

THE FRAMING DYNAMICS OF PATENT VALUATION

**VALUE DETERMINANTS FOR MANAGEMENT CONTROL OF
PATENT PORTFOLIOS**

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Abstract

This paper aims to examine valuation framing of patent stakeholders for management control purposes, and how they engage during pruning decision processes, determining whether to abandon or to keep a patent after 10 years or more of its lifetime. Through an exploratory single-case study, drawing on framing theory, the investigation enables an in-depth understanding of the value determinants and the dynamics during the decision-making. A qualitative study has been conducted through semi-structured interviews with patent stakeholders pursuing different roles within a multinational industrial case company, going through a digital transformation. The thesis' empirical analysis shows how the interviewees interpret patent value, both on an individual level as well as collectively. Frame blending, frame shifting, and frame denial are identified during the assessment of patent value, due to the dynamics of multiple frames leading up to the final decision. Moreover, the three main contributions to the domain of patent valuation can be summarized as: (1) a presentation of patent stakeholders' courses of action during pruning decision processes, (2) how framing plurality illustrates patent stakeholders' value assessment on a deeper level, and (3) how patent stakeholders engage in the valuation depending on if a patent protects a mechanical or a digital product.

Keywords: Patent valuation, framing plurality, pruning decision, management control, intangible assets

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1. Introduction

The significant fraction of enterprise value related to intangible assets has during the past 50 years experienced an increasing trend. When investigating the market value of S&P 500, about 90% of the market capitalization consists of intangible assets where the value is not directly observable in the financial statements (Ocean Tomo, 2020). In a knowledge-based economy, patents are defined as one of these valuable intangible assets, hidden from the balance sheets (Haskel & Westlake, 2018, p.15). A patent is an exclusive protection of a technical invention where the owner who is in control of the patented solution has the power to prevent others from using the same feature for up to 20 years. When filing for a patent application, the detailed information regarding the invention will be disclosed and become part of the public domain (European Patent Office, 2024a). Patents are moreover viewed as important assets to explore due to three reasons; Firstly, patent value is considered invisible (Burk, 2021), secondly, they contribute to the encouragement of innovational investments (Haskel & Westlake, 2018, p.153), and thirdly, the decision regarding which patents to retain in a portfolio holds strategic significance (Reitzig, 2003). Giuliani & Marasca (2011) further discuss intangible assets and how the value creation process is complex, thus, hard to evaluate through a quantitative valuation formula. Traditional valuation models, such as discounted cash flow analyses, have proven to be problematic to assess the return on investment for innovations, risking to inhibit such initiatives (Christensen et al., 2008). It is clear that the financial valuation of such assets remains a matter of concern (Giuliani & Marasca, 2011), suggesting the need for additional studies within the patent value domain. Patent value is in addition expected to vary during its lifetime, due to the portfolio becoming technologically old (e.g. Grimaldi et al., 2015), motivating why continuous value assessments are necessary. Therefore, an in-depth examination of patents as valuable intangible assets is highly relevant for management control purposes.

Previous literature examines both the value creation of patents (e.g. Fisher & Oberholzer-Gee, 2013; Reitzig, 2004; Striukova, 2007) as well as the assessment of patent value (e.g. Chang, 2012; Grimaldi et al., 2015; Reitzig, 2003). Patents can create value in different ways, both through individual entities and through systems and structures, as well as by market or non-market relationships (Striukova, 2007). When assessing patent portfolio value, prior papers have completed a quantitative coding of qualitative value parameters to increase the measurability (Grimaldi et al., 2015; Reitzig, 2003). Making a valuation assessment has proven to be difficult since patent value is dependent on the specific context (Lagrost et al., 2010; Striukova, 2007). Burk (2021) evaluates patents from a different perspective, using a sociological approach based on framing theory by Cochoy (2008). The aim is to investigate inherent patent information from a law perspective, useful in terms of jointly creating frames for a mutual understanding. Building on the

assumption that patents must hold some worth or utility (Burk, 2021), justifying investments in such assets, this thesis approaches the patent valuation domain for management control purposes rather than from a legal point of view. There is a lack of research regarding how cognitive framing can support the understanding of patent valuation, and illustrate its dynamic processes and patterns. Thus, this thesis investigates patent valuation from a framing perspective, inspired by the framework by Cochoy (2008). Cochoy (2008) presents three categories of framing, involving both quantitative and qualitative aspects as well as collective interactions, using the terminology of calculation, qualculation, and calculation. By incorporating this categorization, the aim of this thesis is to explore patent valuation after a patent has reached an age of 10 years, for management control purposes. The study is limited to pruning decisions, whether to abandon or to keep a patent in a portfolio. The following research question has been defined to guide the investigation:

How do patent stakeholders engage in patent valuation in the pruning decision?

A qualitative single-case study has been carried out through conducting semi-structured interviews with intellectual property (IP) professionals, product managers, as well as technology managers at the case company in question, all with experience from pruning processes. The empirical analysis shows signs of frame blending, frame shifting, as well as frame denial within the case company, explaining the dynamics arising during the decision-making, both on an individual level and collectively. The study further reaches three main conclusions, contributing to the current domain of patent valuation, summarized as patent stakeholders' (1) courses of action during pruning decision processes after a patent has reached an age of 10 years, (2) cognitive framing practices when determining patent value, categorized into calculation, qualculation, and calculation, and (3) approaches to assessing patents that protect mechanical versus digital solutions.

The thesis structure begins with an overview in chapter two of both the domain and the method theory, leading up to the theoretical framework. The methodology is further presented in chapter three, including the research design, the collection and analysis of data, together with the data quality. In chapter four, the empirical findings are analyzed, outlining the pruning decision process and the framing activities within the case organization. Finally, a concluding discussion is presented in chapter five, covering this thesis' three main contributions, as well as the limitations with the study and future research recommendations. In the Appendix, section 7.1., definitions regarding concepts within the patent domain can be found for guidance.

2. Theory

This chapter starts with an overview of previous literature within the domain of patent valuation under 2.1. This includes a review of studies examining patent value creation, the assessment of patent value, and the theoretical gap identified. In section 2.2., the method theory is reviewed by digging deeper into the concept of framing where calculation, qualculation, and calculation, as well as framing plurality are presented. Finally, under 2.3., the domain and the method theory are combined into the theoretical framework applied in this study.

2.1. Domain theory – patent valuation

The primary rationale supporting the existence of patent systems, enabling the creation of patents as assets, typically centers in the incentive for innovation (Burk, 2012). It is suggested that innovators might hesitate to allocate resources for developing new and beneficial technology or disclose inventions unless they are assured of receiving a return on their investment through protection from being copied (Burk, 2021). Several previous studies within the domain of patents focus on investigating various perspectives of how value creation by patents takes place (e.g. Conley et al., 2013; Fisher & Oberholzer-Gee, 2013; Reitzig, 2004; Striukova, 2007), useful strategies to effectively utilize value from patents (e.g. Grimaldi et al., 2018; Somaya et al., 2011), or how the subject of patents require an involvement of IP, technology and business professionals (e.g. Conley et al., 2013; Fisher & Oberholzer-Gee, 2013; Reitzig, 2004; Striukova, 2007). There is a limited number of scholars that emphasize how to assess patent value and monitor its development during its lifetime (e.g. Grimaldi et al., 2015; Reitzig, 2003). In the following three sections, prior studies describing the value creation of patents as well as how patent value is assessed will be presented, ending with the theoretical gap identified.

2.1.1. Patent value creation and integration for strategic decision-making

In order to understand the importance of patents, and why companies are willing to invest in such assets that are not part of the financial statements, there is a need to investigate how patents create value. Several authors cover the domain of value creation in relation to patents (e.g. Conley et al., 2013; Fisher & Oberholzer-Gee, 2013; Reitzig, 2004; Striukova, 2007) but they do this in different ways. An article that explores this subject is written by Striukova (2007), who has completed a review of previous literature in regard to value creation of patents. The author contributes with a two-by-two matrix that classifies how patent value can be created through the separate dimensions. The dimensions for how corporate patents are analyzed are divided into embedded in individuals versus embedded in systems and structures, and non-market versus market

relationships. An important finding in this paper is that corporate patent value can reside from a mix of all these four. The first box of the framework, combining the dimensions of patent value being embedded in individual entities with market relationships, involves patents' ability to generate income, both through selling products and through fees from licensing out patents to others. The second box combines patent value being embedded in systems and structures with market relationship, and this includes using patents both to block competitors from entering a market but also to allow entry for certain actors, known as providing firms with trade privileges. In this way, patents have the ability to create value through facilitating market relationships. In addition, patents can increase organizations' bargaining power in cross-licensing agreements, exemplified as a company being accused of patent infringement. However, if the firm owns patents that can be used for suing back, a cross-licensing deal can be established. Moreover, this box includes the creation of standards and how standard-setting organizations (SSO) support companies in, for instance, decreasing R&D costs.

