as it is impossible to file a patent application on every idea and innovation within R&D department. After the initial phase, valuation must be iterated during the patent application's prosecution phase and even several times during the whole life span of the patent after the patent has been granted, as changing business environment has a constant effect on patent value. After the initial valuation, the next appraisal needs to be conducted within one year after the patent application has been filed (priority year), because at that point there is still the possibility to file further applications *on the same invention* in further countries. If the international patent application (PCT) is filed within the priority year, it creates 1,5 additional years to decide the countries. After a patent is granted, starts the patent maintenance phase, from the grant of the patent till the patent expires. During the maintenance phase, the evaluation process needs to be iterated as often as changing business environment requires. (Gassmann 2021: 51-52.)

For the success of strategic patent management, it is crucial for the different stakeholders and decision-makers to stay abreast of the changing value aspects of patents in different phases of the patenting process. During patent application prosecution phase in patent office(s), the contents of the patent may for example change drastically from the initial contents. The evaluation and the further proceedings should be considered regularly. The next chapter will discuss the different value factors which need to be considered.

3.4.1 Qualitative Evaluation Factors

In evaluating patents, different aspects of value should be reviewed and weighted. These aspects include market conditions, technological and financial significance, legal status, and strategic goals which want to be reached with the patent. (Ignat 2016: 4.) The strategic goal is the first aspect to start with, to ask, why is this patent sought? Gassmann (2021) introduces the following six evaluation factors which can also be seen under the same umbrella of value aspects:

- Market factors (market conditions)
- Competition (market conditions)

- R&D criteria (technological aspect)
- Production criteria (financial aspect)
- Legal criteria (legal status)
- Overlap criteria (market conditions) (Gassmann 2021: 51-52; Ignat 2016: 4).

If a patent is directly related to a product, the effect on market potential, market volume and market growth must be considered. A product with a patented feature may be a high-volume product or a niche product, it may create a clear competitive advantage, or it may possess only a minor improvement compared to competitors' products. (Gassmann 2021: 51-52.) Patent contents have notable influence on the market value. For example, the quality and number of patent claims determine how broad the scope of protection is and how strong is the patent in case of litigation proceedings. (Ignat 2016: 5.) The market factor is also relevant if a patent is planned to be licensed or sold and the market value needs to be estimated. (Gassmann 2021: 51-52.) When selling a patent, the number of citations, geographical coverage, and possible maintained validity after litigation proceedings also affect the market value (Ignat 2016: 5).

If a patent prevents competitors from using a desired solution, it has a significant influence on competition and may generate a monopoly situation in favor of its owner (Gassmann 2021: 51-52). Contents of the patent is important in protecting products: the wider the scope of protection is, the more it affects competitor activities. If the contents of the patent can be interpreted to be weak, competitors might more easily infringe the patent. (Ignat 2016: 5) There might also be direct competition between incumbents in the size of patent portfolio. (Gassmann 2021: 51-52.) In case a company tries to enlarge its patent portfolio by number, the quality becomes a factor of less importance as the value of individual patents lie in enlargement of the portfolio.

R&D criteria refer to the technical significance of the patent, as well as investments and risks that are involved. Many times, technology companies file patent applications even on minor technical improvements or on minor changes how to implement a technical solution. This kind of minor improvements or changes do not necessarily bring any clear benefits to the related product or there might not even be any plans to productize the solution, and the value of the patent is rather low. (Gassmann 2021: 51-52.) If an invention is not planned to be applied in production, there could still be possibility to sell licenses to such patents, or even sell the patent. Life cycle of products have a big

influence on the value of patents. If technologies develop fast in the industry, patents might be too slow a tool for protecting innovation. (Ignat 2016: 4.)

Production criteria tell if it is feasible to productize and manufacture the patent related solution. If the solution requires building totally new production lines and/or acquiring new equipment, the investment may not pay back. Production costs in view of materials or labour might also be too high. If costs indicate too high price for the product, an otherwise excellent solution might not be feasible. (Gassmann 2021: 51-52.)

If there are multiple patents with a link to each other, they can generate a *patent fence* effect shielding for example a product or a solution. It is harder for competitors to try to circumvent a patented solution if there are multiple overlapping patents granted. Overlap benefit might also occur if there are synergies with other products, or possible further projects planned on the topic. (Gassmann 2021: 51-52.)

Finally, legal criteria have great weight on the value: how wide is the patent protection in terms of geographic validity, how wide or narrow is the scope of protection claimed in the patent and for how long is the patent still valid (Gassmann 2021: 51-52). Number of patent claims can also be seen as a quality factor, because claims describe the technical content and details of the invention. The more details are accepted in the patent application, the wider is the scope of protection. (Ignat 2016: 5.) When filing a patent application, companies usually try to get as broad protection as possible on the solution by writing the initial patent claims broadly. The broader the patent claims are, the more certain it is that the patent office will find objections for the patent during their examination. This will lead to narrower patent claims, and the result might be that the scope of protection has narrowed down outstandingly and hence the value of the patent has decreased. (Gassmann 2021: 51-52.) If there are legal attacks against a patent, and it survives the attacks and remains valid, it is a sign of a strong and highly valuable patent as validity uncertainties have been resolved (Ignat 2016: 5).

It is very industry or even company specific which evaluation factors should be emphasized, depending on the patent strategy and furthermore the general company strategy. It is important for all stakeholders to understand and acknowledge how the different factors play part in value creation of patents, and the strategic goals pursued in relation to those factors.

3.4.2 Qualitative Evaluation Methods

Qualitative evaluation methods in this context refer to different ways of evaluating business logic and strategic impact of a patent. These methods can be utilized to enhance strategic decisions. (Gassmann 2021: 54-61.) With help of evaluation methods, value factors can be translated into observable and measurable phenomena. In addition, the methods can contain evaluation criteria based on personal judgment of the evaluator. (Adriessen 2004: 13.).

There are multiple different models for evaluation depending on the viewpoint and the metrics chosen (Gassmann 2021: 54-61). A very simple scoring method may be used which do not indicate any more detail than low-middle-high value. On the other hand, European Patent Office (EPO) offers a very comprehensive evaluation software (IPScore) which has several tens of questions to be answered under different topics of legal stand, technology, market conditions, finance, and strategy. After answering all the questions, the software gives a result of value. (Ignat 2016: 4.) The downside of the IPScore software is the ponderous structure, especially if there is a large patent portfolio to manage.

This thesis introduces Gassmann's (2021) three types of evaluation methods: monivariate, bivariate or trivariate evaluation method. There are multiple different methods under each alternative. Also, the evaluation framework for intangible assets by Adriessen is introduced as a fourth method. All these four methods can be utilized in a very simple way, although the level of details can be increased if required.

3.4.2.1 Monivariate Evaluation Method

In the monivariate method, all the chosen criteria can be assigned a value number, which indicate the value from, for example, 0 (no worth) to 6 (excellent). The value of the patent can then be calculated through averaging the values given to each criterion, or by giving each criteria its own weight. Table 3 below presents the monivariate evaluation method with different evaluation criteria by Gassmann (2021).

Criterion		Value number (0..6)
Difficulty of circumvention for competition:		
Direct substitutes	Pract. impossible	5..6
	Requires effort	2..4
	Easily achieved	0..1
Attractiveness for competitors:		
Competitive interest	Strong	5..6
	Average	2..4
	Minimal	0..1
Discovery of competitive usage:		
Proof	Easily obtained	5..6
	Difficult to obtain	2..4
	Impossible to obtain	0..1
Direct usage in production:		
	Probable	5..6
	Possible	2..4
	Improbable	0..1
Size of respective patent portfolio segment:		
	Too small	5..6
	Appropriate	2..4
	Too big	0..1
Additional criteria:		
Future technology or future products		...
Ensuring important R&D results		...
Supporting sales		...
Strengthening negotiation position		...
Public funding for project		...
Contributes to a standard		...
Other		...

Table 3. In the monivariate evaluation the value can be calculated through averaging the values given to each criterion, or by giving each criteria its own weight (Gassmann 2021: 54).

In Table 3, different value criteria are listed on the left column. The most important criteria vary within different companies, and they can be chosen according to the patent strategy. In the middle column, multiple tiers can be determined for each criterion, and finally, in the right column, these tiers are given a value number. (Gassmann 2021: 52-54.) For each criterion, a weight from 0 % to 100 % can be determined (Ignat 2016: 5). By summarizing the value numbers, each patent receives a total value (Gassmann 2021: 52-54). Of course, it is not necessary to calculate the grand total as each criterion can be monitored separately.

The valuation criteria can be subjective or objective. Subjective criteria refer for example to the circumvention possibilities or the significance in the eyes of competitors. Under the objective criteria fall for example how many times the patent has been cited in patent examination procedures around the world, how wide is the geographical scope, or appearance of litigation proceedings. None of these *empirical indicators* cause value as such, but in general, patents which are cited frequently, have wide geographical scope or are involved in litigation proceedings, tend to have more value. Statistical studies

indicate that it is possible to draw direct conclusions about the value of a patent based on the empirical indicators. There are service providers who conduct this kind of analysis on patent data, yet the data on empirical indicators can be easily retrieved from public databases. (Gassmann 2021: 52-54.)

For example, Schindler uses a professional patent agency for evaluating patents. Their R&D department, sales department, and the external service provider evaluate patents together about every two years. The evaluation is conducted with a monovariate type of a point system. Economical, legal as well as technical aspects are taken into account and these aspects are observed in three different phases of patent's life cycle: creative phase, development phase and maturity phase. Figure 3 below shows what kind of value points and stakeholders are in the three phases (Gassmann 2021: 55).

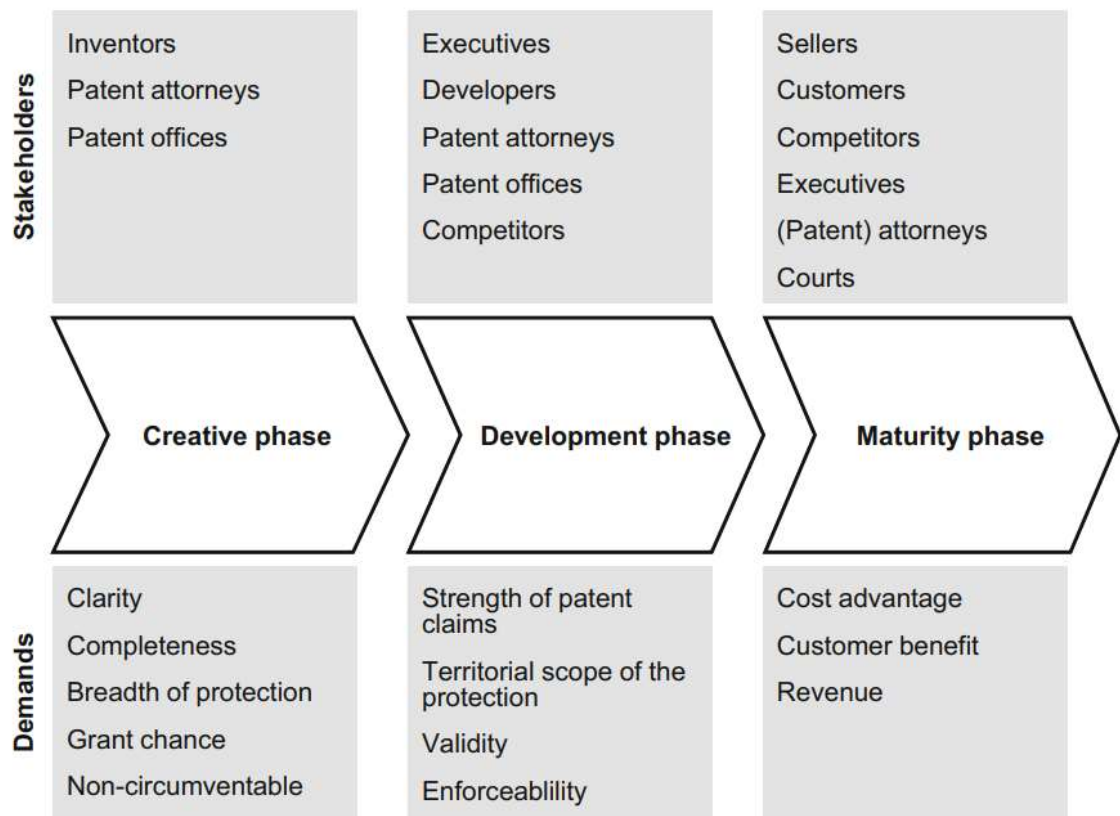


Figure 3. Schindler's monovariate evaluation method with three phases (Gassmann 2021: 55).

As shown in Figure 3, the creative phase represents the initiation where something is invented, and the inventors discuss the contents of the invention with patent attorneys. The clarity and the completeness of the invention must be developed, the possibility to

circumvent the patent must be assessed, and the desired breadth of protection decided. Thereafter the chance of reaching a granted patent must be considered. If the invention is worth pursuing, a patent application will be filed in patent office. In the development phase, the patent application is in the prosecution in patent office(s). There can be changes in the strength and validity of the patent claims. The geographic scope of the protection must also be decided. Enforceability can be related to different jurisdictions as in some geographic areas it can be difficult or impossible to enforce patents due to weak court systems or corruption.

Enforceability is an important aspect also when it would be difficult to monitor or prove infringements. However, this should be considered already in the first phase. The maturity phase has to do with the maintenance of granted patents. Are there still cost advantages, customer benefits or revenue from the patent? Is the patent worth defending in case of an infringement? In addition to the Schindler's concept, product and technical experts would be beneficial to include as stakeholders in all of these three phases.

3.4.2.2 Bivariate Evaluation Method

Bivariate evaluation method can be utilized for example when comparing the value of company's own patent portfolio to the portfolio of others. In such case, the two variables used in the evaluation would be the turnover of the company and the number of patents in the portfolio relevant to the turnover. A high number of patents does not make the portfolio valuable if the turnover produced is low. Especially in licensing-based patent strategy, comparing the number of patents to the revenue produced by licensing could help determine the value for the terms of cross-licensing agreement. Gassmann (2021) introduces also Poredda & Wildschütz (2004) approach for bivariate evaluation, where patents are positioned in a matrix with two dimensions as shown in Figure 4 below.

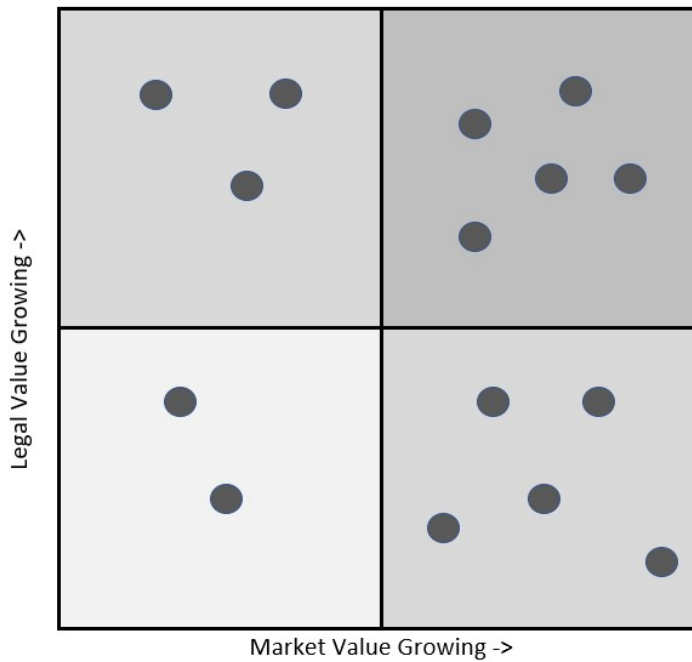


Figure 4. The bivariate evaluation examines patents in a matrix with two dimensions. The two value attributes in the matrix are legal value and market value (Poredda & Wildschütz 2004, cited in Gassmann 2021: 59).