The third box by Striukova (2007) combines value embedded in individual entities with non-market relationships, demonstrating how patents allow firms to internally combine resources of knowledge and creativity, resulting in knowledge spillovers. Knowledge spillovers have in addition been defined as important for economic growth (Haskel & Westlake, 2018, p.72), motivating how this creates value. Furthermore, sharing knowledge and possessing an innovative culture within a company increase the possibility of future innovations. Finally, the last and fourth box of the framework by Striukova (2007) includes value embedded in systems and structures with non-market relationships. This box involves creating strategic networks as well as trust, both between and among organizations. The idea is that products tend to include not only one, but several patents, suggesting that firms will have difficulties in remaining relevant unless they engage in networks. All in all, the two-by-two matrix aims to illustrate that whether a patent is viewed as a value creating asset or not will be context dependent, and thus, a patent which is considered valuable for a specific firm might be worthless for others. Therefore, this framework contributes as a useful tool, allowing IP managers and decision-makers to analyze how patents create value in different contexts.

Conley et al. (2013) emphasize the change among innovative companies that are developing towards having a more integrated, cross-functional approach in regard to IP management, instead of solely assigning this to the legal or IP department. A similar argument is presented in previous literature (e.g. Agostini et al., 2023; Dolfsma, 2011; Reitzig, 2004; Striukova, 2007) where for instance Striukova (2007) presents this as part of the third box (in the framework mentioned earlier), involving an information exchange between different functions being necessary within a firm as it allows for desired internal knowledge spillovers. Reitzig (2004) adds to the subject of integration by suggesting that IP management must be a concern for several parts of an organization, discussing the

need to incorporate different functions to be able to create as much IP value as possible. Moreover, Fisher & Oberholzer-Gee (2013) describes this issue where organizations struggle with the exploitation of IP value due to a lack of cooperation between strategy, R&D, and legal units. The required integration presented is closely related to processes of decision-making. This is further exemplified by Dolfsma (2011) who explains that many functions are involved in processes of decision-making related to patents, however, the matter of concern is that all employees do not possess the same knowledge when it comes to patent strategy and decision-making. Moreover, Dolfsma (2011) adds that patent decisions cannot only be made at certain levels within a company, emphasizing the need to incorporate top management in such decision-making. The incentive for involving several stakeholders within a firm can further be likened to what Striukova (2007) presents as the positive effects of internal knowledge spillovers in terms of patent value creation.

Apart from the integration of distinct stakeholders within organizations (e.g. Agostini et al., 2023; Conley et al., 2013; Dolfsma, 2011; Reitzig, 2004; Striukova, 2007), an additional form of integration is emphasized in prior literature, namely the alignment between a company's business strategy and its patent strategy (Grimaldi et al., 2018; Somaya et al., 2011). Somaya et al. (2011) discuss the necessity of making sure that business objectives are in line with a firm's patent strategy since this will support corporations in terms of how to direct innovative activities. In addition, it is explained how the patent strategy will be critical depending on what organizational model a certain company has. Thus, it could be suitable to apply distinct organizational strategies for separate applications of one single technology that is considered to be core. Grimaldi et al. (2018) further explain different exploitation strategies in order to create as much value as possible from all patents within a portfolio. The four alternatives for exploitable strategies are (1) maintaining or direct commercialization, (2) licensing or cross-licensing, (3) selling, and (4) abandoning. The idea behind the paper is to firstly determine whether each patent is in line with the business strategy in general, and secondly, to define which strategy that would be the most appropriate one for maximizing the value creation from that specific patent.

The strategies presented by Grimaldi et al. (2018) differ slightly in the terminology and categorization compared to the paper by Somaya et al. (2011), which instead divides patent strategies into proprietary strategy, leveraging strategy, and defensive strategy. A proprietary strategy is closely related to obtaining a certain market position through focusing on having a broad patent protection, while a leveraging strategy is about patenting solutions that are expected to be useful for others, creating a willingness to license out such patents. Lastly, a defensive strategy (Chung et al., 2019) involves building a patent portfolio with the purpose of having it as a defense if others try to sue

you for infringement, supporting the establishment of potential cross-licensing deals (Somaya et al., 2011).

All in all, it is clear that value creation of patents (e.g. Conley et al., 2013; Fisher & Oberholzer-Gee, 2013; Reitzig, 2004) can be examined from different perspectives. These include combinations of value being embedded in entities or in systems and structures together with market or non-market relationships (Striukova, 2007), but also aspects of integration (e.g. Conley et al., 2013; Dolfsma, 2011; Fisher & Oberholzer-Gee, 2013; Reitzig, 2004) and patent strategies (e.g. Chung et al., 2019; Grimaldi et al., 2018; Somaya et al., 2011) and their impact on patent value. It can be concluded that IP management, in terms of the value creation process, involves a complexity and is not straightforward. In addition to the value creation process, IP management must involve a continuous evaluation of patent value (Grimaldi et al., 2015; Reitzig, 2003), which is discussed in the next section of this chapter.

2.1.2. Assessing patent value

Previous literature examines how to analyze patent portfolios in order to monitor the portfolio composition and justify the maintenance of each patent. Hence, patents do not only create value in multiple ways, but they contain it as well, thus, a wide range of information can be obtained by reviewing them. Through investigating different parameters in patent portfolio analyses, strategically useful information about the patents will be revealed (e.g. Chang, 2012; Ernst, 1998; Grimaldi et al., 2015; Li et al., 2020; Lin et al., 2011). In previous studies about valuation of intellectual capital (IC), with a focus on human capital, documentation complementary to the financial statements has been found to be used as accounting systems, monitoring the evolution of intangible asset value over time (e.g. Dumay & Cuganesan, 2011; Edvinsson, 1997; Skoog, 2003). For the management control of patents, there is an absence of such documentation assisting in the monitoring of the value. Instead, scholars have used different parameters to analyze patent portfolios in an attempt to detect intrinsic patent value (e.g. Burk, 2021; Grimaldi et al., 2015; Reitzig, 2003).

From a technological point of view, the information embedded in patents can be evaluated and provide indications of R&D capability (Lin et al., 2011), technological strength of a company (Chang, 2012; Li et al., 2020), as well as technological trends in general (e.g. Lee et al., 2011; Yoon et al., 2013). For instance, Lin et al. (2011) exemplify the usefulness of analyzing patents for start-ups to reveal their R&D capacity. This was found to be of great importance for start-ups' opportunities to have a reference point in discussions with established firms, to assist their strategic decision-making to enhance jointly successful commercialization of the inventions. The technical strength of a corporation can also be investigated through patent portfolio analyses, useful for evaluating internal IP management efficiency of patent portfolios' technological strength

(Li et al., 2020). Li et al. (2020) uses a patent portfolio model to measure the technological strength of a company. The model is designed to use patent portfolios to evaluate both the advantages and disadvantages of the technological standpoint of the firm, pinpoint development opportunities and optimal allocation strategies, helpful for the decision-making in resource optimization and to devise a roadmap for the technical domain. From an external perspective, but for internal R&D management purposes, useful information about competitors' R&D strategies can be disclosed by examining their patent portfolios, applicable for internal decision-making of R&D activities (Ernst, 1998; Grimaldi et al., 2015). Ernst (1998) investigates how strategic R&D planning will be impacted by competitors' moves and their patent portfolios. Furthermore, general technological trends within the field can be detected through examining the information from multiple patents granted during a period, which is essential for the disclosure of critical technologies moving forward, and the expansion of certain technology markets (e.g. Lee et al., 2011; Yoon et al., 2013).

Managing and determining the value of IC, more specifically human capital, is significantly more explored than value determinants for patents (e.g. Dumay & Cuganesan, 2011; Edvinsson, 1997; Skoog, 2003; Tayles et al., 2007). A pioneer approach to disclose the inherent value of human capital was the incorporation of additional reports to the traditional financial statements, utilized by Skandia (Edvinsson, 1997). Dumay & Cuganesan (2011), Skoog (2003), and Tayles et al. (2007) present similar methods to measure the value of IC and to make sense of the complexity using discoverable components with management accounting systems implemented. Moreover, Giuliani & Marasca (2011) investigate the valuation process of IC instead of focusing on measuring a static value, which shows that managers' attention should be focused on the active role of IC and its impact on financial performance.

Literature focusing on valuing patents does not include similar management accounting systems as the evaluation of the human capital aspect of IC. Instead, other quantitative and qualitative methods have been used to determine patent value and its development in the absence of formal measurement models. Lagrost et al. (2010) suggest that to find an appropriate method for patent valuation, the specific context must be taken into account. Quantitative methods for assessing patent value involve measuring numerical data, considered as an objective approach, including cost, market, or income approaches, suitable for external patent valuation. On the contrary, a qualitative valuation approach for patents is suggested as more helpful for the internal management of patent portfolios, aiming to assist in guiding comparisons, categorizations, and rankings of patents being part of a portfolio. However, it should be noted that for managerial reasons, qualitative data is sometimes categorized in a quantitative manner, resulting in quantitative data that stems from a qualitative judgement (Lagrost et al., 2010). This distinction between quantitative versus qualitative approaches can be distinguished when reviewing literature

within the field of patent valuation as well as the reasoning behind it. For example, from an external viewpoint, some scholars have proposed that the economic value of a patent equals the stream of its renewal fees (Gambardella, 2013) or the transaction price when selling the patent (Fisher & Leidinger, 2014). These approaches are similar to commonly used valuation methods for other assets, such as discounted cash flow or market price analysis. However, if the purpose is to detect value for the internal valuation and management of patent portfolios, those approaches seem useless. Such an analysis involves limited information about the benefits that are put against the costs, motivating why a monetary approach does not give the full picture of patent value. Therefore, other methods involving qualitative elements to determine the value of patent portfolios, for management control purposes, are more relevant to use (Lagrost et al., 2010). Nevertheless, it should be highlighted that the comprehension of the inherent value of patents for internal purposes is relatively unexplored in prior literature, both theoretically and practically.

Grimaldi et al. (2015) and Reitzig (2003) are some of the few scholars in the field that investigate different value indicators and how these can be useful in terms of managing patent value. Hence, they aim to approach patents as valuable assets in the absence of accounting systems, such as separate reports covering this type of intangibles. These studies highlight that due to different managers' selections of valuation methods, patent value can be assumed to vary depending on the purpose and the context of the evaluation. Reitzig (2003) attempts to determine which patent characteristics that potentially impact the value, both when a patent first is filed for as well as the point in time when the study takes place. Grimaldi et al. (2015), on the other hand, try to appraise patent portfolio value to create an overview useful to optimize the holdings for strategic technology planning.

To interact with the patent value assessment process and guide strategic decisions regarding patent portfolios, Grimaldi et al. (2015) and Reitzig (2003) assume that the perceived value of a patent is substantiated through analyzing factors from theoretical findings in previous literature. Both studies use a methodology approach for which they quantify the qualitative indicators, where Reitzig (2003) reaches conclusions regarding which parameters that are of greatest importance to determine patent value. For Grimaldi et al. (2015), this quantified approach allows for mapping out patent characteristics in a Cartesian coordinate system illustrating the portfolio composition, useful for managerial purposes. Moreover, Reitzig (2003) investigates to what extent five different features of patents potentially can impact the value for patents used as "bargaining chips", allowing companies to enter cross-licensing negotiations with competitors in the semiconductor industry. Expert teams, consisting of technical and marketing representatives, were to fill in a questionnaire where they were to rate whether the five different characteristics played a significant role for the patent value for this certain use. Grimaldi et al. (2015) also base the study on five indicative parameters, however, they differ slightly from the parameters

by Reitzig (2003). Grimaldi et al. (2015) additionally divide the parameters into two sections for which the data collection methods differ. For three of the parameters, a bibliographic approach is used for which objective data regarding technologic-bibliometric information about the patents is collected from IP databases. For the other two parameters, interviews with companies' managements have been carried out where they were to assign a value for each patent regarding their patenting strategy and economic relevance. The approach by Grimaldi et al. (2015) assumes that patent value cannot be assessed without examining all five parameters building up the Cartesian coordinate system. This opposes the study by Reitzig (2003) which describes that different parameters are of varying importance for the valuation.

The parameters included in the paper by Reitzig (2003) are (1) technical importance (in previous literature stated as novelty and inventive activity), (2) invent around, (3) learning value through disclosure, (4) portfolio position, and (5) the difficulty of proving infringement. (1) Technical importance measures how valuable a patent is for current and future technological development while (2) invent around focuses on the constraints for competitors to develop a similar function or product. (3) Learning value through disclosure aims to investigate if competitors can gain knowledge regarding technological standpoint and research focus through examining the patent, which Li et al. (2020) believe can be used to competitors' advantages while negatively affecting the patent holder. Furthermore, (4) portfolio position means to what extent a single patent is expected to be affected by its relation to other patents in the portfolio, while lastly, (5) the difficulty of proving infringement involves how difficult it is to prove that someone infringes on the patent, and hence, the strength of the protection by the patent. The interviewees jointly valued each parameter on a scale from one to five in terms of how they interpreted their impact on patents in the sample. Reitzig (2003) further concludes that for patents used as "bargaining chips", to feature cross-licensing negotiations in the semiconductor industry, technical importance was the parameter of greatest importance. The elements of disclosure as well as how challenging it is to invent around an invention were proven to be less significant. For patent portfolio management purposes, Reitzig (2003) resonates that the findings indicate that a renewal decision for maintaining patents in a portfolio should mainly depend on the technical importance. How challenging it is to invent around a patent, or if competitors can receive insights from the disclosure, should then be of secondary importance in the patent renewal determination.

Similar to Reitzig (2003), Grimaldi et al. (2015) also investigate the technological importance. However, the approach is more objective, for which the number of claims a patent has determines this parameter. The second parameter investigated by Grimaldi et al. (2015) is forward citation frequency, a parameter commonly used to analyze the significance of the technology (Chang, 2012), as if it is frequently cited, it may indicate that the patent is highly relevant within the technological field. The third parameter used

is the international scope, motivated by the assumption that the quality of the patent is correlated with the geographical coverage. The data for these three parameters are collected with a technologic-bibliometric approach from an IP database where the three parameters receive a merged mean value, without weight differences, illustrated as a bi-dimensional representation bubble in the Cartesian system. The remaining two parameters include patenting strategy and economic relevance, where information was gathered through interviews with relevant managers. Four possible patent strategies are presented and quantified, on a scale ranging from offensive strategies to defensive strategies, where the highest value is assigned to patents protecting a prominent strategic position that contributes to a competitive positioning within the technology field. The last parameter, economic relevance, examines the extent to which the company benefits from the patented innovation, on a scale ranging from interpreted as not having any remaining economic value to interpreted as being core due to a high economic importance. In conclusion, the framework illustrates the perceived value of patents being part of the portfolio composition.

Prior studies also show that patent value is not static but develops during distinct phases of a patent's lifetime (e.g. Grimaldi et al., 2015; Kotler & Bliemel, 1995, cited in Reitzig, 2003). Already during the 60's, changes in patent value over time was noticed (Reitzig, 2003). Usually, the value of a patented invention follows a technology cycle, for which the value tends to rise until it reaches the peak of the technology cycle and then declines thereafter (Kotler & Bliemel, 1995, cited in Reitzig, 2003). Similarly, Grimaldi et al. (2015) demonstrate how the value development of patents can be separated into three phases, for which the patents initially are viewed as having poor economic relevance but high strategic relevance. The patents then evolve to a perceived valuable phase for which both the economic and strategic relevance is perceived as high. Moreover, as the patent portfolio ages, the lifecycle passes by, and hence, strategic value has been lost. Thus, there is only a sufficient value of economic relevance left. Reitzig (2003) additionally highlights the lack of exploration regarding this issue in his study since the parameter has been found relevant in multiple previous papers, however, the exclusion has been done due to a selection bias regarding the age of the studied patents used as reference material.

2.1.3. Theoretical gap

To conclude, most of the literature within the patent domain related to management control purposes focuses on value creation and the utilization of patent portfolios (e.g. Conley et al., 2013; Fisher & Oberholzer-Gee, 2013; Reitzig, 2004; Striukova, 2007). Research regarding how managers evaluate their patents over time to justify the costs is significantly more limited. Prior research papers investigate patent value through qualitative parameters where the importance level of the value determinants have been ranked and coded in a quantitative manner. The methodologies used have also been rather

closed, using questionnaires to rank different parameters (Grimaldi et al., 2015; Reitzig, 2003), excluding a more flexible approach that gives rise to novel ideas and innovative insights. In addition, Grimaldi et al. (2015) assume that all five parameters examined need to be included in the value assessment, while Reitzig (2003) suggests that the different determinants will not be viewed as equally important. Since value can be created in multiple ways and will be context dependent (Striukova, 2007), the fundamental assumptions by Grimaldi et al. (2015) and Reitzig (2003) could be questioned. Previous literature also states the importance of having an integrated value assessment, involving people pursuing different roles within a company (e.g. Agostini et al., 2023; Conley et al., 2013; Dolfma, 2011). However, the studies do not demonstrate whether, or how, this integration actually is carried out in practice. This indicates a need for further studies exploring an internal cross-functional approach towards qualitative patent valuation, in line with Lagrost et al. (2010), as well as examining how the determinants' importance level impact the value of older patents.