As shown in Figure 4, the two dimensions, legal value and market value indicate the relation between the patent and the market share of the patent-related product. The attractiveness of the patented solution on the market and the product category revenue determine the market value. Legal value on the other hand includes the patentability and the scope of protection of the solution, geographic width, and infringement monitoring possibilities. This evaluation method is suitable for evaluating product-related patents. (Gassmann 2021: 56-59.) Of course, the two value attributes can be chosen differently and thereby the matrix modified to different contexts and requirements.

3.4.2.3 Trivariate Evaluation Method

The trivariate method includes a third dimension to the matrix where the three value attributes are visualized. In Figure 5 below the trivariate valuation method by Brockhoff (1999) (as cited in Gassmann 2021: 60) is presented.

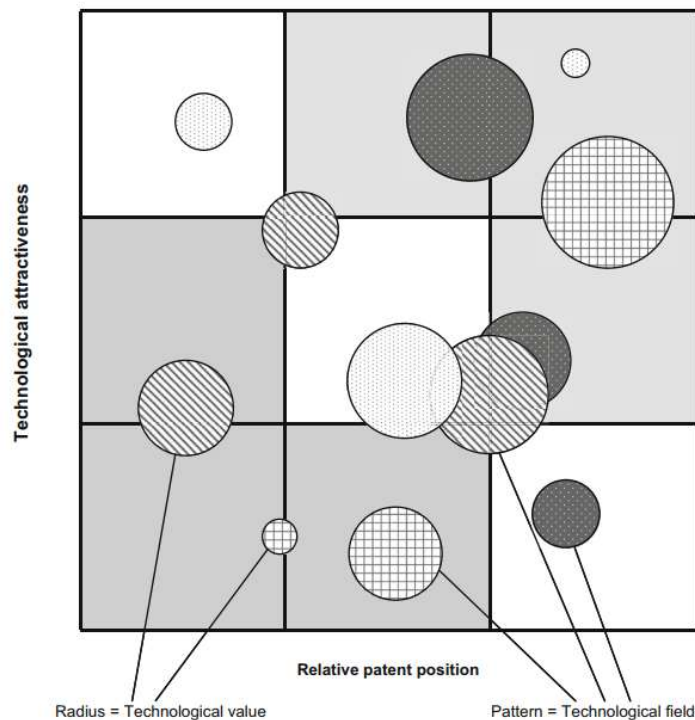


Figure 5. In the trivariate method three value attributes can be visualized in the matrix. The size of the bullet depends on the technological significance of the patent. Each technological field has its own pattern. The relative patent position refers to the patent's position in relation to other companies' patents within the same technological field. (Brockhoff 1999, as cited in Gassmann 2021:60.)

Figure 5 shows that in the trivariate matrix by Brockhoff, there are three dimensions used to indicate the patent's position. The dimensions are relative patent position, technological attractiveness and technological significance. Each technology field can be represented with a different pattern and compared with each other. The relative patent position indicates the patent's position in relation to other companies' patents within the same technological field. This ratio is calculated by comparing the number of patents the company owns to the overall number of patents in a certain technology field. The maximum result is one. This value is shown along the abscissa. The technological attractiveness, which is shown along the ordinate, can be calculated for example by comparing the growth in patent applications the company has filed on a certain technology field to the growth on other technological fields. The diameter of each circle indicates the technological significance. This can be calculated by comparing the number of patents in a certain technology field to the number of all patents in the portfolio. (Gassmann 2021: 59-61).

3.4.2.4 Evaluation Framework for Intangible Assets

Adriessen (2004) has developed a *Weightless Wealth Tool Kit* for the valuation of all intangible assets of companies. The framework also offers insights for evaluation of patents in form of checklists for identifying strengths and weaknesses. The topics for the checklists are Added Value, Competitiveness, Potential, Sustainability and Robustness. The checklists contain core questions for each topic which help determining the value. Each question is marked either yes (=1) or no (=0) and the total value is calculated based on the answers. The checklists can be utilized in meetings or workshops with business units. It is recommended that the questions are answered mainly based on market research, competitive research, and/or organizational research, with addition of business intelligence. (Adriessen 2004: 386-389.) Table 4 below introduces one example question of all five topics in view of patent evaluation.

Examples from the Adriessen's checklists	Score (1=Yes, 0=No)
Added Value: The core competence offers a substantial benefit for your customers or a substantial cost saving for your company.	
Competitiveness: Your customers choose your products or services largely because you have this competence.	
Potential: There is an increasing demand for products/services that can be provided thanks to this core competence.	
Sustainability: It would require considerable investments in time and/or money for competitors to master this competence.	
Robustness: The technology and information technology systems that form part of this competence are vulnerable.	
Total score	

Table 4. Examples of the questions of the five checklists, Added Value, Competitiveness, Potential, Sustainability and Robustness (Adriessen 2004: 386-389).

Investigation of customers' satisfaction to patent-related products is a key aspect when determining the questions for the point of **Added Value** on the checklist. Are customers demanding the patented feature? Is it probable that the demand will continue in future? High score on this point indicates that the patent protects a feature of a product which brings operating or cost benefits, or for example a process which saves manufacturing

costs. Customer satisfaction surveys or market analysis can help to answer the added value questions. Questions concerning **Competitiveness** should be determined in view of solutions which make customers choose a product or service over competitors' equivalents. Do other competitors have a similar solution to the patented one? Is the patented solution easy to circumvent? Answers to the questions about competitiveness can be found out from competitive research together with business intelligence. Checking for patent's **Potential** is about the future possibilities. Does a patented solution offer new opportunities in the future? Is it possible to enter new markets thanks to a patented solution? Are there economic, social or regulatory threats affecting the utilization of a patent? Market research and research for economic and social developments can help answering potential-related questions. **Sustainability** refers to how easy or difficult the benefits from a patent can be sustained in the long run (or during the lifetime of a patent). Is the patented solution difficult to copy due to skills, knowledge or processes the company masters (probably not advisable to patent in the first place, rather better to keep as a trade secret)? Are there other patents, trademarks or legal measures protecting the solution? Market research and business intelligence helps with answering the sustainability questions. **Robustness** checklist of questions deals with the vulnerability of a patent. Are there any value or norm changes likely to happen which would affect the benefits of a patent? Are the processes supporting a patented solution reliable? Are the skills and knowledge related to a patent dependent on a small group of specialists? Answering yes to the robustness questions indicates a degree of vulnerability. (Adriessen 2004: 386-389.)

Reviewing and discussing the core questions under these five topics can produce new insights on evaluation of patents. Possibilities to improve the score that a patent receives can also be studied. Each company must determine their own essential questions to their operations.

A company should determine which is the most practical way of analyzing patent value. The alternatives vary from the simplest method of scoring from one to 3 to very detailed methods of multipage evaluation. However, clear, and visual presentations make it easier for patent departments to get the message through and understood when presenting patent value related topics to different stakeholders.

3.5 Intellectual Property Management Systems (IPMS)

There are several software applications developed for enhancing patent and other intellectual property management. Traditionally, intellectual property management systems (IPMS) have been quite simple docketing systems, keeping documents organized and tracking due dates, the modern IPMS have been developing towards interactive direction with automated processes and a lot of integration possibilities. Modern IPMS also offer company-specific configuration and customization for the IPMS platforms. (Clarivate 2021: 2; Dennemeyer 2023: 3.)

Data on IP assets is constantly changing. In addition, employees, business strategies and resources change, and therefore IP requires active management. Manual management of IP may be possible in a small-scale, but as the portfolio grows, it becomes more and more complex with higher risks and reduced value gained. With help of IPMS, IP management becomes structured and effective by making processes more automated and repeatable, connecting stakeholders, and enabling clear visibility to the portfolio. This leads to increased corporate value and competitiveness, higher revenues, and lower costs. IPMS facilitates communication which is one of the obstacles in effective IP management as there are multiple stakeholders involved. One key to good communication is data visualization. Visual reports and graphs are easily retrieved from IPMS. (Smith & Parr 2018: 360-363.) Ackerman (in Smith & Parr 2018) introduces five important questions that could be answered utilizing IPMS: *“Who are the most prolific inventors? What products have sprung from their invention disclosures? What are the patented technologies and other intellectual property assets contained within each product or service? What are the most IP-rich divisions within the company? Which of the company’s IP rights are connected to licensing agreements?”* (Smith & Parr 2018: 363.)

Databases developed for managing intellectual property have existed already for at least two decades, but the functions of IPMS have developed a lot over the past ten years. The development of earlier versions of IPMS was started partly because some companies identified the patchwork of different kind of self-made and unfit systems as inefficient and risky for IP management (Anaqua). The first IPMS were closed systems offering mainly manual docketing, documenting, and monitoring of due dates, whereas the modern cloud based IPMS enable automatic docketing and monitoring of data, interaction between both internal and external stakeholders within the system, and

interfaces to external service providers' systems, as well as getting broader and more detailed insights to make better decisions. (Clarivate 2021: 2-4.) Figure 6 presents Clarivate's idea of a modern IP management with a modern IPMS.

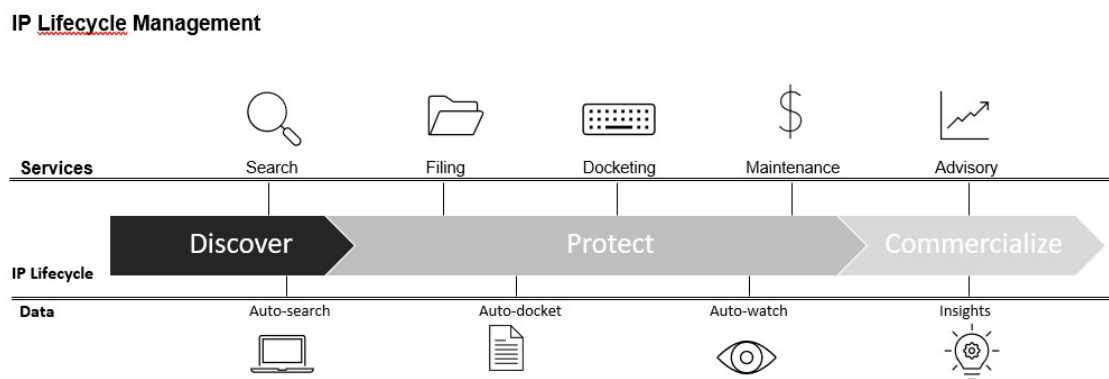


Figure 6. Clarivate's idea of IP Lifecycle Management with a modern IPMS (Clarivate 2021).

Intellectual property like patents have a lifecycle, and different phases of the cycle require management of different processes. With modern IPMS it is possible to manage the lifecycle from the beginning when the intellectual property is evolving from innovation to invention and a patent application, and thereafter to the application prosecution phase and finally the grant and maintenance and possible licensing of the patent. In the early phase, it may be possible to conduct prior art searches, distribute material, have discussions, and evaluate the invention via IPMS. In the prosecution phase all the important documents, patent office decisions (Office Actions) and responses to those decisions can be safely docketed in IPMS and all the related due dates are monitored automatically. In the maintenance phase IPMS monitors the due annual fees, and the discussion and evaluation can be continued within the system in appropriate intervals.

3.6 Conceptual Framework of This Thesis

In modern business context it is increasingly important for companies to pay attention to management of innovations and intellectual property. Strategic management and evaluation of patents are easily left to the background, as they have no direct impact on company business, and there are usually more urgent matters to manage. Patent management decisions should be based on broader context where both internal and external attributes are considered, but the decision framework should be flexible enough to enable stakeholders to choose the most suitable methodologies (or attributes) for

analyzing data in each individual case. Only relevant data should be distributed to the stakeholders to prevent them getting exhausted with unnecessary information. However, all the relevant data should easily accessible. (Archer & Ghasemzadeh 1999.)

The gained value from patents can be substantially improved if a patent strategy is built on the basis on a company general strategy or on the business units' strategies. Managing the strategy and making decisions based on the strategy requires contribution from several levels of management and the orientation of the initiative should be top-down. Otherwise, the participation and the quality of decisions can remain low. In the defensive patent strategy, the main goals are Freedom-to-Operate, differentiation from competitors and licencing revenues. No matter if the strategy is offensive or defensive, active monitoring of patent infringements and enforcing patents is required to maintain the value of patent portfolio.

The value of a patent varies greatly depending on licensing potential, operating location, quality of the patent, and significance of the market covered by the patent as well as success factors of patent enforcement. When evaluating patents, it is beneficial to present value factors to the evaluators in a clear and visual way. Relevant information in visual form also ensures the best contribution to decision making from different organisational levels. There are multiple evaluation methods available which also offer the possibility to visual presentation. Nevertheless, companies can create their own modified version of a model or framework for evaluation to ensure that decisions are made based on the most important value attributes in each company. Broad-enough decision frame without unnecessary information ensures good quality decisions and value creation. There should be a structured yet simple framework for the evaluation process with a certain number of stages.

Intellectual property management systems (IPMS) traditionally provide secure and efficient way of managing patents and other intellectual property by offering organized document management, tracking due dates, and creating reports. In addition, modern IPMS service providers have developed a wide set of features to overcome the obstacles of interaction between stakeholders and to ensure secure communication and effective decision making within the system. Activities can be automatized and cooperation between stakeholders enhanced utilizing IPMS as a tool. Table 5 below shows the Conceptual framework of this thesis.

Table 5. Conceptual framework for collecting and analyzing data to evaluate a patent portfolio.

Strategic Management of Patent Portfolio using Modern Data Platform as a Tool		
Patent Strategy	Patent Evaluation	IP Management System
<ul style="list-style-type: none"> • What are the costs involved? • What are the benefits of strategic patent management? • What kind of strategy could be beneficial? 	<ul style="list-style-type: none"> • Which factors affect the value of patents? • What methods can be utilized in qualitative evaluation of patents? 	<ul style="list-style-type: none"> • What are the benefits of IPMS? • How can modern IPMS improve communication and security?
<ul style="list-style-type: none"> • Ensuring Freedom-to-Operate • Differentiation from competitors • Licensing revenues 	<ul style="list-style-type: none"> • Value matrices • Scoring frameworks 	<ul style="list-style-type: none"> • Secure document management • Interactive system
Agostini et al. 2023 Blind et al. 2009 Daizadeh et al. 2002 Gassmann 2021 Jell 2012 Locke et al. 2011 Pfeffer 2006 Smith & Parr 2018 Soranzo et al. 2017 Tanskanen 2011 Torrisi et al. 2016	Adriessen 2004 Archer & Ghasemzadeh 1999 Brockhoff 1999 Gassmann 2021 Ignat 2016 Lang 2021 Poredda & Wildschütz 2004	Anaqua Clarivate 2021 Dennemeyer 2023 Smith & Parr 2018

As seen in Table 5, the Conceptual framework is divided to three main themes that should help in building the consistent model for collecting and analyzing data to evaluate a patent portfolio.

First, a *patent strategy* is required to gain value from a patent portfolio. Without a strategy, investment focus and allocation of resources are not clear and therefore time and money may be wasted. Second, after the strategy is determined, *evaluation of individual patents* is required. Otherwise, it is impossible to play according to the strategy when there is no clear picture of what kind of patent assets the portfolio contains. Thus, investments cannot be targeted in the most valuable patent assets without evaluation of patents. Third, even if the strategy is in place and the patents are evaluated properly, the contents of a patent portfolio become vague in the long run if there is not an *effective*

tool to store and distribute information. This is where IPMS facilitates the management of patent data.