2.2. Method theory – framing

Within framing theory, it is important to understand the emergence of frames that affect individuals' viewpoints in different contexts including a valuation aspect based on judgement. The concept of framing is mentioned in previous literature by several authors (e.g. Benford & Snow, 2000; Cornelissen et al., 2011; Kaplan, 2008; Lok, 2010; Meyer et al., 2016; McCright et al., 2016), however, the articles address the concept of framing from different perspectives. Kaplan (2008) describes this concept as organizational actors possessing separate cognitive frames (Cornelissen & Werner, 2014; Werner & Cornelissen, 2014) which in turn impact the processes of decision-making, exemplified by two technology strategy projects at a case company. By cognitive frames, the author implies the specific lenses from which the different people involved in the decision-making processes view the environment (Kaplan, 2008). Cochoy (2008) takes another approach, illustrating how several frames for one individual creates a single view, implying that framing appears on two levels; personalized within an individual as well as collectively within a group. Cochoy (2008) further divides framing into three categories: calculation, qualculation, and calculation, and exemplifies this with a shopping cart's function during a shopping process. These three ways of framing are further described in the following section, 2.2.1.

2.2.1. Calculation, qualculation, and calculation

To understand the origin of cognitive valuation framing (Cornelissen & Werner, 2014; Kaplan, 2008; Werner & Cornelissen, 2014) and how it is unconsciously developed, it is necessary to investigate how the development is happening in relation to the context, to individuals' needs, selection material, as well as individuals' behaviors in collective and

collaborative settings. The paper by Cochoy (2008) investigates three different kinds of framing, incorporating both quantitative and qualitative aspects as well as collective interactions, using the terminology of calculation, qualculation, and calculation. In this paper, Cochoy (2008) digs into customers' behaviors during a shopping session with a shopping cart. Previous research that has inspired the investigation has shown that customers' choice regarding which products to buy is not solely based on cognitive and functionalist proportions, but also situated and cultural dimensions. Calculation, qualculation, and calculation are all expressed through observations and interviews at a supermarket, guiding the reader to understand this framing emergence. The plurality of frames is created by different forms of economic cognition related to the decision-making process and how a consumer moves from a price-based calculative judgement to a quality-based qualculative assessment. Moreover, the shopping cart functions as a frame for collective calculation through a transformation of the individual customer into a collective one (or a cluster, i.e. a small group of people gathering around the same shopping cart). The idea illustrated by Cochoy (2008) can be likened to the framing plurality covered by Kaplan (2008), however, Kaplan (2008) takes a different perspective, examining framing plurality in terms of framing contests (see section 2.2.2.).

Calculation, by Cochoy (2008), sheds light on how frames related to calculation of objects, for monetary restrictions such as a budgetary constrain, and objective limitations, affect the execution and limitation in an individual's selection process. The author exemplifies that an early commitment in the shopping process is made when the customer picks a cart with a suitable volume, as the volumetric capacity then will constrain the consumer's purchasing capacity. The choice is influenced both by the shopping carts provided by the store as well as the customer's estimation of size, weight, and fragility of the products that are planned to be purchased. In summary, quantifiable elements being part of the decision-making process create the calculation framing activities made by individuals. Furthermore, qualculation involves quality-based framing, including needs, purposes, selection equipment, and the market. This is illustrated by a shopping list, involving specific characteristics of certain products, for instance describing color, shape, or origin, which during the shopping process will be compared against the store's supply. For an item on the list such as sugar, a consumer will for example need to assess whether the sugar is supposed to be granulated or in cubes, or whether it should be brown or white (Cochoy, 2008). Finally, the last framing aspect, calculation, highlights how cognitive frames (e.g. Cornelissen & Werner, 2014; Kaplan, 2008; Werner & Cornelissen, 2014) are created, modified, or copied due to individuals being part of collective clusters. Individuals obtain reference points and consider others' opinions, for instance through verbal discussions, body language, and behaviors or roles which have the ability to impact how frames are shaped. Thus, by taking the standpoints of others into account through interactions, the collective can affect the individual's frame (Cochoy, 2008).

2.2.2. Framing plurality

Since different people's cognitive frames are impacted by distinct experiences (e.g. Cornelissen & Werner, 2014; Kaplan, 2008; Werner & Cornelissen, 2014), a framing plurality will appear on two levels. Firstly, within an individual, and secondly, during calculative interactions between individuals (Cochoy, 2008). In the paper by Kaplan (2008), this framing plurality is expressed as individuals having different ideas about what would be the best solution in terms of determining what investments to make. In other words, there was a divergence of actors' frames rooted in the fact that the case company's environment included a high level of uncertainty. Similar to calculation (Cochoy, 2008), this divergence led actors to engage in collective framing practices, attempting to make their frames predominate within the organization. If these activities were successful, a certain frame would begin to guide actors in strategic decision-making processes. On the contrary, if the activities were unsuccessful, the plurality of frames resulted in decisions being deferred due to the difficulty in reaching a resolution, suggesting that framing played a crucial role in directing the strategic choices within the case company (Kaplan, 2008).

Three concepts related to framing plurality (Kaplan, 2008) are frame shifting, frame blending (Werner & Cornelissen, 2014), and frame denial (McCright et al., 2016). Frame shifting is explained as actors coming up with a new frame after questioning the existing frame, thus shifting from an initial frame to a new one (Werner & Cornelissen, 2014). In addition to frame shifting, Werner & Cornelissen (2014) mention frame blending, describing this as combining two distinct schemas, or incorporating parts of one frame into another. This combination in turn results in a hybrid frame where two separate schemas have been integrated as well as aligned. The blended mix can moreover help to circumvent cases where different frames are competing with each other, through the deliberate incorporation (Werner & Cornelissen, 2014). Finally, McCright et al. (2016) discuss the concept of frame denial where a frame is completely denied due to the superiority of other frames. Thus, this is also relevant in terms of framing plurality, since there might be cases where a certain existing frame is completely ignored.

It is clear that previous literature approaches the concept of framing plurality from different views. Kaplan (2008) discusses this in the context of a framing contest where one frame becomes the predominant one out of several, relating this to the impact on strategic decision-making. Cochoy (2008), on the other hand, investigates three different kinds of framing, incorporating both quantitative and qualitative aspects as well as collective interactions. Werner & Cornelissen (2014) instead focus on frame blending and frame shifting, while McCright et al. (2016) examine frame denial. An important similarity between the papers is the expression regarding the importance of resolving a divergence of frames in order for organizational actors to reach conclusions within decision-making processes. Using specific terminology has also been proven to be an

efficient tool to impact framing activities in a desired direction (Cornelissen et al., 2011; Meyer et al., 2016). If actors have difficulties to understand and discuss their frames, this might cause an unresolved plurality of frames where decision-making risks being deferred (e.g. Cornelissen et al., 2011; Kaplan, 2008; Meyer et al., 2016).

It is furthermore possible to see differences in the contexts for which the studies are conducted. Kaplan (2008) discusses framing within the context of technology strategy projects, investigating cognitive framing contests (Cornelissen & Werner, 2014; Werner & Cornelissen, 2014), while Cochoy (2008) categorizes distinct elements within framing activities during a shopping process. Finally, Cornelissen et al. (2011) and Meyer et al. (2016) focus on terminology framing in order to enhance the understanding, and support the implementation, of certain strategic initiatives through an alignment of frames (Benford & Snow, 2000) to prevent resistance.

2.3. Theoretical framework – framing plurality of patent valuation in the pruning decision

Taking into account the theoretical gap within the patent domain, there is a need to understand patent valuation more thoroughly. Due to the framework by Cochoy (2008), displaying a categorization of unconscious cognitive framing activities, in combination with the uncertainty related to decision-making processes described by Kaplan (2008), an addition to the current patent valuation literature, incorporating framing theory, is deemed suitable. Such an approach aims to illustrate the dynamics during the valuation process leading up to a decision.

The combination of framing theory with the valuation and management control of intangible assets is in general very limited in previous studies. The only prior research combining the domain of patents from the perspective of framing theory is Burk (2021). Burk (2021) takes a critical perspective towards the intrinsic value of patents on the basis that patents have failed in their main intended purpose of driving innovation, and instead must fulfil other purposes. Based on the assumption that there must be a hidden value behind patents, motivating companies' continuation of filing and trading activities of patents, Burk (2021) examines patent documentation through the framing perspective presented by Cochoy (2008). The study by Burk (2021) is conducted within the field of patent law, hence, focusing on how qualification factors related to patent documentation, such as the rights covered by the claims and citations of prior art, transform abstract ideas into boundary objects used in discussions. Through this approach, the author is able to categorize and compare invisible components of patents. Due to the law point of view, the investigation does not explore patent valuation for management control purposes, and no case study has been conducted that confirms the practical relevance of the findings. However, the study contributes with inspiration about how patents can be viewed from a framing perspective to detect hidden determinants of value, as well as the qualities of

patents being categorized into defined and distinctive objects, where cognitive frames can serve as reference points for discussions between different stakeholders.