Next, patent strategies have been discussed from the defensive point-of-view. Literature suggests that the commercialization of patents in form of licensing plays a minor role, although it can be a significant part of the defensive patent strategy in some companies. Ensuring Freedom-to-Operate and differentiating from competitors are the main directions which this thesis will build an evaluation model on. Literature also points out the methods for evaluating intellectual property. These methods taking the form of value matrices and frameworks can become the basis for development of an evaluation model. This thesis also tries to identify the main value attributes which would need to be part of the evaluation model based on available literature and best practice. When utilizing these tools, decisions should be made within an appropriate decision frame, and IPMS should bring the secure and safe environment to distribute information and make decisions interactively.

The selected elements of the existing knowledge identified in this section as the Conceptual framework of the thesis will guide this thesis to the next phase in conducting the Current state analysis.

4 Current State Analysis of Patent Portfolio Management at the Case Company

This section discusses the current state of the patent portfolio management in the case company. The current internal patent management process is described and co-operation between different stakeholders – patent management team, inventors, and multiple business unit teams – is examined and analyzed. The analysis is conducted via process document analysis as well as key stakeholder questionnaire and interviews, in order to get a perspective of the process and its strengths and weaknesses.

4.1 Overview of the Current State Analysis

The goal of the Current state analysis (CSA) was to get an overview of the current patent management and evaluation process and the co-operation between patent management team and the internal stakeholders: inventors and business unit representatives. The process involves also external patent attorneys and patent offices but the thesis studies only the process and communication with the internal stakeholders. The CSA was conducted in four phases in the spring and early summer 2023. The phases included process document analysis, questionnaire to internal inventors, business unit interviews and internal Patent Management interviews.

In the first phase, internal process documents were examined and analyzed. Based on the analysis, the current process was described and visualized with a process map.

In the second phase, a questionnaire was sent to the first group of internal stakeholders which are the company inventors. The questionnaire contained both multi-choice questions and open-answer questions. As the patent strategy starts from early beginning of inventing, the goal of the questionnaire was to hear inventors' voice on the current patent management process and what would be the strengths and weaknesses they would raise. Following the questionnaire, project managers were interviewed concerning the process related to inventions in projects. As an outcome of the analysis, the development needs of the inventor process could be determined.

The third phase contained interviews with business unit stakeholders referred to as business representatives. Business representatives include product managers, product owners and unit leaders. The interviews were semi-structured with pre-determined topics

and free discussion. The goal was to examine the patent management process functions within business units. The outcome of the analysis is the opportunities and weaknesses of the current business unit co-operation.

In the fourth phase, the outcomes of the three first phases were discussed with the patent management team and reflected to the team's experience of the current process. The outcome was the team's internal view of the strengths and weaknesses.

4.2 Description of the Current Patent Management Process

The case company manages a patent portfolio of approximately 2000 patents and patent applications. Inventions in the case company derive both from R&D project work as well as individual eureka moments. Most of the inventions are minor improvements to the existing technology, but some of them develop to become remarkable innovations that have notable impact on the industry. A structured process is needed to manage inventions to patents and further to valuable assets. Figure 7 below visualizes a process map the current patent management process.

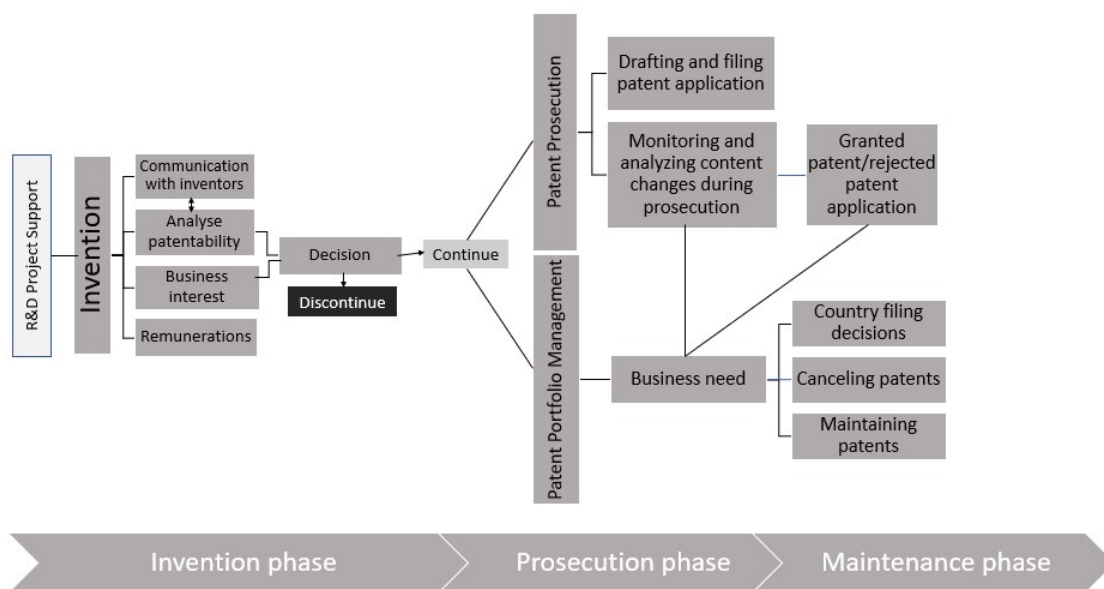


Figure 7. Patent Management Process Map (internal document).

Patent management team has rather a passive role in the R&D department's work. The department identifies possible inventions by itself and contacts patent management team

for support only when needed. When support is needed, patent management team provides R&D department with necessary information on existing technology and patents (prior art) and can also help inventors to develop raw ideas into inventions.

After an invention has been detected, it will be registered in the patent management database and receive an id number. All discussion, documents, and drawings will thereafter be stored in the database. In addition to the discussion with inventors, the invention phase of the process includes analyzing patentability, investigating business interest to the invention from relevant business units and paying first inventor remunerations. The invention phase can take from couple of months' time up to couple of years. The timeline depends on the maturity and development needs of the invention. Communication between the stakeholders is important in this phase.

After co-operation with inventors and business units, a patentability and business interest analysis can be conducted and a decision to continue or discontinue to a patent application must be made. Value of an invention is assessed right from the beginning and can be indicated with value factors from 1 to 5, one being very low and five very high value. Many times, the value is determined only verbally and the value numbers in the database are not up to date. It is also not clear, what aspects are behind the value number: how does technical, marketing, or legal value affect the number? Or is the value based on FTO? Evaluation has improved during the past two years as the comments concerning value have been documented in the database with an evaluation date.

If the result of the patentability and business interest analysis is positive, the process can proceed to the prosecution phase. If the business case of the invention is clear, the timeline from invention to prosecution phase can be only couple of weeks. In the prosecution phase, drafting of patent application is started and the first patent application (priority application) is filed in a patent office usually within some months. In case of filing a patent application, the application becomes an asset to be managed as a part of the patent portfolio. The external prosecution in patent offices and internal patent portfolio management go hand in hand. During patent application prosecution patent office can point out necessary changes to the patent application contents which are required to get the patent granted. Decisions of patent office(s) on the patentable content have impact on the value of the patent. Required changes must be monitored together with inventors and business unit experts to prevent the contents from becoming disadvantageous or

unprofitable to the applicant. The scope of protection might for example become too narrow which would make the patent lose its value.

When a patent is granted, the content becomes immutable, unless disputed and changed in court proceedings. The prosecution in a patent office can take from less than a year to several years, depending on the number of decision-response-rounds reiterated. The granted patent will become a stable part of the portfolio if maintained, in maximum 20 years from the filing date. Yet business need is not unchangeable, and therefore, the relevance and maintenance need of granted patents should be investigated regularly with involved business units. Many times, it is not reasonable to maintain a patent the whole 20 years.

4.3 Strategic Patent Management

For strategic management of patents, it is very important that communication between different stakeholders is working well in all process phases. Next, the description focuses on the current state of the patenting process within the patent management team, inventors, and business representatives.

4.3.1 Analysis of the Current Process – Patent Management Team's Point-of-View

The teamwork in patent management team is good and the discussion is open between the team members. Co-operation with inventors is usually smooth, except that waiting additional materials and more detailed explanations can sometimes take long. It is not easy being an inventor as it requires a lot of work to compile all the information needed for a patent application, and with high other workloads, lack of time can mean that invention-related work is delayed. If an invention is not considered worth patenting, the hard work by the inventor(s) may have been in vain.

All the invention-related material is gathered in the patent database and each invention has its own id. The documenting of the material can sometimes be incomplete as the material is sent in separate emails. However, the biggest stumbling block in the work of the patent management team is the lack of business representatives' time which also affects the commitment given to the patenting topics. It is insufficient to try to reach business representatives for the third time for a comment or instructions to be able to

make decisions. Patent management team members also considered personnel turnover a challenge when new business representatives have no experience with patents. Tacit knowledge is lost every time a person leaves or changes position. The meetings with business representatives usually last 1,5-hours and there is a long list of topics to discuss. The 1,5-hour time is therefore not sufficient to go through all the topics without haste and leaving some topics totally without discussion. This is typically solely a problem of the patent management team, as the decisions do not have a direct impact on business units' daily work.

Patent management team, however, pointed out that there is no regularity in business unit meetings which makes agendas especially long. Even if efforts have been made to make meeting more regular, business representatives often postpone the meetings when there are more urgent daily matters to solve. In some cases, patent management team could rely more on its own expertise and make decisions based on the facts received from business units without waiting precise instructions. For example, deciding the further filing countries based on the earlier information about competitor activities and main markets and only informing business representatives instead of waiting for their list of countries.

The current patent database does not make any interaction possible within the database and therefore all the communication is documented in separate emails or meeting memos. This makes the picture of decision making scattered and not so easy to follow. Even if the main lines of discussions and decisions are saved in the database, it is a slow manual work with a high chance of errors and forgetfulness.

4.3.2 Analysis of the Current Processing of Inventions

The invention process and support for inventing is in a notable role in strategic patent management. R&D department, project management and individual Inventors should be aware what the company patent strategy is in order to direct inventions to right direction.

The current invention management in the case company was studied by examining questionnaire responses from over 60 internal inventors. The respondents were located in China, Finland, Germany, India, Sweden and the US, the majority in Finland and Germany. 55 % of the respondents were familiar or very familiar with the main lines of the patenting process, 37,5 % were somewhat familiar and only about 8 % were not

familiar at all. However, 31 % of the respondents claimed that patenting is not considered in the R&D work on regular basis. Figure 9 below reflects the inventors' answers concerning the familiarity of the process and if patenting is considered in patenting on regular basis.

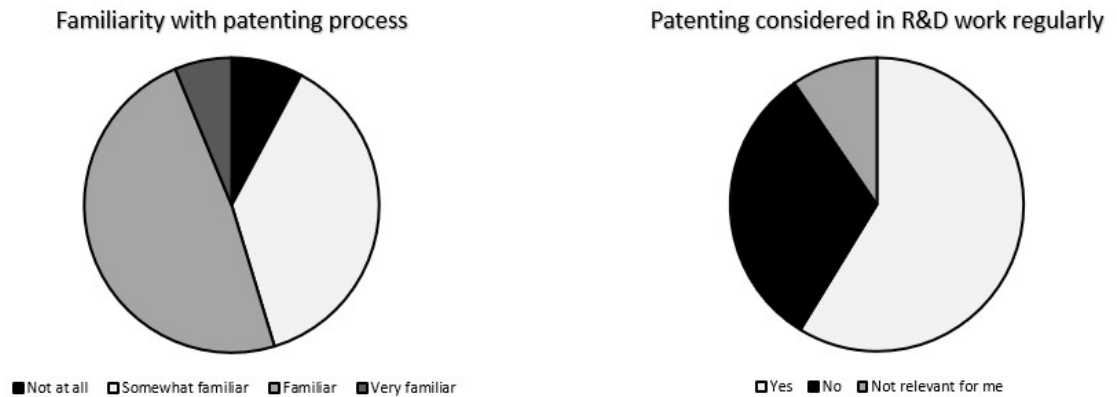


Figure 8. Inventor Questionnaire results concerning how familiar inventors are with the patenting process and is patenting considered in R&D work on regular basis (internal survey results).

According to the project managers, patenting is included in the project checklist only in project gate 1. Inventions are also considered later during the project in case project head designer and project workers are experienced to do that. On the product development side, project engineers should be able to identify possible inventions. On the other hand, Research & Innovation department could benefit from more support as the R&I engineers are suspected to be less experienced in general. Management of inventions can be seen as a part of innovation management. Only a small part of all ideas and results from development work in a company can be or are worth being protected with patents. The cost-benefit ratio is considered later in the invention phase when business interest is clarified.

In the case company, engineers are mainly working in silos in their own project teams. They are supported by patent experts only upon request. Most of the inventor questionnaire respondents did not have experience from workshops where development ideas would be discussed in a broader frame. This means that the engineers themselves or their superiors in a project need to be able to identify an invention. It may be that inventors do not have any contact with patent management team before they have filled in an invention notification form. The form contains instructions, and it can be found in

the company intranet under IPR matters. The intranet page also contains general information about inventions and patenting.

According to the inventor responses, the current process is supported by good instructions in the invention notification form. The instructions cover all the sections of the form. The weakness of the instructions is that they exist only in Finnish and English. Old instructions can be found also in German. In addition to the instructions in the form, patent experts from the patent management team support inventors when needed. One of the inventors emphasized that global support from Finland is not sufficient. This might relate to the need of support in face-to-face interaction in one's local language. Many times, the support needed is related to finding existing similar technology or solutions that might already be patented (prior art). Prior art study is necessary to prevent infringing competitor patents and ensuring freedom-to-operate (FTO). Prior art can also bring new perspective to newly developed or under-development solutions as well as finding ways to circumvent existing competitor patents (FTO). A tool for searching prior art is available for everyone in the case company, but most of the engineers are not familiar enough with the tool to utilize it. Experienced inventors in the case company usually do not need any other support than invention notification instructions and support from patent management team concerning prior art studies. However, it might be that the support is available only for those who know where to look or ask for it, as some inventors were not aware that an intranet page about patenting exists. Thus, for inexperienced inventors it can be difficult to find or look for information and instructions in the intranet. Even if found, it might not be sufficient.

Without experience, it can be difficult to identify a patentable idea or solution. Even for experienced inventors it is not easy to determine what kind of inventions create value and what are not worth being developed further. Currently, there is no open discussion about ideas and competitor patents and most of the teams work in their own silos. As a result, there is no clear and timely picture of the patents affecting each business unit or product. Also understanding the meaning and value of patent protection remains vague in the daily work of many engineers. Constant hurry with on-going projects prevents using any time to go deeper in patents or even consider possible inventions. This also causes misalignment of patenting and product management, and some units are lacking behind competitors regarding patents.

Invention cannot be patented if it is not novel. To keep an invention novel, it cannot be published before the patent application is filed in patent office. Some inventors pointed out that it is unclear where, when and with whom an invented solution can be discussed without publishing the idea too early. The meaning of publishing is not clear for everyone: Is an invention published if it is internally presented or presented to a customer as a prototype? What is the right timing for publication? Finally, patent management of the case company is centralized in Finland. Therefore, there is no local support in local languages in other locations around the globe and this is something that would be desired by some inventors. Support in local language would help understanding the requirements of inventing and patenting and help to develop "raw" ideas into inventions.

4.3.3 Analysis of Current Patent Portfolio Management

Currently, product managers or product owners, as well as unit leaders are supporting patent management team in decision making in all process phases. Inventions are whether directly stemming from a project work in a certain unit, or if not, patent management team will present an invention to a unit which could be the appropriate owner of the invention. New inventions are also introduced to unit leaders in regular steering group and IP board meetings. This is the first phase where decisions to continue with developing the invention is made and finally proceeding to filing of patent application. Next phase where business stakeholders are involved in the decision making is the point of possible further filings of patent applications in further countries. Further filing decisions need to be made within one year of the first (priority) filing, and then again within three years of the priority filing. The last phase, maintenance of granted patents, lasts until the patent expires or is let lapse. The scanning of granted patents with business stakeholders is arranged yearly, or at least every two years. According to some business leads, costs of patenting are not clear in all phases of the process. The emphasis has been on the annual maintenance costs although drafting costs in the invention phase and prosecution costs in patent offices form a significant part of the costs.

Initially, information about new inventions is exchanged via emails. Country decisions concerning further filings are also often transmitted by email. This poses a security risk. Regular meetings between patent management team and business stakeholders are arranged to discuss new inventions and the maintenance of patents. Business stakeholders participating the meetings include one or two crucial business

representatives: product manager and/or unit leader. Many times, decisions are not made during the meetings as business representatives need to discuss certain patents further with other experts. These experts might be technical experts, project managers or product owners. Final decision will then follow via email to patent management team. Some ad hoc matters are also taken care of via emails.

For the analysis of the current patent portfolio management, product managers and unit leaders were interviewed. In the semi-structured interviews, the patenting process and the role of internal stakeholders were discussed from each business unit's point of view. Knowledge on patenting is varying greatly among business representatives, as some have many years or decades experience, and some have just dived in recently. This should be considered when discussing patents, as patent jargon can cause unclarities and confusion. In general, most of the interviewees were satisfied with the current way of working, but at the same time, several problem points were raised up.

4.3.4 Analysis of Alignment of Patenting Strategy with Business Units' Strategies

When discussing alignment of patenting strategy with business units' strategies in the interviews, it was obvious that currently these strategies are not aligned. Patent Management does not have a clear picture of any business unit strategy, and decisions about patenting are made case by case, not following any clear patenting strategy. Business representatives would like to have a clear frame for the decisions. Following questions were raised by a business lead and a product manager, respectively: "Do we want to save money and proceed to patenting only in case of important inventions, or do we want to increase the number of patents in the portfolio by patenting even minor development?" "What is worth patenting?" Some teams are particularly strict with their patenting policy as they are connecting patenting for customer needs as one of the business leads pointed out: "if customer has a problem and a solution is developed to solve that problem, it is worth patenting". If there is no customer need behind the invention, patenting is not seen so necessary. In addition to business units being familiar with patent strategy, it would be beneficial for patent management team to know the focus points of each technology line.

The question of whether patenting is reasonable and productive in China was also raised during the interviews. In China, there are lot of infringements of patents all the time and

it is extremely costly to enforce patents if warning letters to infringers are not sufficient. A comment from a business lead concerning patenting in China: “Waste of resources”.

Nearly all business representatives considered enforcing of patents crucial to their value: There is no point in maintaining patents if not enforced in case of infringements. Some of the interviewees even pointed out that the company is too passive in enforcing patents which lowers the value of the patent portfolio. Most of the interviewees were content with understanding costs of patenting better nowadays than earlier. Yet, to understand the costs of the different process phases, especially prosecution phase, even deeper would be beneficial.

4.4 Analysis of Current Practices in Evaluation of Patents

Consistent way of evaluating patents is the corner stone for being able to follow patent strategy efficiently. The following chapters analyze the current state of evaluating patents.

4.4.1 Experience in Recognizing and Evaluating Inventions Among Development Teams

According to the interviewees, there are experienced team members in development projects who can recognize possible inventions. However, the problem with relying on the experience of certain individuals might make the perspective quite one-sided and narrow. The value of an idea should always be assessed in a wider context. According to one of the interviewed product owners “Sometimes even experienced engineers are late with realizing that something patentable has been developed”. Another interviewed business lead stated “There are many raw ideas which are not patentable as such and would need further processing. There are not so much discussion and development around raw ideas unless the significance is obvious from the beginning”. The value is not discussed in wider context and the potential is left for few individuals to decide. There is also a problem with eureka moments of inexperienced employees who do not consider patenting at the right moment or their raw ideas are left in the desk drawer. They would need to be trained about patenting.

The lack of wider perspective realizes also when teams are working in their own silos. Nearly all interviewees admitted that there is no co-operation nor discussion between

different units or even different teams in the same unit about development projects. If there is discussion between units or teams, it occurs randomly. In addition to not communicating to other teams and units about development work and inventions, teams sometimes forget to keep patent management team updated about invention development regarding already filed patent applications. If an invention is developed further during patent application process, it is still possible to make changes to the application within certain time frame, or file “divisional patent applications” on the changes, in order to keep the contents of the patent application relevant to the solution that is possibly going to be used in production. If the final solution differs from the contents of the patent application, the granted patent is of significantly less or no value to the company.

4.4.2 Business Unit Meetings Concerning Inventions and Patents

As the meetings with business representatives are arranged rarely (usually once a year) and the meetings are full of topics, it is inevitable that the 1,5-hour time is usually not sufficient to go through all the matters properly. The changing value points especially concerning prosecution phase are often falling out of the agenda. Despite the full agenda for the 1,5-hour meeting, most of the interviewees were of the opinion that they would not divide the contents into two or three separate meetings. Only few would prefer arranging separate meetings for invention, prosecution, and maintenance topics. These few representatives considered it important to understand patenting better. Nevertheless, most of the interviewees wanted to avoid arranging multiple meetings because of high workload and full calendars. To organize meetings seldomly, preferably once a year, and take care of everything at the same time would ease their work. Additional ad hoc meetings are anyways arranged if something cannot be handled by email. Although business representatives are committed to these meetings and want to contribute to decision-making, due to lack of time there are often topics falling outside the agenda which is making the work more difficult for the patent management team. Also, not being able to regularly discuss the implications of prosecution to the value of the patent indicate that the value assessments may not be up to date.

Value of a patent is usually discussed in the initial invention phase when the significance of the invention and the needed scope of protection is weighted. This discussion should continue in prosecution phase and maintenance phase when the business case of the patent is reviewed, but it usually continues only in form of selecting geographical scope

based on the general topic of the patent. The limitations to the scope of protection or the prosecution costs are rarely discussed. The value is usually weighted verbally during discussion and no consistent ranking is used nor different value attributes considered consistently. Therefore, there is no consistent way of recording or documenting the value. When the value is explained in textual format by describing the contents and the use of patent, it may be understood very differently by various readers.

4.4.3 Different Value Points of Patents

Different value points of patents were discussed in the interviews with business representatives. The value points were competitive advantage, marketing value, legal value, licensing value and portfolio value. Nearly all the interviewees were familiar with these value points and aware of their importance, however, usually they are not specifically brought up in the meetings. According to some of the business representatives, marketing value is not utilized to the full potential currently. There have been some marketing campaigns which highlight certain patents in a product, or patents that have been in a significant role in winning customer bids in certain units. According to one of the business leads "We have won bids because of patented solution in the product". Mostly however, patents are not brought up in customer relationships. One reason is that many patents would not be beneficial in marketing because they are protecting minor solutions that are not visible to customers or do not bring direct value to customers. Nevertheless, the utilization of marketing value was somewhat unclear to business representatives.

Business representatives recognized the missing utilization of marketing value, but from the patent management team's point of view, especially the legal value point is not getting enough attention. When the scope of protection is not considered during the prosecution process, it remains vague also during the maintenance phase. Currently, the empirical indicators of the value are also not considered during patents' lifespan.

Licensing has not been considered significantly in the case company so far. Most of the interviewees did not see a business case in licensing because the main purpose for the patents is to ensure freedom to operate (FTO) for the case company itself or to bring competitive advantage to a product or service that the case company is offering. The potential of licensing was considered interesting to some of the interviewees. This would mean more active patenting in case of inventions that would not directly bring revenue.

However, it was pointed out that a potential licensee(s) should be recognized already before starting patenting process. Business units themselves would not have resources to maintain licensing operations, there would have to be a responsible team for the purpose. Most of the business representatives believed licensing could be an option for certain patents that are not utilized by the case company anymore and are anyways going to be cancelled. Yet, an option could also be to sell such patents. Currently, licensing and selling patents is not considered regularly.

4.5 Analysis of Current IPMS as a Tool

Modern Intellectual Property Management Systems (IPMS) are facilitating patent management with many possibilities for more efficient ways of working and interactivity between stakeholders. However, the current IPMS in the case company is outdated and rigid with its functions. It enables proper document management and tracking of due dates, but the system is available only to the patent management team and ways of distributing information to other stakeholders is very limited. There might also occur data security problems if data is distributed via email. The next chapter describes the current information management and distribution.

4.5.1 Patent Information Material for Decision-Makers

The current database is sufficient for the internal use of the patent management team. It provides good structure for document management and useful ways to track due dates. Several kinds of reports can be directly created from the system, but the format is not suitable for presenting nor interaction. Although there is a ranking for patents in the IPMS, it is not regularly maintained and checked with decision makers.

For presenting patent information material to business stakeholders, patent management team utilizes “patent card” reports which can be directly taken out from the current database. The patent cards are in pdf format and summarize relevant information on each patent family. These info cards have been an in-built feature of the database, but patent management team has developed their contents within the last two years to be more informative to the business stakeholders as earlier they contained information mainly for the team’s own use. In addition to the patent cards, information is presented in Excel lists which indicate for example the costs of each patent in each country.

Sometimes PowerPoint presentations are used to introduce business stakeholders to patenting details like different process phases. Many Excel reports can be received directly from the database, but for example reports concerning annuity costs must be retrieved from an external service provider's portal. PowerPoint materials must be created separately.

Although the materials have been improved, and most of the business representatives understand the relevant information from them, one of the business leads emphasized that we should change such rigid and non-interactive reporting and presenting methods as receivers cannot make any notes nor add comments of their own. The reports are not visual unless made more visual separately with Excel, and there are also not any data drilling possibilities to go deeper in details or background information.

In addition to the form in which information is presented, it is important to keep all the materials written in a language which everyone can understand despite the background and experience on patenting. Business representatives were missing a clear framework for decision making: which responsibilities do they have in each process phase? Which decisions need to be made in which phase? They are also lacking clear guidelines or a handbook for patent management. According to the interviews, business representatives would also like to have more information on product level: "Which patents protect which products?" Patents should be possible to categorize, and filter by products or by technology topics. Currently, the database does not give this information easily. If a business representative is taking over decision making regarding patents that he/she is not familiar with earlier, the information on who has made the decisions before, who have been technical experts and product owners, and why certain decisions have been made, should be easily available. Otherwise, it is troublesome to try to find out the right contacts to discuss the patent and its significance. Currently, this kind of tacit information is not documented in the patent data base.

4.6 Key Findings of the Current State Analysis

Current state analysis helped to build a detailed overview of the patent management process in the case company. The interviews revealed that in many cases best practices are person dependent as different inventors and business representatives prefer or might

even be keen for their own ways to work. However, a consistent framework for the process in all phases should be developed.

Concerning the *strategic management of patent portfolio*, lack of time is the general and all-encompassing problem which causes problems with decision making and assimilation of information on for example competitor patents. Stakeholders are calling for a clear patent strategy. Patent strategy is needed in all process phases: In the early invention phase of the process, inventors want to know, what the company is interested to patent, and in the prosecution and maintenance phases, business representatives want to know, how the money should be invested. The costs of patenting in different phases are not clear to all business representatives.

Inventors are wishing for more support for understanding patenting and the strategy, but the form of desired support is not clear. Should it be patent expert participating in project design work, general patent training, or local support? All these aspects were raised in the inventor questionnaire. Although the process should be developed to have a clear and uniform practice and framework in all process phases, there can be some flexibility with working methods. Such flexibility can relate to for example communication methods or the format of shared materials and instructions.

From the *patent evaluation* point of view, the process is lacking an efficient practice. There is no tool for presenting value points to the decision makers and the evaluation is mainly conducted via discussions with no consistent way of documenting the result. However, business representatives are familiar with the meaning of different value points.

Concerning the *IPMS*, the current database is rigid and not interactive with the patent management stakeholders. A clear framework and guideline for decision making as well as modern tool for communicating with stakeholders is lacking. Documenting of tacit knowledge is insufficient and makes understanding earlier decisions complicated for new business representatives. There are no open nor regular discussion between units and teams as teams are mainly working in their own silos. This is preventing idea development and new insights across the units and teams. Some stakeholders are suspicious about new software tools while others consider them crucial for efficient cooperation. Most of the stakeholders are interested in implementing the new IPMS. Although business representatives were satisfied with the current process in general, the

reason for their satisfaction can probably be that patent management is a bit far from their daily work and targets. The benefits and value of patenting is not close to their daily work and agenda. The lacking connection between benefits of patents and strategic targets keeps the interest on a low level.

4.6.1 Summary of the Patent Management Process

The case company has many experienced inventors who are familiar with patenting and can identify possible inventions. Yet, the quite big group of inexperienced inventors should be taken into account and offer more support and instructions to those who need it. Currently, there is no open discussion about inventions and patents between development teams. Discussion could bring new insights to the work ja help to develop raw ideas to patentable inventions.

Business representatives are generally quite satisfied with the current process, although there are several problems identified, like shortage of time and missing strategy. The experience on patenting varies greatly among the business representatives. Even if a business decision maker is experienced, wider discussion across business units would bring new insights and perspective to the discussion. Currently, teams are mainly working in their own silos.

Patent management team has committed stakeholders, but they are not always able to give enough time and effort to patent decision making. Information and instructions from the stakeholders should be received more efficiently and timely. Documentation of patent materials, decisions, and evaluation is not always clear and uniform and currently involves a lot of manual work which is prone to errors.

Current patent information materials are comprehensive, but their format is rigid and non-interactive. Sharing materials in a modern data platform would make the discussion more accurate, real-time, and efficient, minimizing possibility of errors and oblivion. Business representatives also pointed out the lack of clear patenting strategy. In addition, keeping patent management team updated about the important technology trends and the strategy of each unit, would make it easier to align the strategies with each other.

4.7 Strengths and Weaknesses of the Current Patent Management Process

In the current state analysis, strengths and weaknesses of the patent management process were identified. The following Table 7 illustrates the identified topics under the three themes of patent strategy, patent evaluation, and IPMS.

Table 6. Strengths and Weaknesses of Current Patent Management Process

Strengths and Weaknesses of Patenting Process		
Patent Strategy	Patent Evaluation	IP Management System
Strengths <ul style="list-style-type: none"> • Several stakeholders with good knowledge and experience on patenting • Commitment of business representatives 	Strengths <ul style="list-style-type: none"> • Interest on wider discussion regarding value 	Strengths <ul style="list-style-type: none"> • Efficient document management • Efficient due date tracking
Weaknesses <ul style="list-style-type: none"> • No clear patent strategy • Vague understanding of patenting costs • No time for competitor patent analysis (FTO) • lack of early support in inventing • Changing organization 	Weaknesses <ul style="list-style-type: none"> • No consistent way of evaluating patents • Narrow frame of communication and decision making 	Weaknesses <ul style="list-style-type: none"> • Lack of interactivity • Security problem in distributing information • Low level of customizability • No integration possibilities

Strengths. Patent management team has excellent expertise on patenting, and support is always available when needed for individual inventors, development teams, or for decision making. In addition to the patent management team's expertise, there are inventors and business representatives with great experience on inventions and patents. This expertise should be utilized to the full. Business representatives are also committed to work for the uniform patenting strategy and alignment of patenting strategy with the business unit strategies. There is wide interest to widen discussion regarding value and utilization of innovation. Expanding communication across units and teams could bring new insights to development work and bring raw ideas to more mature direction. Wider discussion could also improve quality of inventions and find new ways to utilize them across the company. The current IPMS has efficient document management and tracking of due dates. Luckily, these features of the old IPMS do not have to be compromised when changing to a modern IPMS, as the modern IPMS have as good

functions as the old one. A modern IPMS will be used as a tool to make the discussion more interactive, real-time, as well as safe and secure.