The existing research that combines a cognitive framing approach of qualculation with calculability, for the management control of intangible assets, is limited to the valuation of human capital, being part of IC (Rooney & Dumay, 2016). Rooney & Dumay (2016) investigate financial measures to calculative and measurable procedures of IC reporting as well as non-financial measures, with the aim of creating a more holistic judgement of IC practices and IC management. Thus, there is no previous literature, to the best of our knowledge, that uses the theory of framing with the aim of examining how patent valuation is viewed for management control purposes.

This thesis aims to investigate the value of patents for a management control setting, incorporating a framing perspective, including how calculation, qualculation, and calculation framing activities co-exist in the evaluation process and how these interact with each other. The first objective of the study is to understand how individual viewpoints are created through the framing of patent value. With a foundation inspired by value determinants from previous literature (e.g. Grimaldi et al., 2015; Reitzig, 2003; Striukova, 2007), the theoretical framework allows for a discovery of how these parameters are used and whether there are additional ones that are important for the decision-making process. This thesis takes an exploratory and open approach, aiming to discover the full picture of patent valuation. The second objective is to understand the process where patent stakeholders engage and interact with each other in order to reach a conclusion, exploring the dynamics of framing. Combining the two objectives, this thesis aims to depict how patent stakeholders engage in patent valuation for a management control purpose. The study is limited to pruning decisions, determining whether to abandon or to keep a patent after 10 years of its lifetime. Figure 1 below presents the theoretical framework for this study, examining patent valuation from a framing perspective:

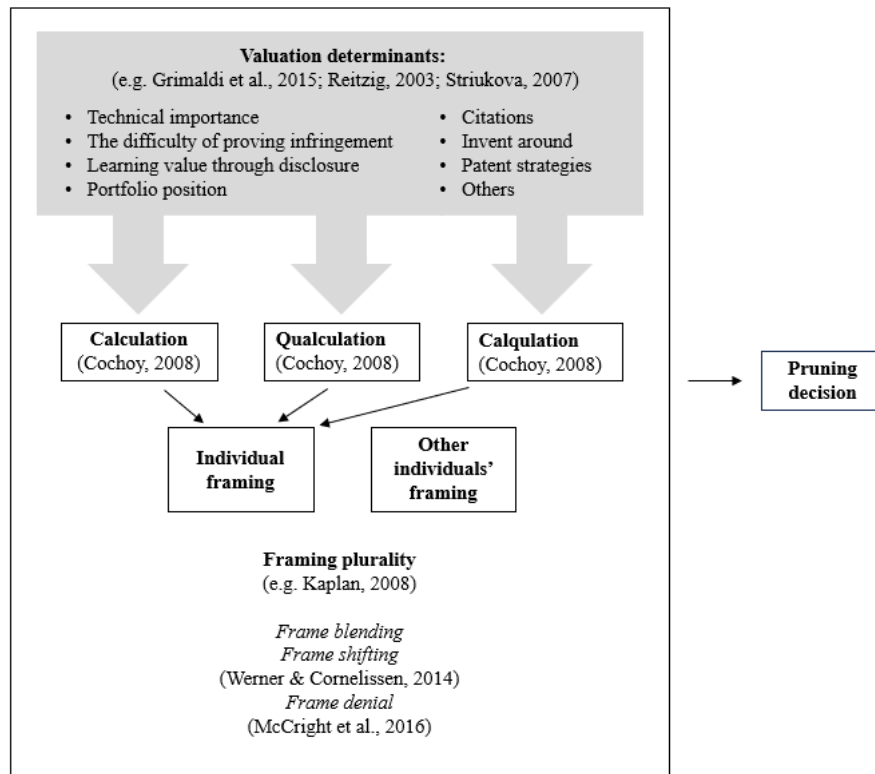


Figure 1. The theoretical framework illustrating a combination of patent value determinants and framing theory from previous literature, leading to a decision-making.

3. Methodology

In this chapter, the methodology for the single-case study will be explained. Firstly, the reasons for selecting the specific research design and case organization will be described under 3.1. and 3.1.1. Secondly, the collection and analysis of data will be elaborated on in section 3.2. and 3.3. Finally, there will be a discourse of the data quality in chapter 3.4.

3.1. Research design

In this study, the aim is to contribute to a better understanding of how patent stakeholders within a multinational, decentralized company interpret the valuation of patents, more specifically during pruning decisions after patents have lived for 10 years or more, for management control purposes. This limitation is relevant since a patent has a maximum lifetime of 20 years (European Patent Office, 2024b) but the costs to keep a patent alive increase throughout the years (European Patent Office, 2024c). Additionally, patent value is expected to decrease after reaching a technological peak (Grimaldi et al., 2015; Kotler & Bliemel, 1995, cited in Reitzig, 2003). This motivates why it is reasonable for the case company to evaluate whether patents need to be abandoned or not after 10 years or more by assessing the value against the costs, and justifying these to make sure that the patent portfolio is efficiently managed. At this point in time, more information about the patent's benefits and usefulness has also been acquired since half of its maximum total lifetime has passed, creating a better foundation for making a fair assessment. Currently, there is a lack of research about how employees interpret patent valuation internally during pruning decisions, and how a pruning process is designed in practice. The choice of research design for this paper is thus to conduct an interpretive qualitative study based on the analysis of observations and answers from interviews (Bryman & Bell, 2017, p.372) through an exploration of what goes on internally in regard to the management of older patent portfolios. This data collection is divided into two phases, pre-interviews and formal semi-structured interviews, further described in section 3.2. Lagrost et al. (2010) further support the idea to use a qualitative approach for valuing patents from an internal perspective. The thesis takes an emic viewpoint, aiming to understand the case firm from within (Lukka & Modell, 2010), by interpreting different valuation aspects of patents where conclusions will be drawn on a subjective basis. The research process has also been both iterative and abductive (Bryman & Bell, 2017, p.45) by repeatedly alternating between data gathering and theory examination, a necessary approach due to the lack of similar research within the field of framing patent valuation.

3.1.1. Case company

The research involves a single-case investigation (Bryman & Bell, 2017, p.86-87) where a multinational industrial company, going through a digital transformation, is examined. Both the selected company and the participants' names and official titles are anonymized in the study. The firm is throughout the thesis pseudonamed and referred to as "IndOrg" and the participants are categorized into one out of three categories, in line with their official roles. This enables an examination of how different roles are impacted by distinct frames but also how the power structure affects the final decision-making during pruning decisions. The selection of the single-case company is further based on the amount of patents that the firm is in control of, and its ability to offer a substantial number of stakeholders involved in the pruning process that have interpretations of patent value. Due to the company being a large, multinational, and industrial corporation, it develops and produces products in different countries and for separate markets. Hence, the company spends large amounts of money on product development each year, motivating the need to be protected by multiple patents at different sites globally. During 2023, IndOrg's number of patents exceeded 10 000, indicating a significant holding of intangible assets, expected to be of interest for management control purposes. Moreover, due to a decentralized organizational structure, IP professionals are located in different places, monitoring portfolios together with other relevant stakeholders within their divisions. Hence, each division's management control process for patents has a high degree of autonomy, for which the involved stakeholders have a freedom to create their own approach towards evaluating patent value. This further suggests a high number of interview objects that are able to present their viewpoints within the field of research, required to investigate and answer the research question.

Throughout the whole research process, IP professionals at the case firm have in addition been able to offset time for weekly unrecorded meetings of 30-45 minutes, in order to enhance our understanding of the organization in question and relevant IP matters. Figure 2 below summarizes the research process' different components, separating between phase one and phase two as well as presenting the continuous elements of meetings and revision of prior studies.

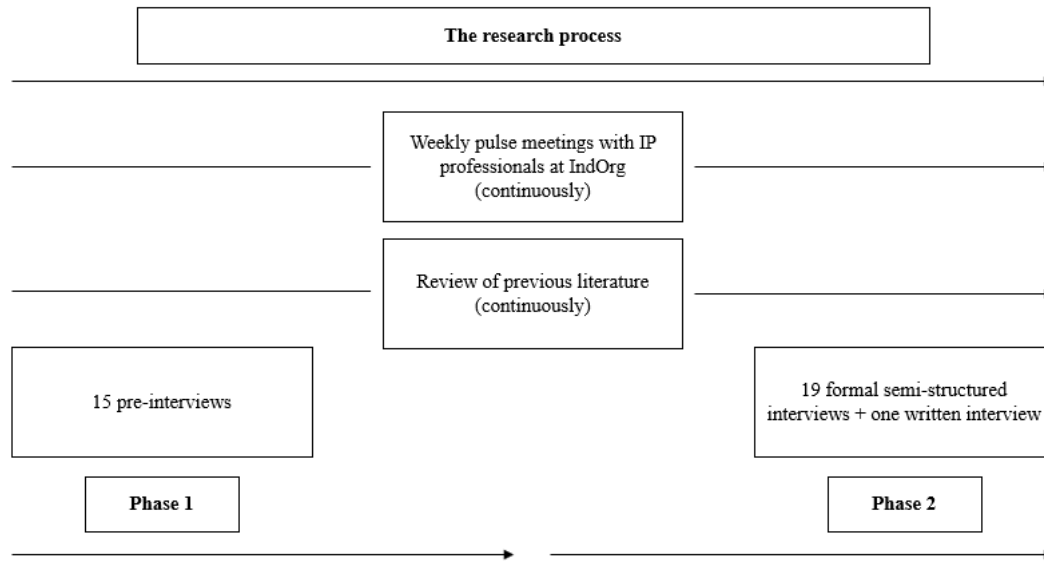


Figure 2. An illustration of the research approach, how it is divided into two phases with elements that have been continuous throughout the whole process.