Weaknesses. A clear patenting strategy is missing from the decision making. It would be helpful for all stakeholders and for alignment of strategies. Current lack of wider discussion between business units and teams makes the decision frame narrow and one-sided. On the other hand, lack of time prevents business units from studying competitor patents comprehensively which is important in recognizing possible infringements and staying tuned on the trending technologies and developments. Many inventors would like to have more support from patent management team during development work. It is difficult for inexperienced inventors to identify when an idea could be developed into an invention.

The case company's organization is dynamic and changing frequently. This makes it hard to keep the know-how on patenting within the stakeholders. Every time somebody leaves, they might take tacit knowledge with them, and it is difficult for a new person in charge to investigate all the reasons and contact persons behind decisions if they are not documented well enough. Inexperience with patenting might also cause that valuable inventions are slipping through fingers when not discovered and patented early enough.

The current IPMS is not offering any possibilities for interaction between stakeholders as the system is closed and only in use of patent management team. Information must be distributed to stakeholders outside the IPMS which usually means sending emails. Data cannot be secured when distributed outside the IPMS. All the adjacent operations must be taken care of in separate databases as no databases nor software applications can be integrated with the current IPMS. There are some customized functions in the current IPMS, but possibilities for further customization are limited.

Based on these findings in the Current state analysis, Section 5 will build a proposal for improving the different phases of patenting process. Improving the process and utilizing modern IPMS as a tool helps to reach the goal of improved strategic management of patent portfolio.

5 Building Proposal for a Model of Strategic Patent Portfolio Management

This section builds the proposal for model for collecting and analysing data for improving strategic patent portfolio management in the case company based on the results of CSA (Data 1) and the best practice and existing knowledge (literature review), as well as improvement ideas gathered from the interviews with the internal stakeholders and IP experts from other Finnish industrial and technology companies (Data 2, collected in this stage).

5.1 Overview of the Proposal Building Stage

In this section, the steps for building the proposal are presented. Based on the CSA, the improvement targets are 1) to clarify patent strategy and cost structure, 2) widening decision frame and evaluation of patents, and 3) implementing modern IPMS. The best practice and existing knowledge have given many insights for improving patent strategy and models for evaluation. Communication processes are in key role and a model for structuring the process towards improved strategic patent management and evaluation of patents needs to be built. Improving communication process with the stakeholders will also develop the patent management team's ability to work effectively and align the patent strategy with the business unit strategies. The new IPMS would work as a key tool for all these improvements.

The proposal building was conducted in three phases. First, the results from the CSA were reviewed with the key stakeholders, i.e., patent management team. The improvement requirements in support and training for inventors as well as meeting practices, patent material distribution and availability of instructions to business representatives were acknowledged within the team. The business representatives' instructions should explain the patenting process and cost structure.

Second, the internal stakeholders' improvement suggestions were reviewed and analysed in connection with the best practice and existing knowledge from the literature review. Business representatives were emphasizing clear patent strategy, a handbook for patenting process and modern ways of communicating as key starting points for improvement. In order to succeed in these improvements, right kind of information needs

to be distributed to business units. Also, finding an efficient method to evaluate patents would facilitate the strategic management of the patent portfolio in all process phases.

Third, IP professionals from three other Finnish industrial and technology companies were interviewed to get an overview how working practices are in other companies. The interviews were giving many useful tips for improving practices in the case company.

5.2 Findings from Data 2

In this section, findings from the CSA, inputs from the literature and suggestions from the internal stakeholders as well as insights from IP experts from other industrial and technology companies are summarized. When collecting suggestions from stakeholders and insights from other companies' practices (Data 2), the following topics were raised needing improvement: 1) Defining a clear patent strategy on a business unit level, 2) Development of consistent method for evaluating patents and 3) Need for modern IPMS tool to manage data. The important patent strategy components and different methods of evaluation from CF were guiding the proposal building together with the opportunities offered by modern IPMS. Key focus areas, inputs from the CF as well as the suggestions from stakeholders and the insights from other companies for each CSA topic are listed in the below Tables 8-10.

Table 7. Patent Strategy – Key stakeholder suggestions (findings of Data 2) for Proposal building in relation to findings from the CSA (Data 1) and the Conceptual framework.

	Key focus areas from the CSA (Data 1)	Inputs from literature (CF)	Suggestions from stakeholders (1) and insights from other companies (2) for the Proposal, summary (Data 2)	Description of their suggestion
1	Determining clear patent strategy	Patent management: The prominent role of strategy and organization (Agostini et al. 2023). The influence of strategic patenting on companies' patent portfolios (Blind et al. 2009). Patent Management (Gassmann, 2021). Patent Filing Strategies and Patent Management (Jell, 2012). Intellectual Property: Valuation, Exploitation, and Infringement Damages (Smith & Parr 2018). Used, blocking and sleeping patents: Empirical evidence from a large-scale inventor survey (Torrise et al. 2016).	1a) Map the proportion of BUs vs patenting: define targets for all BUs	Different BU:s have different strategy and different kind of customer base and business model. This demands different focus for patent strategy as well.
			1b) Regular BU strategy update	Starting meetings with BU strategy update and define where the technological focus is in the unit.
			1c) Arranging discussions within and between BUs about current technology development	To widen the discussion and perspective on trending technologies and find the possible synergies between units.
			2a) Regular committees for prosecution decisions	For keeping Patent Management abreast of the current developments and business units of the changing patent contents.
			2b) Regular training for inventors and business unit representatives	Needed for avoiding patenting and decision-making mistakes and maintaining knowledge on patenting processes.
			2c) Clear strategy defined and explained in inventor instructions	To clarify what the company is willing to patent to help inventors focus on the right topics.
			2e) Named persons for each topic in competitor patent monitoring	Needed for allocating workload and assigning responsibility.

As seen from Table 7, determining a clear patent strategy for all business units were considered a requirement for efficient patent portfolio management based on the CSA. The internal stakeholders' suggestions and insights from other companies concerning clarifying patent strategy are summarized in the table with a description of their impact

on the company operations. The contents of the Table 7 are explicated in the next section.

Determining a clear patent strategy for all business units. As existing knowledge in literature claims, it is essential for efficient patent management to determine a clear patent strategy which is aligned with the company strategy in general. When discussing with internal stakeholders from different units (Data 1), several stakeholders from different levels pointed out the need for a clear patent strategy. Based on the discussions, it was evident that different operating models and customer base in different business units require their own patent strategy determined. It was suggested within the patent management team to map the proportion of each business unit's significance in the company vs. the size of patent portfolio in the units and set targets for patenting in future. One of the business leads emphasized the importance of asking the right questions in each phase of the process.

For keeping on track of the strategy in each unit, a business lead suggested that there would be a short review on business unit strategy in the beginning of a maintenance meeting which is arranged every 1,5-2 year. Technological focus and trends could be reviewed at the same time. This would prevent patenting from drifting in different direction from the technology focus and strategy.

As an improvement for current ways of working in teams' own silos, Patent Management Team suggested to start arranging common meetings between units and teams in order to widen discussion about technology development. There could be synergies found between development projects and raw ideas might be possible to be developed further when perspective and discussion is expanded.

Interviews with other industrial and technology companies brought several insights to the patent process development proposal. First, regular committees for patent prosecution would be beneficial to keep business unit representatives updated of the changes in the patent application prosecution and patent management team updated in recent developments related to the invention. Dedicated patent prosecution committee meetings would reserve time to this topic, enable deeper discussion on the patent contents and thus, make decisions more accurate.

Second, insights from other companies indicated that regular training would be beneficial to all inventors, even if they are experienced in patenting. Training would enhance strategy consistent patenting and decrease subjective point of views in defining value of inventions. Also, risk of identifying inventions too late could be mitigated by regular training. In connection with training, an expert from an industrial company pointed out that clarifying and explaining patent strategy thoroughly in inventor instructions would lead the focus of inventing to the right direction and decrease the number of unwanted inventions without discouraging inventors from being innovative.

Third, the topic of monitoring competitor patents was considered challenging also in other companies. Due to the high number of competitor patent hits in patent search engines, those hits should be distributed to several responsible persons according to detailed topics. The distribution should be executed in a way, that only one responsible person gets a list of competitor patents related to a specific topic, and another gets a list related to another topic. This ensures that responsibility of checking the listed competitor activities is dedicated to one person. If there are multiple recipients to the competitor patent lists, there is a high risk that nobody will take the time to check the list through. An expert in a technology company pointed out that training would be beneficial in relation to competitor patents to make the process more efficient and help the responsible persons to concentrate on the right details in competitor patents. The significance of this responsibility should be emphasized in the training.

Table 8. Patent Evaluation – Key stakeholder suggestions (findings of Data 2) for Proposal building in relation to findings from the CSA (Data 1) and the Conceptual framework.

	Key focus areas from the CSA (Data 1)	Inputs from literature (CF)	Insights from other companies for the Proposal, summary (Data 2)	Description of their suggestion
2	Development of consistent evaluation method	Making sense of intellectual capital: Designing a method for the valuation of intangibles (Andriessen 2004). Patent Management (Gassmann, 2021). Modern evaluation of patents (Ignat 2016).	a) The most important question: why is the patent pursued and what is the goal of getting the patent granted?	The purpose of patenting must be clarified right from the initial phase of inventing and continue asking these questions throughout the whole process.
b) Keep the evaluation method simple enough			If evaluation methods is too complicated and difficult to maintain, there is a risk that evaluation will be neglected in the long run.	

Table 8 shows that the second key focus area identified in the CSA is development of consistent evaluation method for individual patents. Insights from the other technology and industrial companies are gathered and described in the table. Next section explains the table contents.

Development of consistent evaluation method. The existing knowledge from the literature indicated that there are multiple methods for evaluating patents and it depends on company needs which value factors are adequate to be followed or measured. According to an expert from a Finnish technology company, it is crucial to ask two questions in the initial phase when an invention is identified: “Why is the patent pursued? What is the goal of getting the patent granted?” Although these questions are especially important in the invention phase, they should be kept in mind throughout the patenting process: if answers to these questions change, actions should also be reassessed.

Concerning method for evaluation of patents, another expert from an industrial company pointed out that the method should not be too complicated in order to make it work in the long run. If the results of the evaluation are difficult to maintain, it is probable that the maintenance would be incomplete or even neglected totally.

Table 9. IPMS – Key stakeholder suggestions (findings of Data 2) for Proposal building in relation to findings from the CSA (Data 1) and the Conceptual framework.

	Key focus areas from the CSA (Data 1)	Inputs from literature (CF)	Suggestions from stakeholders (1) and insights from other companies (2) for the Proposal, summary (Data 2)	Description of their suggestion
3	Implementation of modern IPMS	Our Story (Anaqua n.d.). A new paradigm: from docketing software to integrated IP Lifecycle Management (Clarivate 2021). Intellectual Property Management Systems. Choosing the best software solution for your business (Denemeyer 2023). Intellectual Property: Valuation, Exploitation, and Infringement Damages (Smith & Parr 2018).	a) Enhance interaction with stakeholders within IPMS	All relevant information and documents in one place for all stakeholders.
			b) Improve data security	If discussion and document change occurs within a safe system, data security is improved.
			c) Graphs on patent costs with drill-in possibility	Visual way of showing costs helps to understand them better. With drill-in option the factors behind the costs could be studied.
			d) Tacit knowledge to be documented in the IPMS: not lost when organisation changes	To facilitate work in case on organizational changes: information would not disappear with people.

As seen from Table 9, the CSA results indicated a demand for a new modern tool to overcome the rigidity of the old IPMS. Suggestions from internal stakeholders are shown in the table. The contents of the table are elaborated in the next section.

Implementation of modern IPMS. The existing knowledge and best practices concerning IPMS was mainly coming from the IPMS service providers' white papers and brochures. It is evident that modern IPMS have lots of useful features to improve interaction between stakeholders within the system and make distribution of information more effective and secure. Patent management team recognized the need for a modern IPMS based on the problems with the current rigid IPMS with no interaction possibilities, with low level customizability and with no integration possibilities to adjacent service functions like payment service of annual maintenance fees. In addition, patent management team could see the need for more secure distribution of confidential information. The modern IPMS enables distribution of information in a secure environment without emails. The

business representatives also acknowledged the benefits of a modern tool. The current format of information was considered rigid because stakeholders cannot make their own notes and comments for other stakeholders to see. If information must be sought from several long email chains, it is difficult to comprehend the big picture and stay on track.

One of the business leads suggested that the new IPMS could have graphs visualizing costs with a drill-in possibility. Visual presentation of costs would facilitate understanding the costs better. The possibility to change cost attributes and see the results visually would help forecasting costs in different scenarios. In a modern IPMS, this kind of visualization could be possible.

Another suggestion raised by the same business lead was that all the current tacit knowledge should be available in the IPMS. It would prevent important information from going lost when organization changes. This tacit knowledge is for example the information behind the decisions and the experts with whom the decision-maker has discussed when ending up to a certain decision. It would make it easier to step in as a new decision-maker if all crucial information would be available in one place.

5.3 Initial Proposal for Patent Management Process Model

This section presents the initial proposal for managing patenting process and evaluating patents as well as describes how the modern IPMS could be used as a tool for data collection, distribution, and analysis. A model for collecting, distributing, and analysing data in each process phase is presented as well as a model for evaluation.

5.3.1 Element 1: Supporting R&D Projects and Technology Discussion Across Units

According to the CSA, the first phase of patenting process, the R&D project support has been in a minor role, and not actually even determined as a part of patenting process. There has been support available when requested but no active participation from the patent management team's side. According to the existing knowledge and best practice from the literature, it is important to actively protect new development and solutions from copying. The discussions with internal business representatives and the insights from the discussions with IP experts from other companies pointed out that there is a risk of not identifying important inventions without actively participating in development projects.

Yet, as a project manager claimed in his interview, there are multiple projects ongoing where there are nothing new developed and there is no chance of inventions involved. This indicates that development projects requiring patenting support should be identified in the project initiation phase. The interviews with the business representatives in the CSA also revealed the interest and benefits from wider discussions between development teams and even across business units. Wider discussion can lead to a wider decision frame and more quality decisions as learned from the existing knowledge and best practice in literature. The Figure 9 below shows how patent support for R&D projects and wider discussion on developments could be improved:

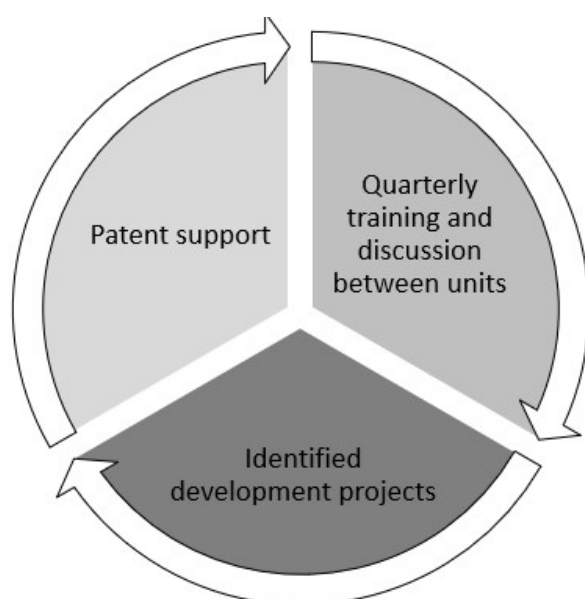


Figure 9. Improved R&D project support.