3.2. Data collection

The data collection of this study consists of two phases. The first phase included 15 pre-interviews and could be considered as preparatory, to ensure precision, a greater relevance of the study and optimization of the following data collection. Thus, the pre-interviews are not included in the empirical analysis, but established the foundation. The second phase focused on the formal data collection to answer the research question, involving an execution of 19 in-depth recorded semi-structured interviews.

The first phase included an unstructured interview approach (Qu & Dumay, 2011) for which the nature of the interviews can be equated to conversations about patents with experts in the area. Once a general understanding of the literature landscape and IndOrg had been acquired, additional pre-interviews were conducted with a relatively unstructured approach, including elements of a semi-structured interview method (Bryman & Bell, 2017, p.454) through themes that narrowed down the field of discussion. The last pre-interviews were conducted as pilot studies (Bryman & Bell, 2017, p.266) to ensure that the focus area, the limitation of pruning decisions after 10 years, and the questions included in the formal interview guide were relevant to examine. Following the abductive research process (Bryman & Bell, 2017, p.45), the interview guide was modified at this stage to include examples of value determinants due to emerging difficulties of interviewees to display their thoughts guiding interpretations of patent value. The participants of the pre-interviews were, without chronological order, seven internal IP professionals, four employees pursuing other roles whose relevance to the study's topic was tested, and four external IP specialists possessing IP roles at other

companies, or running IP projects within academia at an American university. Although this thesis examines the perception of patent valuation within a specific case company, the external IP specialists could confirm that the aim, scope, and research approach seemed relevant also from a generic perspective. The pre-interviews were approximately 30 minutes long and unrecorded, and included notes as well as observations, mainly to avoid the risk of the interviewees feeling hindered from talking freely about their thoughts of the subject. This was considered essential at this exploratory and preparatory stage. All in all, the relevance of the case company for the study could be confirmed and an overview of IndOrg's patent management processes was outlaid.

The second main data collection phase consisted of 19 in-depth semi-structured interviews (Bryman & Bell, 2017, p.454) and one supplementary interview in a written format (undertaken as a way to meet the requests of this specific interviewee). In total, 21 interview objects participated where two of these attended the same interview session. The in-depth interviews were conducted between the 8th of March and 9th of April, for which an interview guide with three central themes was used (see Appendix section 7.3.). Due to the exploratory approach of the study, aiming to investigate the range of cognitive frames explaining decision-makers' perceptions of patent valuation during pruning decisions, combined with an examination of previously found value determinants, semi-structured interviews were deemed the most suitable. However, it should be noted that this approach can be distinguished from previous studies within the field of managers' perceptions of patent value (Grimaldi et al., 2015; Reitzig, 2003), derived by different choices of method theories and research methodologies. The papers by Grimaldi et al. (2015) and Reitzig (2003) involve empirical investigations of five predetermined parameters each, focusing on a stack of patents and collecting data both from IP databases as well as through questionnaires. However, to determine valuation frames and explore additional value parameters, the semi-structured approach has been considered more appropriate to fulfil the aim of the study, allowing for richer insights through a flexibility and follow-up questions (Qu & Dumay, 2011). Moreover, no further quantitative IP data has been collected, due to the focus of exploring managers' perceptions of value during the pruning process, rather than to find a monetary patent value. This approach is additionally in line with the suggestion by Lagrost et al. (2010) regarding the interpretation of patent value for an internal management purpose, in contrast to an external patent valuation perspective. No predetermined stack of patents was used to center the discussion of patent value around, in order to avoid a selection bias for which all patents might otherwise possess specific characteristics, or strategic uses, potentially creating a bias in the answers and harming the generalization possibilities of the study.

To discover indications of cognitive frames, all interviewees have experience from pruning decisions internally during the last couple of years, ensuring an individual viewpoint on the valuation subject and process. Limiting the interviewees' to internal

employees of IndOrg aligns with the single-case research approach (Bryman & Bell, 2017, p.86). During one of the interviews, two IP professionals participated simultaneously. Out of the 19 verbal interviews, 11 of the respondents were IP professionals, six were product managers, and two were technology managers (see Appendix section 7.2.). Participants were reached out to using a snowball sampling approach (Bryman & Bell, 2017, p.411), starting out with interviewing senior IP professionals who then introduced prospective participants, ensuring a relevant knowledge level of patents among the interviewees. The selection of relevant interviewees was moreover made based on their roles and geographical locations, allowing for a diversified collection where a spread of roles and geographies enabled a variety of insights regarding employees' valuation frames.

A vast majority of the in-depth interviews were conducted through Microsoft Teams, with one exception for an in-person interview. Nine of the interviews were conducted in Swedish, and the remaining in English, adopting the language to the most convenient option for the interviewee. The length of the interviews varied between 41 minutes and 118 minutes, with an average of 56 minutes (see Appendix section 7.2.). Emails were sent out with a presentation of the thesis subject together with the interview guide one day in advance of each interview to ensure the interviewees had enough time to reflect over the pruning process and their perceptions of patent valuation beforehand.

3.3. Data analysis

Firstly, after conducting each interview, the content was discussed in relation to the research question and main take-aways were written down as a summary in order to quickly receive an overview of the data, in line with the first phase by Nowell et al. (2017). Secondly, since all formal semi-structured interviews were recorded through Microsoft Teams, transcripts of the recordings were made for a comprehensive review of every interview. The interviews were transcribed in the language spoken during the interviews. Thirdly, the initial coding stage began (Nowell et al., 2017) for which the theoretical framework (Lukka & Vinnari, 2014) was applied to guide the research process. Applying a framing perspective, data connected to the value determinants was categorized into themes of calculation, qualculation, and calquulation, following Cochoy (2008). Distinct cognitive frames that steer the pruning decision were also identified in order to address the research question of the study.

The coding process began with selecting insightful quotations from each interview, describing either the pruning process or representing different valuation frames, and adding them into a Microsoft Excel spread sheet for a comprehensive overview. The quotes from the interviews conducted in Swedish were translated into English. Thereafter, each quote was color-coded and assigned one out of five categories to enable a thematic

analysis (Nowell et al., 2017). The categories were named the pruning decision, calculation, qualculation, internal calculation, and external calculation. The quotations were further separated into empirical categories of value determinants or theoretical themes (see Appendix 7.4. for examples). The process of using multiple levels of coding aligns with Coffey & Atkinson (1996, cited in Bryman & Bell, 2017, p.553) and follows the idea by Bryman & Bell (2017, p.254) of coding interviews according to a coding scheme, in this case based on a color categorization rooted in the theoretical framework presented.

Finally, the categorized quotes were compared and analyzed where frequently presented cognitive frames later were displayed as empirical findings, with supporting quotes available in the Appendix, section 7.4. The empirical findings were furthermore compared to the existing research within the field in order to answer the research question as well as to detect the thesis' contributions to the domain of patent valuation.

3.4. Quality of data

Two criteria that are suggested to determine the quality of the study are the concepts of trustworthiness and authenticity (Bryman & Bell, 2017, p.380; Lukka & Modell, 2010). Trustworthiness includes four different parts, divided into (1) credibility, (2) transferability, (3) dependability, and (4) confirmability. The concept of (1) credibility involves internal validity while (2) transferability corresponds to the external validity. The focus in this study will be on the internal validity, since external validity is more of an issue in qualitative research, concerning the question regarding if a study is replicable or not (Bryman & Bell, 2017, p.379-380). The pre-interviews conducted before the formal interviews have been helpful in terms of designing the final interview guide in order to extract as much useful information as possible. This supports the internal validity in terms of receiving answers that are clear, easing the agreement between the researchers regarding how to interpret the interviewees' answers and how these could be theoretically developed. The external validity, related to the replicability and generalizability of a study, creates difficulties in qualitative research since it is not possible to freeze a certain social environment at the time of the initial investigation (Bryman & Bell, 2017, p.379-380). The external validity of this study therefore focuses on providing evidence for the specific investigation, allowing for a potential generalization of the findings. Increasing the replicability of the investigation would have been easier if using a methodology including questionnaires where patent value parameters are ranked, similar to previous literature (e.g. Grimaldi et al., 2015; Reitzig, 2003). However, such an approach has been excluded since it would not allow for a deeper analysis of patent valuation which this study aims for.