In Figure 9, it is proposed that development projects requiring patent support should be identified in the initial phase of the project. Thus, the support can be focused on key projects. Patent support means that a technical patent expert would participate in project meetings especially in the early phase, but also in later project gates where the design is reviewed and before any pilots or testing on customer site are started.

In addition to active support in development projects, a regular training program for different stakeholders would be launched. Starting from basic training on patents which would be targeted to inventors, but also business representatives and project managers. After basic training, there would be regular training for different target groups: inventors and project managers, business representatives, and training on competitor patent

monitoring. The regular trainings would be arranged quarterly for inventors, and once a year for business representatives and persons in charge of competitor patent monitoring. The quarterly training for inventors would have changing topics, but also iterating same topics from time to time to ensure that all interested parties are offered possibility to attend. In the beginning there should be multiple trainings within a short time to cover the most important topics for all target groups. Patent management team would arrange the training material and the trainings themselves. It is important that the training is interactive: there would be possibility for free discussion and attendees would be able to ask questions. All the training materials and videos would be gathered in the new IPMS for easy access later. A guidebook for business representatives would be produced in order to clarify patenting process and costs for different process phases.

Also, regular discussion on technology development and trends across business units would be arranged. There would be regular “Technology Update Cafes” with changing topics from different development teams arranged by patent management team. Patent management team is in the middle of all development and can identify the topics after discussing with development teams. Of course, it would be beneficial that different development teams would actively suggest topics. The audience for these meetings would be the business leads of development teams and technical and product experts. Thus, there would be a wide range of specialists sharing thoughts. The summaries of discussions in these “Technology Update Cafes” would be gathered in the IPMS in the same way as the training materials to be accessed later. Technical experts could also be invited to suggest topics for workshops if they would see benefits in arranging such. Workshop participants from different teams or units could bring new insights to development work.

5.3.2 Element 2: Process Improvement in Invention Phase

The CSA revealed that there is no clear structure how to evaluate and work with inventions. The existing knowledge and best practices from literature point out that a clear patent strategy is beneficial for the patent portfolio management and the strategy should be followed consistently. The existing knowledge also offers important questions to be asked during patenting process and some further key questions were raised in the interviews with business representatives (Data 2). The importance of determining product owner in an early phase were acknowledged by business representatives and

benefits of patent committees for the prosecution phase were pointed out by IP experts from other companies.

When a possible invention is identified, patentability must be assessed first internally and second with external patent attorney. If criteria for patentability (novelty, inventive step, and commercial production) seem to be fulfilled, next step is to assess business interest for the invention. Depending on the type of invention, it might come from a certain business unit as a result of a development project, or if not, the business owner might need to be determined. When business interest is assessed, it would be beneficial to check the interest also in other business units. One option to introduce inventions to other units are the Technology Update Cafes which were proposed in the previous section. As inventions cannot be published in this stage, the confidentiality of the information must be emphasized. The following Figure 10 presents the improvements proposed to the invention phase of the patenting process. The structured process would contain key questions to be asked and evaluation to be conducted in the initial business interest review. Also, the patent committee members would be defined early for the coming prosecution phase.

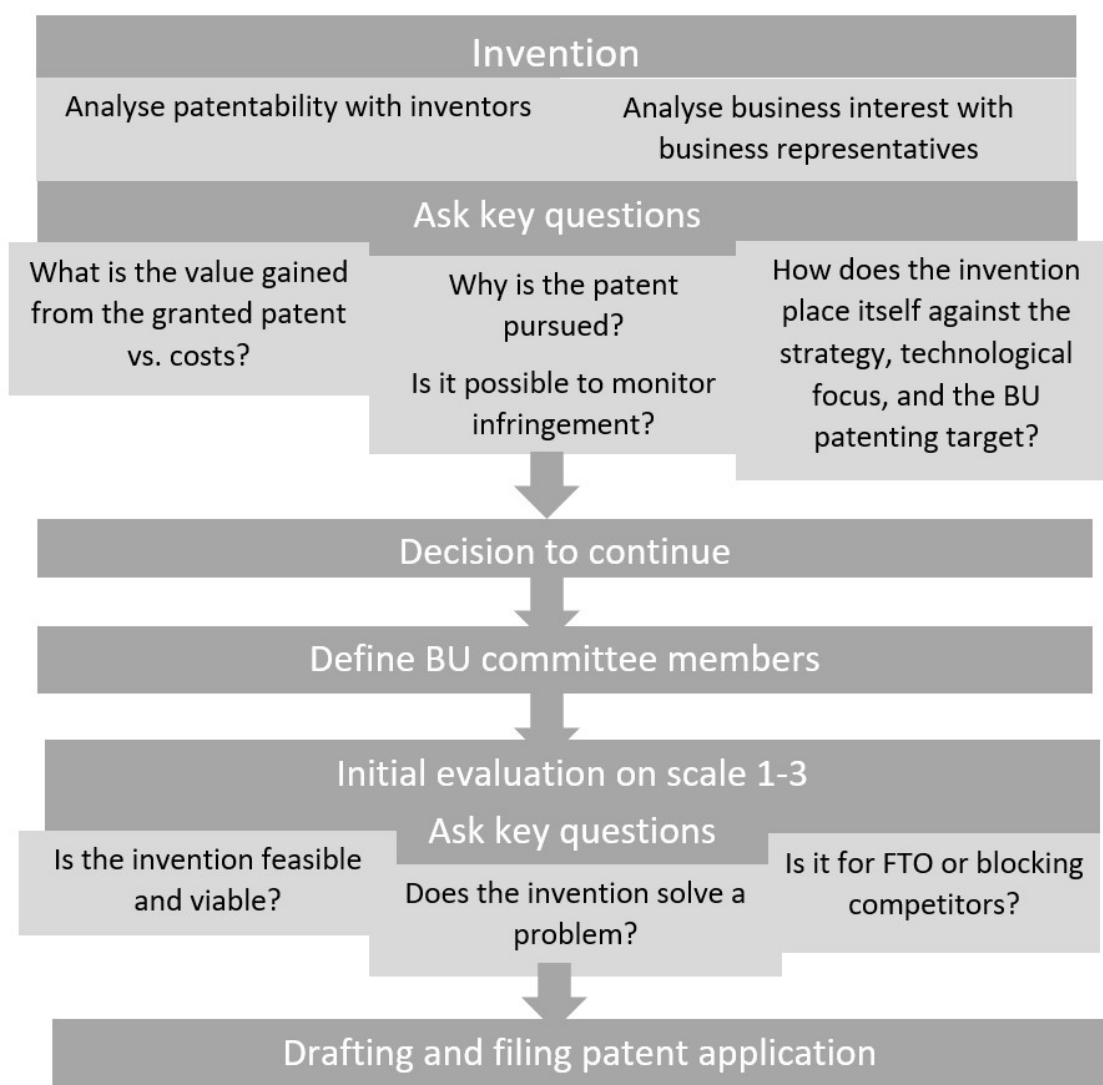


Figure 10. Initial proposal for process model of invention phase.

As seen from Figure 10, the first question to be asked is “Why is the patent pursued?” Is the invention planned to be productized or is it valuable as a blocking patent against competitors? Is the utilization still unclear? Costs of patenting process would be also assessed against the future value gained from the patent. Are the invention contents complex and therefore cause long prosecution with several rounds in patent offices? Infringement monitoring should be possible in some level because if a company cannot monitor competitors’ possible utilization of the patented solution, the patent is no worth the patenting costs. Lastly, the invention’s position should be mapped on the strategic, technological focus, and BU patenting target point of view. Does the business unit have a target to increase the number of patents and what is the significance of the technology in view of trends and strategy? All these questions should be answered in the initial review with business unit representatives and be documented in the IPMS. Information

on patent-related products should be marked in the IPMS in order to enable filtering patents based on products or vice versa.

If result of answering the key questions leads to a decision to proceed to a patent application with the invention, the next step would be to define patent committee members for the prosecution phase from the responsible business unit. The members would also be marked in the IPMS so that all the stakeholders see who the right contact persons for the patent are. The committee members should represent technical and product knowledge to be able to follow both the development of patent contents in patent offices as well as development of patent-related product or technology in the business unit. The committee members would also participate in the initial evaluation of the invention made in the invention phase.

The initial evaluation is proposed to be made in early phase with scale of 1-3. This scale indicates the strategy behind the first patenting decision and makes it possible to search and filter patent families in the IPMS based on the initial evaluation status. Number 1 on the scale would mean that the patent is pursued because the invention is already implemented or planned to be implemented in production. Number 2 on the scale would mean that the patent is pursued as blocking competitor activities or ensuring company freedom-to-operate (FTO). Number 3 on the scale would mean the purpose for the patent is not yet clear and needs to be defined later. An invention should never be evaluated as 3 for a long time and the ones hanging as “not clear” should be reviewed regularly. Key questions to be asked in this initial evaluation are: Does the invention solve a problem? Is it feasible and viable? Or does it ensure FTO or force competitors to finding other ways to operate? If an invention solves a problem for a customer, in production, or concerning safety, it has high probability to be implemented. Yet, if it is not feasible and viable, the implementation probability decreases. Answers to these questions indicate if the invention is 1 or 2 on the initial scale. On the other hand, unclarity about the answers indicates that the inventions need to be places in group 3 for inspection in later stage.

5.3.3 Element 3: Process Development in Prosecution Phase

According to the CSA results, irregularity of meetings with business unit representatives causes problems in managing patent portfolio. This is especially the case in connection with prosecution because there is no time to go through all prosecution matters in the meetings. As the existing knowledge and best practices from literature point out,

decisions should be based on facts and preferably multiple point of views. Engaging right people in decision making can help keeping patenting aligned with the strategy. Regular patent committee meetings are what IP experts from other companies arrange to keep on track of patent and technology development. Figure 11 below shows the proposed process development for prosecution phase.

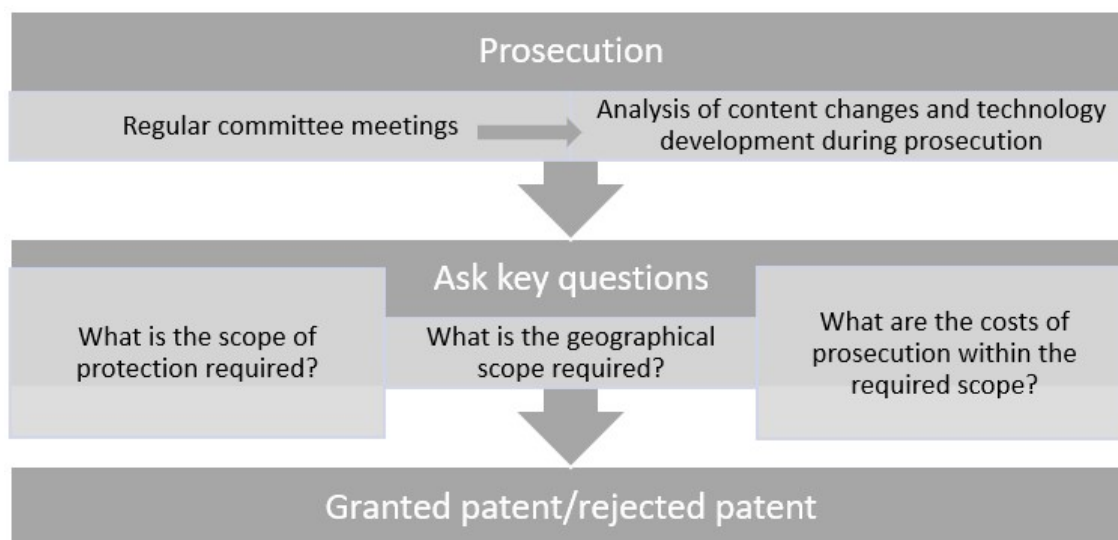


Figure 11. Initial proposal for process model of prosecution phase.

As proposed in Figure 11, the prosecution would be monitored in regular patent committee meetings monthly or bi-monthly. Patent committee members, who would be named in the invention phase, would be patent-related technical and product experts. Technical experts would understand and assess the significance of changes in patent contents during prosecution in patent offices. Together with product owner the technical experts would keep patent expert updated of technological development and focus. If a patent application is rejected in some national patent office, it will have influence on the value of the patent also in other countries. This would require involving business leads to assess the impact on the overall value of the patent.

The key questions in the prosecution phase would concern the scope of protection required for the patent to be valuable to the company, what are the patent-related markets and competitor activities from geographical point of view, and what are the costs, when these requirements are pulled together. Patent prosecution would be presented to committee members in the IPMS with graphs visualizing costs. All the

information and decisions would be gathered in the IPMS to be easily available for committee members as well as other stakeholders.

5.3.4 Element 4: Process Development in Maintenance Phase

Several business representatives emphasized the problem of unclear patent strategy in the interviews during the CSA. Especially in the maintenance phase it is difficult to make maintenance or cancelling decisions without a consistent strategy. Patent management team suggested to start defining clear patent strategy and patenting target for all units. When strategy and target are set, inventions should be checked against those and technological focus in the early invention phase. When the patent is granted and decisions about maintenance are actual, again, the same aspects of strategy, technological focus and patenting target of the business unit must be carefully considered and thus, analyze business need for the patent. As patent's lifespan goes forward, technological focus can shift to another direction decreasing patent value. Even strategy and patenting target will change during years. Figure 12 below shows the proposed model for patent maintenance phase.

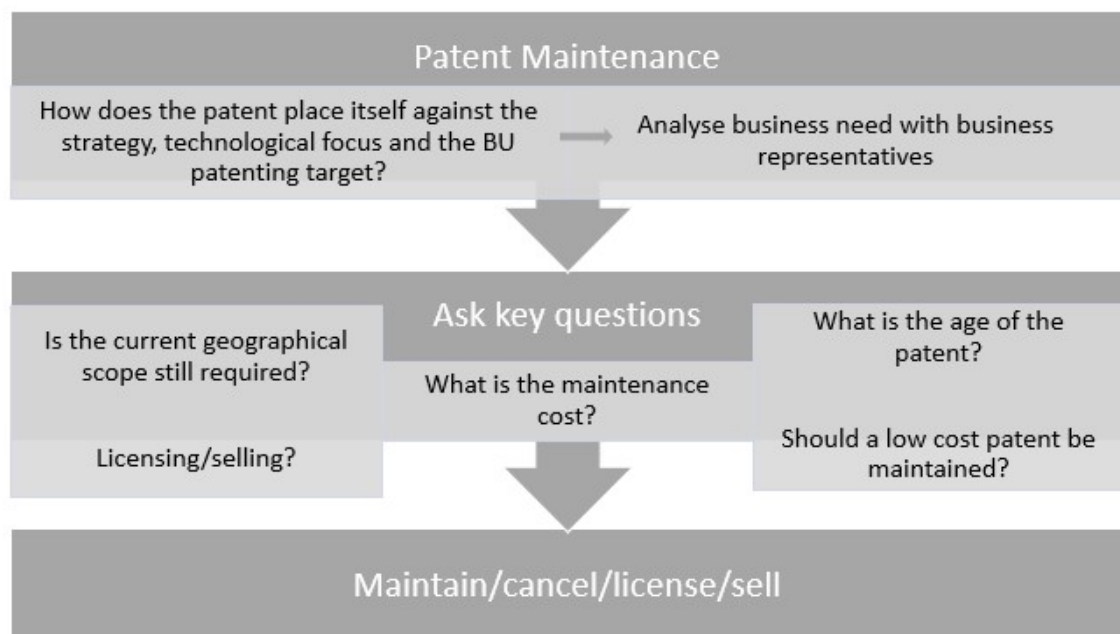


Figure 12. Initial proposal for process model of patent maintenance phase.