Furthermore, the concept of (3) dependability can be resembled to reliability while (4) confirmability refers to the level of objectivity (Bryman & Bell, 2017, p.380). The reliability is addressed by recording the formal semi-structured interviews, keeping records of the research process, while confirmability is ensured by discussing the findings in an objective manner, avoiding the risk of interpreting interview answers differently. In addition, to verify a high level of authenticity (Lukka & Modell, 2010), quotations from the multiple interviews will be presented, acting as evidence for the following analysis, as well as supplementary quotes that are displayed in the Appendix (see section 7.4.). The interviewees have been kept anonymous, as a way to create trust, and confidentiality has been respected. By keeping the interviewees anonymous, the aim has been to increase the probability of receiving truthful and transparent answers. The recording of the interviews have moreover only been shared between the authors of this thesis, supporting the anonymization of the participants in this study.

4. Empirical analysis

This chapter starts out with a description of the empirical material related to the pruning decision in IndOrg under 4.1. and then continues with an analysis of how calculation framing affects patent stakeholders' view of patent value in section 4.2. Furthermore, the categorization of qualitative aspects are presented as calculation framing within IndOrg, covered in part 4.3., and later in section 4.4., the external calculation framing is discussed. Finally, in section 4.5., an analysis regarding frame blending, frame shifting, and frame denial within IndOrg is presented, related to the internal calculation framing dynamics leading up to a pruning decision. The empirical analysis is further summarized in Figure 3 at the end of the chapter.

4.1. Pruning decision process

This thesis is limited to pruning decisions 10-20 years after a patent application first has been filed. These have proven to be relevant decisions to examine due to the involvement of several stakeholders, the importance of optimizing the asset management related to patents within companies, as well as the need to be in control of your patent portfolio. The maximum lifetime of a patent is 20 years (European Patent Office, 2024b) which means that at the 10-year mark point in time, more information about the patent will have been acquired in comparison to the first filing decision. For instance, IP professional 1 describes: *“After 10 years, you have a feeling about is this working? Do we still have an edge? And it always comes back to, is this giving us an advantage or not? And if so, in what markets?”*. Moreover, in many countries, you are required to pay annual renewal fees in order to keep your patents alive, implying that it is necessary to make pruning decision every year. This renewal fee also increases throughout the years (European Patent Office, 2024c), motivating why it is necessary to evaluate if a patent's value exceeds the cost as the patent becomes older. Project manager 4 explains that:

“We usually keep patents in place for up to 10 years. Patent maintenance fees become rapidly more expensive after 10 years so then we need to decide whether to keep it or to abandon it”.

Furthermore, patent portfolios that IP managers are responsible for consist of several patent families. In terms of the pruning decisions after 10 years, every patent family seems to be reviewed when evaluating whether to continue or to discontinue, thus, individual patents are not examined but the patent family as a whole. This is for instance mentioned by IP professional 3: *“Basically, each year we review each patent family and not every single patent in isolation”*. Even though employees who work at distinct divisions and who pursue different roles all agree that an evaluation needs to be done annually, the pruning decision process is not done in a formal way. IP professional 10 explains that:

“We don’t have any formal process for that, and I don’t think we should. I think formal processes like that usually just slow stuff down. I’ve worked for large companies who had crazy processes. I don’t think those helped at all”.

There is a general agreement that either a small group has a discussion or a meeting but sometimes, pruning processes can also be handled just through an email conversation. The findings show that there are different roles involved in these discussions, including people with IP knowledge who can understand what is protected by the patent and the claims, people from the business who knows about the market and sales information, as well as somebody who has knowledge about the technology. The participants can thus include IP professionals, product managers, and technology managers, all considered to be patent stakeholders. However, who is involved can differ from case to case where one example is a statement made by IP professional 4: *“It is just input from the ones with knowledge. And then either through a short discussion or an email conversation”*. This interaction by employees pursuing different roles within IndOrg is further supported by IP professional 2, presenting how he acts as an advisor in the pruning decisions, similar to several others of the IP managers:

“Someone from the business needs to make the final decision. It is not up to me to decide to end this, because it is the business that is protected by this patent, even if I was responsible for submitting the application and have handled the case, it is their business decision. I’m not the person who knows best where their business is heading either and their needs. But I can advise them, tell them who I talk to, and what kind of protection and costs that are part of this patent”.

As described by IP professional 2, IP representatives are not generally the ones who make the final call. People from IP can offer a recommendation and they are also responsible for the patent portfolios, acting as moderators in the meetings. However, since it is the business that bears the costs for keeping the patents alive, the decision about whether to prune a patent or not must be made by the business.

4.2. Calculation

In terms of quantitative value determinants in this study, categorized as calculation framing that patent stakeholders engage in, three main parameters have been found. These include (1) the budget, restricting what renewal fees you can afford to pay, (2) the size of the portfolio, meaning the number of patents that you possess, and (3) the age of the patents. The empirical analysis shows that the factor that triggers the whole pruning decision is the (1) budgetary constrain where the renewal fees act as catalysts for the pruning process. When a fee needs to be paid, the discussions begin about whether there is value left in a patent or not, and thus, if there is justification to pay the renewal fee. IP professional 5 explains that:

“Different countries cost differently, so you need to consider the cost and that different years have different costs. The first five or eight years, it’s fine. Then after 10 years, 12 years, 15 years, it’s totally different”.

This evaluation of the patent value seems to become even more important due to the increasing costs throughout the life of the patent. The results illustrate a tendency to maintain patents during the early years, however, when a patent’s lifetime exceeds the 10-year mark, the valuation needs to be analyzed deeper. The budget is limited, creating a question of resource allocation, which means that it might not be possible to keep all patents in a portfolio, especially not in all countries where they have been valid. Due to the limited budget and the increasing renewal fees, the analysis considers this as a predominant calculative frame, guiding the pruning decision, based on the fact that several interviewees express this issue as a central one. The dominance of the budget within the calculation framing is also enhanced as years pass by due to the growing fees.

Managing the budgetary constrain as well as the allocation of resources gives birth to a trade-off between the two separate calculative frames, (1) the budget and (2) the size of the portfolio. This involves a tension between saving renewal fees by abandoning patents (related to the budget) and having a large portfolio by maintaining patents (the size). The benefit of the latter is explained by Technology manager 1 as:

“Build as big of a portfolio as possible as a defense. The competition has always been tough so it has been viewed as beneficial to build a large patent portfolio and when someone says that you have infringed on their patent, you can say OK, but we have ten thousand other patents that we can throw at you. So, it is a power balance you could say”.

A second tension discovered during the study, in terms of calculation framing, is the trade-off between paying the renewal fees for old patents versus spending money on new patent applications. The way this budget trade-off unfolds depends on if the intention is to prioritize the continuation of older patents or to abandon these and instead engage in new filings. Since it is cheaper with younger patents than older ones, newer patents allow for a larger portfolio that would cost the same as a smaller portfolio which is more mature. This also relates to the second main calculative frame, (2) the size of the portfolio. There is a tension between having a big and young portfolio and having a reduced but older portfolio. In contrast to the general agreement, that the cost issue plays a central role in the pruning decision, it seems as if the cost frame resolves more and more as a portfolio shrinks. A portfolio consisting of less patents will not be as expensive as a large portfolio, apart from when the majority of a small portfolio consists of patents that are relatively old. This is exemplified by IP professional 11 as:

“In comparison to other divisions, we have a relatively small portfolio. It’s not a huge sum of money that we are paying to keep the patents, so I guess in our division, this cost issue is not that big of an

issue [...] The general tone from our end is always if we do not have any strong reason to abandon patents, if the budget holds, patents should be continued”.

This indicates that different employees are responsible for patent portfolios of different sizes, implying that the patent costs vary significantly between distinct divisions within IndOrg. Many of the interviewees describe cost-cutting as a large part of their job in managing a patent portfolio and that the costs always need to be justified in order to be paid. This also holds for IP professional 11, however, the pressure to abandon patents does not seem as heavy due to a smaller portfolio size.