As seen from Figure 12, after a patent is placed on the map in view of strategy, technological focus, and business unit's patenting target, and business representatives

see the maintenance necessary, key questions concerning maintenance should be asked. Both geographical scope and age of patent influence maintenance costs. If business unit still sees a need for a patent, next step is to consider the geographical scope. Patents are maintained separately in different countries, and if some locations are not important anymore for the patent to be maintained, the patent can be canceled in those countries. Maintaining patents becomes costlier during the late years of the patent lifespan as the annuity fees rise. These points should be considered from the strategy, technological focus, and business unit's patenting target point of view. Sometimes, a patent is maintained simply because the overall maintenance costs are very low.

Risk for litigation should also be considered. If a competitor for example violates a patent and the patent should be defended, is the patent worth litigation proceedings? It is a difficult situation for the patent portfolio value if a patent is infringed but the violation is ignored. During maintenance discussions, technological focus of the whole market and even technologies in general should be checked. If a patent is not important for the owner anymore, would licensing or selling the patent be reasonable?

Like proposed in previous sections, decisions and reasoning behind the decisions would be gathered in the IPMS for all the stakeholders to see afterwards.

5.3.5 Element 5: Model for Patent Evaluation

In the CSA it was found that there was no consistent way to evaluate patents in the case company as rating was done in different ways or not at all. In many cases evaluation was in textual mode, in some cases a rating number from 1 to 5 was used, but these ratings were not always up to date and reasoning behind the numbers was vague. Existing knowledge and best practices offered many ways to evaluate patents. During Data 2 collection, a business lead was suggesting more visual ways to presenting patents. Yet, the experience from an IP expert from another company was telling that evaluation should be kept simple enough to be easily maintained. However, the modern IPMS offers visual ways for presenting patents. Evaluation by inserting certain value attributes which are automatically visualized should be possible within the tool.

In the initial invention phase, an initial categorization of the patent was proposed with a scale from 1 to 3. This would put patents in different categories to facilitate filtering. After

the initial phase, the essential evaluation would be conducted, and the result would be visible in a four-dimensional matrix. The figure 13 below visualizes the proposed evaluation model.

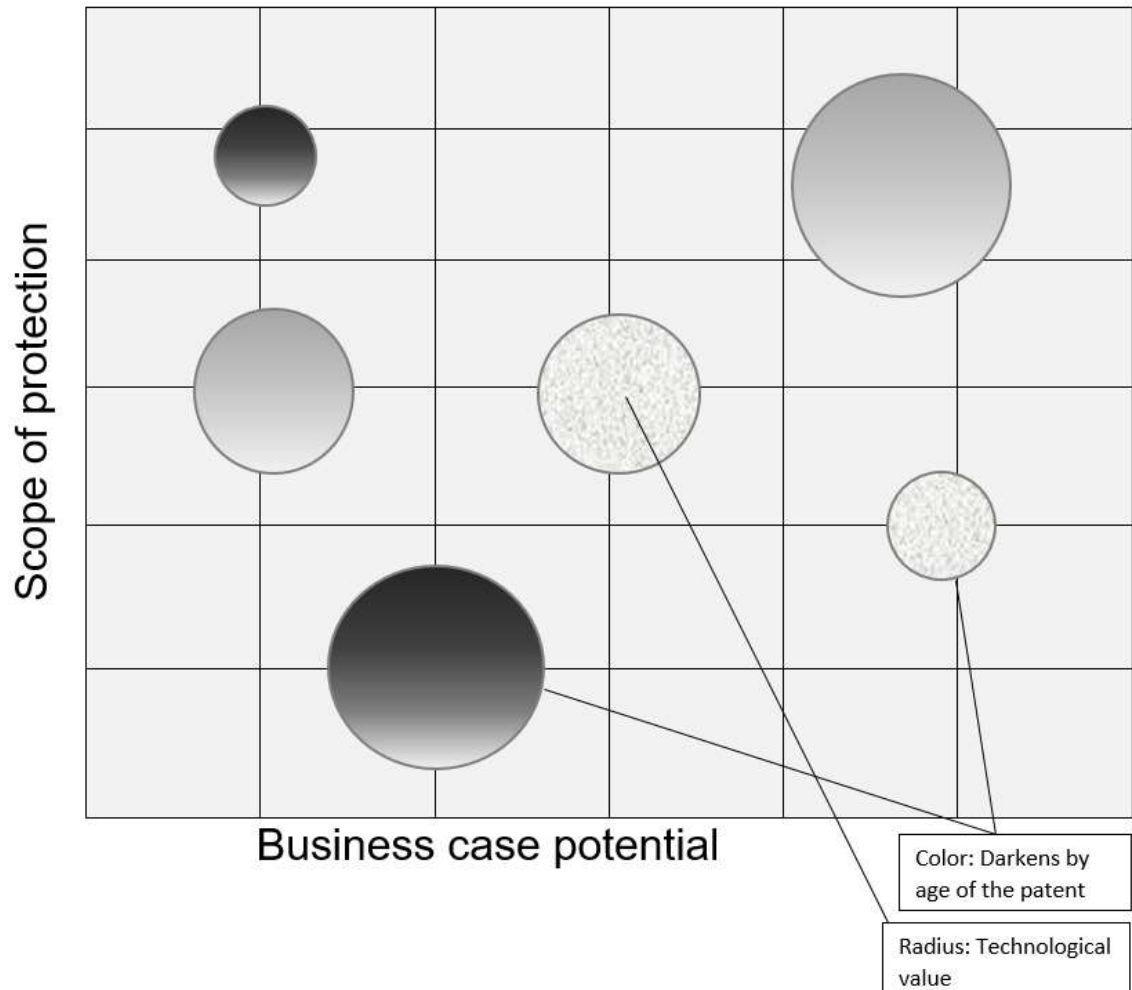


Figure 13. Initial proposal for patent evaluation.

As seen from Figure 13, scope of protection would be placed on the y-axis indicating the value related to contents of the patent. If the scope of protection becomes narrow during prosecution in patent office(s), the related value goes down. Business case potential on the x-axis would indicate the value the patent brings to the business in form of productization or blocking competitors. The radius of the bullet indicates technological value of the patent or the value of technological domain. The radius can be bigger if patenting target for the technological domain is set high in the business unit strategy. Finally, the color of the bullet indicates the age of the patent. Colors can be defined in

the IPMS according to stakeholder preferences. Red color may for example indicate an old patent.

The radius and the color attributes would be determined in the IPMS, and they would be shown in the matrix automatically, depending on the pre-defined business unit or technological domain as well as the age-range of 5 years. *Scope of protection* and *business potential* attributes would be defined on a scale of 1 to 3 in the meetings with business unit representatives and committee members. Number 1 would indicate low value both in scope of protection and business potential attributes, number 2 would be medium in the scope of protection, and good potential for future value in business case potential, and number 3 would indicate high value for both attributes.

The evaluation matrix would indicate the four value attributes – scope of protection, business case potential, technological value, and age – of a patent or a bundle of patents at one glance.

5.4 Summary of the Initial Proposal

In this section, the different process elements are pulled together as a process flow. All the patenting process phases from early development project phase to invention phase, prosecution phase and finally to maintenance phase are illustrated in the process flow chart in Figure 14 on the next page.

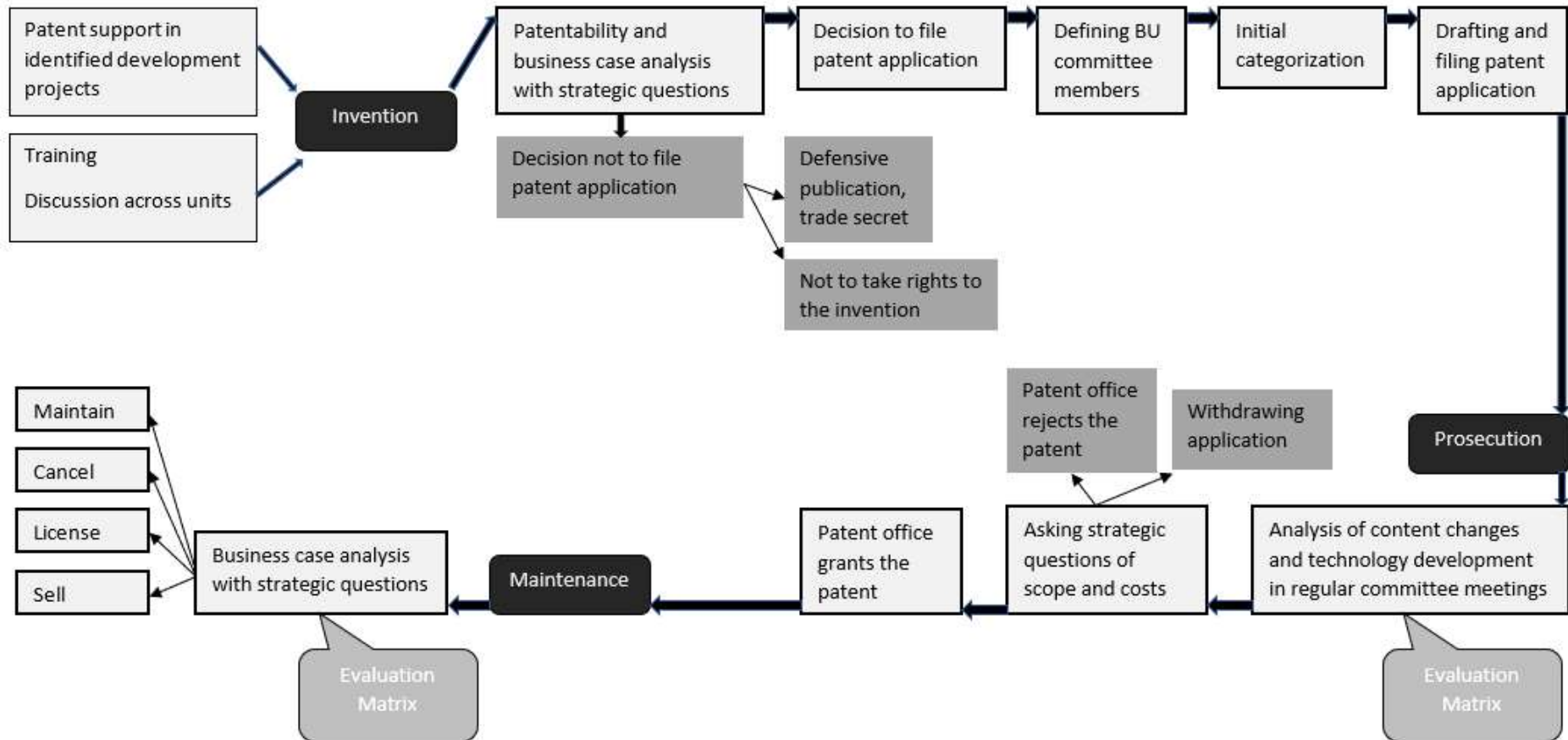


Figure 14. The whole patenting process flow within the IPMS platform.

As seen from Figure 14, the initial proposal is taking development projects as a part of patenting process by offering patent support to identified development projects right from the beginning. Together with training and discussion on ongoing technology projects across business units these activities would have an impact on identified inventions and aligning the inventions with the patenting strategy.

In invention phase, an invention has been identified, and patentability and business case potential should be analyzed. The initial proposal suggests considering each patent in view of strategic questions. How does the invention place itself against patent strategy, technological focus, and BU patenting target? The reasoning for patenting must be clarified in an early phase. Many times, there is no justification for filing a patent application and in those cases, it must be decided whether some other action like defensive publication is needed.

If a patent application is decided to be filed, the initial proposal suggests defining business unit committee members who will be participating in the prosecution and analyzing patent content and technological focus changes during prosecution. The committee members would consist of patent expert, technical expert, and product owner. Also, the initial categorization of the invention on a scale from 1 to 3 would take place in connection with decision to file patent application. The categories would define if the invention was going to be implemented (1) if it was for FTO or blocking competitors (2) and if the category was not yet clear and should be defined in near future (3).

Next, the process enters prosecution phase when patent application is processed in patent office(s) and patent committee is analyzing the patent contents and technology focus development during prosecution. Also, evaluation on scope against costs must be considered, and this is suggested to happen with help of evaluation matrix. Prosecution in patent office(s) is finalized when patent application is granted, rejected, or withdrawn.

If patent is granted, the granted patent becomes a part of patent portfolio which needs to be maintained by annual payments to patent offices. In the process, maintenance phase indicates regular portfolio check-ups where the business case of patents must be reconsidered. The initial proposal suggests that certain strategic questions could be asked in maintenance meetings concerning patents' significance in view of patenting strategy, technological focus, and BU patenting target. Also, the evaluation of patents

should be updated in maintenance phase using evaluation matrix as a tool. As a result, the patent would be either maintained, cancelled, licensed, or sold.

The whole process would be maintained and followed in the new IPMS which is the platform for all discussions and where all materials, costs, decisions, and evaluation are easily available to all stakeholders.

Next, Section 6 describes the validation of the initial proposal with the stakeholders. Improvement suggestions from the stakeholders are presented and the final proposal is pulled together.

6 Validation of the Proposal

This section reports on the results of the validation stage and points to further developments to the initial proposal. First, the steps for validating the initial proposal are described. Second, the development ideas from validation discussions (Data 3) are presented. Third, the final proposal is presented.

6.1 Overview of the Validation Stage

In this section, the steps of validation of the initial proposal are described. The initial proposal was built based on the interviews in the data collection rounds 1 and 2 as well as the existing knowledge and best practices from literature. The initial proposal contained a model for all the four patenting process phases of (1) R&D project support, (2) Invention phase, (3) Prosecution phase and (4) Maintenance phase. The process development model in the initial proposal was addressing the weaknesses found in the CSA. These weaknesses included the unclarity of patenting strategy and vagueness of cost structure. Also, the lack of early support in inventing, problem of changing organization and lack of consistent way to evaluate patents were taken into account in the initial proposal. A modern IPMS could solve the problems found in the CSA concerning the outdated IPMS and offer multiple ways to interact with stakeholders and thus, improve the data collection and analysis in different process phases.

The validation stage was conducted in two steps, as the initial proposal was presented to different stakeholders in two separate sessions. During the presentations, data collection round 3 (Data 3) was carried out. The first validation session included director of the patent management team and business leads and product managers from different business units. The second validation session was arranged for IP Board members which are high-level IP decision makers including members from Executive Board. In both validation sessions the initial proposal for a model for collecting and analyzing data using a modern IPMS as a tool in order to improve the strategic management of the company patent portfolio was presented.

Based on the discussion and feedback in the validation sessions (Data 3), the initial proposal was slightly modified, and the final proposal was established.

6.2 Developments to the Proposal (Based on Data Collection 3)

This section presents the inputs from the stakeholders during the validation sessions (Data 3). The inputs are collected in the below Table 10.

Table 10. Expert suggestions (findings of Data 3) for the Initial proposal.

	<i>Element of the Initial Proposal</i>	<i>Parts commented in Validation</i>	<i>Description of the comment/feedback by experts (in detail)</i>	<i>Development to the initial proposal</i>
1	All process phases	Implementation of the model	Certain characteristics of different business units should be considered in the model. It may need to be adapted to different business unit needs.	Different ways of operating in business units need to be considered when implementing the model and adapting the process accordingly.
2	Invention phase	Question on the process chart related to FTO	Should the FTO be considered in the first phase when the reasoning for patenting is determined? If we are only seeking FTO, there might be other possibilities like defensive publishing which should be considered as early as possible.	Adding the question of FTO in the earlier phase in the process.
3	All process phases	Process follow-up in the IPMS	How the different data in the process phases can be modelled in the IPMS? How can we follow if strategic goals are reached?	When implementing the IPMS, the important data must be modelled to easily create reports and visualize the follow-up of targets to stakeholders.

As seen from the Table 10, the stakeholders had feedback and questions concerning all the four process phases which were presented in the initial proposal. Nevertheless, the general reception of the proposal from the stakeholders was positive.

One of the business leads pointed out that the model for collecting and analyzing patent data should in some cases be adapted to the diverse needs of different business units. Accordingly, this should be considered in the implementation phase by discussing

specific needs of each business unit. However, the target of this thesis is to develop a consistent model throughout business units, but, for example the early project support and key questions in different process phases could be altering to some extent depending on business unit and its operation model.

Another business lead raised a question about one of the key questions in the invention phase. In the initial proposal, the question of FTO was proposed to be part of the initial categorization of patents which would occur during the invention process phase. The business lead believed that FTO is important to be considered already in the earliest phase in the invention process phase, as if the FTO is the only purpose of patenting, the company should also consider whether to make a defensive publication instead of filing a patent application. Being an important point, the question concerning FTO was relocated in the first step of the invention process as shown in the Figure 15 below.

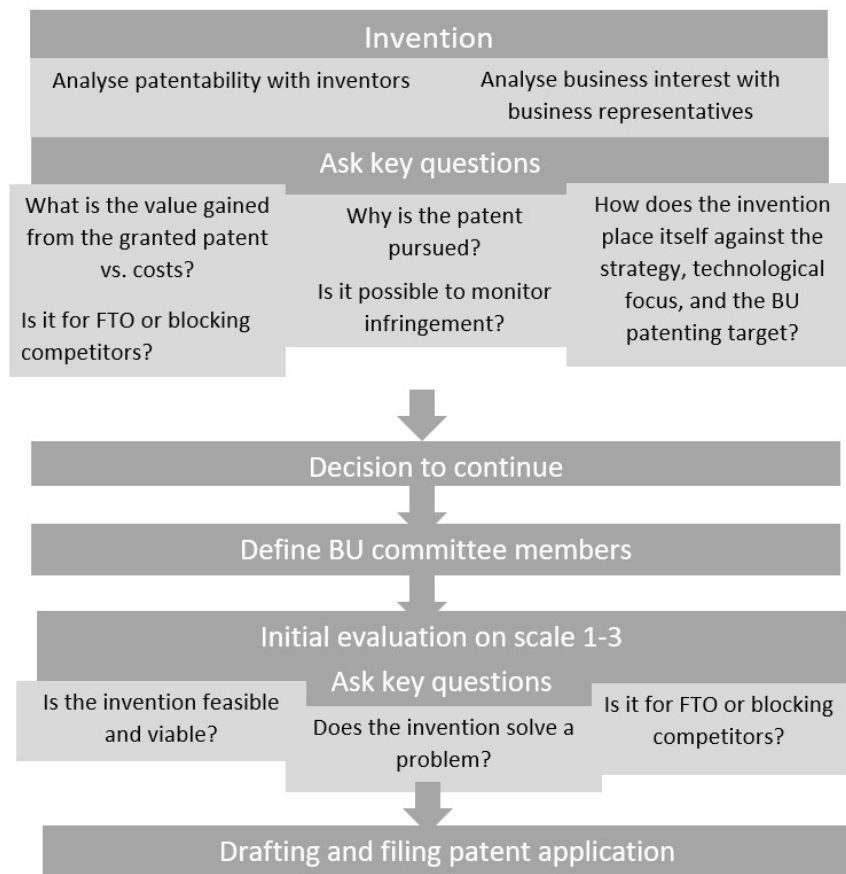


Figure 15. Invention Process Phase after improvement.

The Figure 15 shows that in the proposal for invention phase process the first step was modified to better consider the other options like defensive publishing in case of FTO

being the only target for a patent. However, the aspect of FTO was kept in the later process phase of categorization as the FTO/blocking competitors being one of the categories.

As the last point in Table 11, a member of IP Board and Executive Board was asking, how the targets of different business units could be followed and modelled in the new IPMS. According to him, it would be essential that the reports would be available and easily visualized in the IPMS to the stakeholders to be able to follow and analyze the progress. Accordingly, this important point of modelling the follow-up of targets was added to the implementation plan.

6.3 Final Proposal

In this section, the final proposal based on the validation discussions (Data 3) is presented. First, in the background of the process, patent support for identified development projects, training for stakeholders and discussion across business units would make sure that all the important inventions are identified, and focus would comply with the patenting strategy (Figure 16).

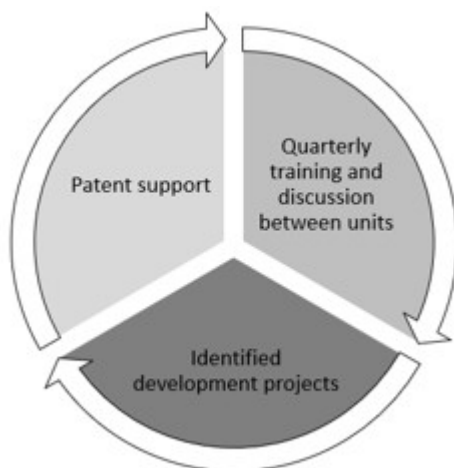


Figure 16. Improved R&D support.

Second, all the processes for each process phase as well as the evaluation matrix are gathered in Figure 17 on the next page.

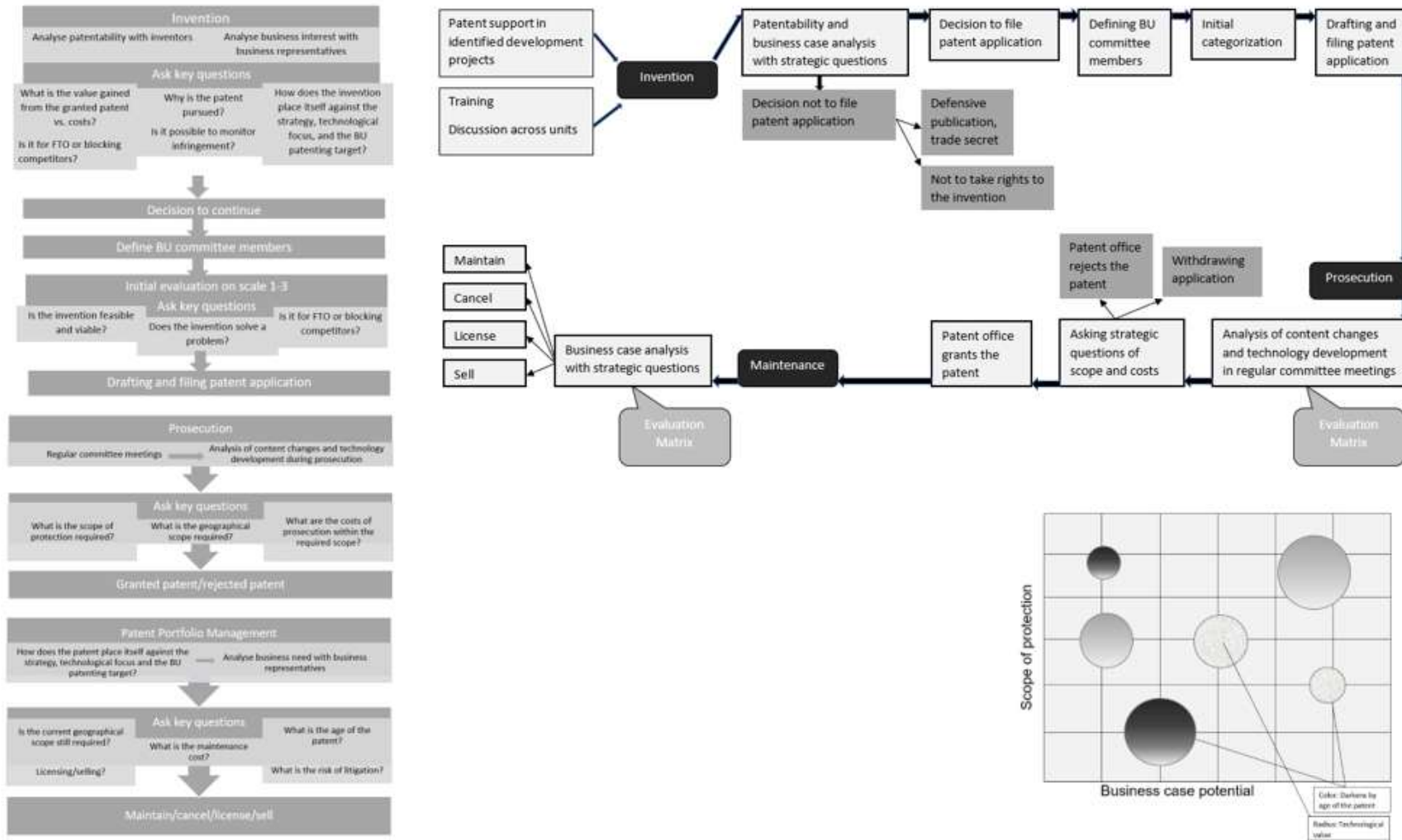


Figure 17. Different process phases and the process flow together with evaluation matrix.

7 Conclusion

In this section, key findings of this thesis are summarized, and the thesis project is evaluated.

7.1 Executive Summary

Significance of protecting IP is growing and acknowledging value of intellectual assets is expanding beyond IP and legal departments. With the middle-sized patent portfolio and with increasing complexity of patenting, strategic management of patent portfolio is becoming more important in catching the value from patents in the case company. With busy business decision makers, it is especially important to have an efficient patenting process. The case company patenting process was having problems with consistency in collecting and analyzing patent-related data as there was no structured process and no efficient tool for handling the data. There also was a lack of efficiency in getting the required data from stakeholders. The objective of this thesis was to develop a consistent model for collecting and analyzing data with using a modern IPMS as a tool in order to improve strategic management of the patent portfolio.

The research strategy in this thesis was applied action research as the objective was to solve a practical problem in the case company's business context. In the beginning, the objective of the study and the problem to be solved were determined. The study utilized qualitative research methods by sending a questionnaire to internal inventors and interviewing internal patent decision-makers and external IP experts.

In the literature review of the thesis, existing knowledge and best practices on patent management and evaluation of patents were studied. Based on the literature review, relevant aspects on patenting costs and strategy as well as communication were identified. In addition, the possibilities offered by modern IPMS as a tool were investigated.

After the literature review, current state analysis was conducted to understand the current patenting process and its strengths and weaknesses. The weaknesses identified in the current process were the lack of clear patent strategy, vague understanding of patent costs, lack of early support in inventing, tacit knowledge lost

due to changing organization, lack of consistent way of evaluating patents, and narrow frame of patent decision making. The weaknesses of the current IPMS were lack of interactivity, security problem with distributing information, low level of customizability, and non-existing integration possibilities.

Based on the existing knowledge and best practices, and the weaknesses identified in the CSA, a development proposal was built together with internal stakeholders. Also, external IP experts from other companies were contributing to the proposal building. As a result from all these inputs, a consistent model for each phase of the patenting process was created. First, early support in identified development projects was included in the early process phase together with necessary training for different stakeholders and technology discussion between business units. Second, important strategic questions were gathered to each process phase to ensure the strategic point of view in decision making. Third, patent committees were proposed to be nominated to each patent application to broaden the decision frame. And finally, the patenting process models for different process phases and a consistent model for categorizing and evaluating patents was pulled together as the process flow.

The proposal was describing a new structured process model which would offer a consistent way to manage patents and emphasize the strategic point of view of the patent management process. The process model would facilitate monitoring of strategy and technology focus alignment in patenting as well as clarifying costs in different patenting process phases. Proposal to include early development projects to the patenting process, and promoting trainings and technology discussion across units would increase understanding on patenting also on the R&D and project management side. All this together would ensure strategic management of patenting in all patenting process phases from the earliest phase of development projects to the last phase of maintenance.

Next, the proposal was validated by presenting it to the internal stakeholders in two separate sessions. In the first validation session, the proposal was presented to the stakeholders who are participating in the patenting process decision making. In the second validation session, the proposal was presented to the IP Board consisting of high-level decision makers and members of the Executive Board. The proposal received constructive feedback and there were some minor changes made to the model based on the feedback.

Thus, this thesis developed a consistent process model for patent management. Implementing and following the proposed process model would improve data collection and analysis and keep all necessary information – also the tacit knowledge – documented safely in the new IPMS.

7.2 Managerial Implications

In this section, recommendations for the implementation of the final proposal are presented. This study contributes to the development of the case company patenting process into more structured and consistent direction utilizing new IPMS tool. As a result, communication among the stakeholders would improve leading to improved strategic management of the patent portfolio. The recommended implementation steps are as follows:

1. Defining clear patenting strategy for all business units in co-operation with unit leads based on the general strategy of each unit.
2. Defining necessary process elements in the new IPMS together with IPMS service provider to ensure that most of the functions are available by the launch of the IPMS.
3. IPMS training for the IPMS users. Encouraging users to give feedback on the new tool.
4. Launching IPMS and presenting the process model functions and its benefits to the stakeholders. Encouraging stakeholders to give feedback on the process model.
5. Updating patenting instructions and preparing patent training material for stakeholders. According to the proposal, patent strategy should be clarified in all instructions and training material to enhance invention alignment with the strategy. Regular training is recommended to be arranged to several stakeholder groups, starting from inventors and project managers, and proceeding to competitor patent monitoring and business representatives. It

would be recommended to have targeted training to different stakeholders and multiple training packages with varying topics.

6. Following-up the process implementation in a form of questionnaire to receive feedback from the stakeholders and continue improving the process.

Following the recommended steps would enhance smooth implementation of the process model and ensure continuous improvement of the process.

7.3 Thesis Evaluation

The outcome of this thesis was quite near the original objective. The applied action research strategy was found to be suitable for the study, so that the main weaknesses were identified in the CSA and later addressed in the subsequent steps of the development part. There were several important stakeholders willing to give their time for the interviews and contributing to the proposal. Patents are not typically at the center of their daily work, and it was valuable to try to see their viewpoint and hear their expertise. At the same time, this study was contributing to the common understanding about patent management.

The weakness of the proposal building was that the implementation of the new IPMS was delayed and practical suggestions for the utilization of the tool were not possible to make. Defining the process functions within the tool is listed in the recommendations in Section 7.2. Another challenge was that, right from the beginning, the study was expanding beyond the objective to develop a model as there were wide discussions on the strategy parallel to developing the model. From time to time, it was hard for the thesis researcher to keep the strategy apart from the model development. This was the case also with the interviews as the discussion was easily slipping towards the strategy topic.

In addition to the strategy point of view, another important topic which was left out of the scope of this thesis was competitor patent monitoring. Problems of competitor patent monitoring would deserve a thesis study of their own.

As a positive side effect of the study and further with proposal implementation, patent management will gain more visibility within the business units in the case company.

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