This tension between filing for new patents versus maintaining the old ones, being a result of the budgetary constrain, has further proven to be affected by the third main calculative frame, (3) the age of the patents. Since the most expensive patents are the oldest ones, the age will affect if a patent is abandoned due to the high costs because of its age approaching year 20, or if a patent is kept because it might have exceeded the 10-year mark relatively recently. However, how the calculative frame of age impacts the pruning decision is analyzed as being dependent on the chosen strategic direction, for instance depending on if the focus is to avoid abandoning old patents or to encourage new patent filings. The trade-off is further exemplified by IP professional 6: *“I can either spend a patent application to get a new patent or I can spend to maintain a patent”.*

The study moreover finds that there is a general agreement among the interviewees that when a patent passes the age of approximately 15 years, the tendency to abandon patents increases, related to the age factor. At this point in time, employees from different divisions within IndOrg explain that it is too expensive to maintain patents at such an age. There are however some exceptions, involving the divisions’ most important patents that cannot be discontinued due to them being viewed as core for the business. This is presented by IP professional 9 as:

“During the last years, perhaps the 17th, 18th, 19th, and 20th year, I may consider abandoning the patent because it has become more expensive and because it is so close until expiration, so no competitor has time to start something and challenge that product within the last two or three years. But that does not apply to our most important patents that are required in order to continue the sales”.

An additional factor brought up by the interviewees is that the patent age can be evaluated differently depending on if the patent protects a mechanical or a digital product, further discussed in section 4.3. in connection to the parameter technical importance.

4.3. Qualculation

Qualculation framing in the pruning decision involves a discernment of qualitative features impacting the individuals’ views of patent value, when calculation framing alone is not enough to make a substantiated decision. Due to the high level of uncertainty in the

valuation process and the trade-offs, the existence of qualculation framing is considered more likely to be present than not. From the data gathered, it is possible to recognize multiple parameters and aspects in the pruning process that appears in a qualitative nature, assisting the stakeholders' interpretations of the inherent value of the patents. Although the interviewees have presented the involvement of qualculation aspects in slightly different ways, the parameters identified can efficiently be summarized into seven categories: (1) technical importance, (2) whether the patent has been implemented in a product or not, (3) invent around, (4) the difficulty of proving infringement, (5) portfolio position, (6) geographical coverage, and (7) patent strategy. Additionally, the parameters technical importance, invent around, the difficulty of proving infringement, and patent strategy are found to be impacted by the technological characteristic, mechanical or digital, of the patented invention. Thus, a distinction can be made for the efficiency and usefulness of these four parameters depending on if the patent protects a mechanical or a digital invention.

One of the main variables, which plays an important role as part of the qualculation framing when reviewing patents, is (1) technical importance, as mentioned by Product manager 4: *"It's a very important factor and the main reason for us to keep the patent"*. There is a general agreement among the interviewees that this is an important parameter that needs to be investigated during the pruning decision by the patent stakeholders, focusing on determining how technically important an invention is for current development as well as for the future. This parameter is found to be following a qualitative approach, opposite to counting the numbers of claims in the documentation, which is a quantitative approach. This qualitative judgement is not static but can vary throughout a patent's lifetime, in line with the technological developments of the firm. Moreover, how this parameter impacts the pruning decision seems to differ depending on if a patent protects a mechanical or a digital solution due to the expectation regarding the useful lifetime. This is exemplified by IP professional 4:

"I partly think about the innovation speed, how fast we develop mechanical versus digital products. For instance, digitalization has made the development of digital products happen at an extremely fast pace. An AI solution that was relevant two years ago might be completely irrelevant now. So, in that aspect, I believe there could be a difference".

IP professional 4 continues: *"The lifetime is extremely long for mechanical products. As soon as you have some digital components in it, the lifetime is shortened"*. This suggests that the technical importance for future developments might be out of date faster for digital inventions due to the fast digital innovation speed, which affects how the patent stakeholders engage in this factor during the pruning decision. On the contrary, it has also been proposed by Product manager 2 that patents for digital inventions can have a longer time horizon of technical importance:

“We would keep digital longer because we have not yet experienced what might be the long-term value of these patents. So therefore, we tend to give them some more credits and stop at a later stage than what we would do on a mechanical patent at this stage”.

The findings can therefore not determine whether the lifetime is longer or shorter for patents protecting mechanical versus digital solutions, however, the technological characteristic of the product seems to impact the individuals' views regarding technical importance.

Additionally, related to the technical importance, is a second parameter, (2) whether a patent is implemented or is likely to become part of a product or not. This parameter has an impact on how decision-makers interpret the value of keeping a patent with the aim of protecting their products and markets, through clearly defining the technical importance of a patent related to one single product. Product manager 1 resonates:

“A parameter that we always look at is whether we've implemented the solution or not ourselves. So, after 10 years, if we haven't implemented it in the product, or would not like to see this idea in our own products further on, then we don't really have anything to protect from a product perspective”.

It is moreover not until patents actually are part of products that a signaling value, for the purpose of marketing, can be utilized. This might be an explanation for why the parameter is highlighted by the interviewees, since if a patent never is implemented, there is no product to protect. Product manager 2 describes how the implemented in a product parameter has a signaling value that can impact the pruning decision:

“The commercial value of being able to state that a product is patent-protected has a great value and is therefore part of the pruning decision. I would call it as a kind of commercial effect in this case. Being able to talk to a customer and say we've come with a unique solution, this is a modern design, it's patent-protected”.

Furthermore, the third parameter that is identified as essential to evaluate during pruning decisions is the ability for competitors to (3) invent around a technical feature. A statement by IP professional 2 follows:

“Invent around is of great importance to look into. We always consider that in the pruning decision. Because if we believe that we are protected, but someone can come and invent around, then the value of the patent will decline fast”.

Throughout the study, it is possible to see a close connection between this variable and a fourth one, (4) the difficulty of proving infringement. When it is interpreted to be easy to invent around, it is oftentimes harder to prove infringement, for which both are considered to negatively impact the valuation of the patent. Respondents express that it is much easier

to invent around a patent for a digital product by changing one small part while at the same time, it is more difficult to prove infringement for such a solution. An illustration of this is made by Technology manager 1:

“For digital solutions, you can change one small part in a code, and it will not be the same solution. It is extremely hard to prove that you have stolen exactly our solution. If it is a mechanical solution, it is much easier to prove that this is the patent that we have, and you have done the exact same thing”.

IP professional 10 further explains how much easier it is to invent around a digital product:

“It’s a lot more difficult, generally speaking, in a mechanical situation. If the thing [the digital feature] says add $A + B$ and then subtract C , maybe just do $A - C + B$ and you get the same results. So, I think that one does vary greatly based on digital versus mechanical”.

These two parameters are however separated due to taking two distinguished perspectives, one focusing on (3) competitors’ possibilities to create similar innovations relying on slightly different methods, while the other focusing on IndOrg’s (4) possibilities to detect and hold others accountable for violations. However, as indicated above, they are often closely connected and both contribute to the patent stakeholders’ qualculation framing. Ideally, the aim is to have a patent for an invention that is hard to invent around but also easy to prove if someone would be infringing on it.

A fifth qualitative parameter emphasizing how patent stakeholders engage in patent valuation is the position the patent has in relation to other patents, thus its (5) portfolio position. IP professional 7 presents: *“The ones that act as a base for others, those are the ones I refer to as crown jewels”*. Technology manager 1 further states that:

“Is this core or base? Well, then perhaps we should keep it since it contributes to a larger protection within a certain area. If it is just a single patent that lies a bit outside and that doesn’t generate anything, then it is just a cost”.

These two examples illustrate the general agreement among the interviewees, that the position a certain patent has in a portfolio will play a role in the pruning decision in terms of qualculatively framing the patent stakeholders’ view of the patent value. If a patent is perceived as being core for the business, or if it serves as a foundation for further patents that are built on the first one, there is a lower probability that it will be abandoned in the pruning decision. It thus seems like patent stakeholders frame such core or base patents as more valuable.

Another parameter affecting the patent valuation concerns the (6) geographical coverage of a patent family. The geographical coverage aspect is central for the pruning process

because when patent families in portfolios are reviewed, the reviewer investigates which countries the family covers. Most frequently, the patent family covers multiple countries, for which a common result of the pruning decision is not to abandon the patent family completely, but rather to reduce the coverage of the family. IP professional 1 presents: *“The most common thing to do, is to reduce the geography in a family”*. Consequently, the question arises regarding which markets covered by the patent family that provide the most and the least value. In the case of IndOrg, it has been found that the protection should preferably be in the same countries as the products are sold and produced in. In addition, the specific countries that the patent stakeholders in general consider as valuable will also be taken into account. IP professional 5 gives a perspective on what a general trimming down process can look like in the annual pruning process, and the reasoning behind this approach:

“More countries equal more costs. So, if we are not very sure whether it will be useful in the future, we normally decide to at least keep it alive in the US and a few countries in Europe. But if a few years later, we are still not sure whether the patent is useful, then we will abandon it in more countries until there are no countries left. So, there is absolutely a difference between different countries”.

Patents granted by the US market and large countries in Europe are found to frequently be interpreted as the most valuable, while patents in smaller countries are considered less important. IP professional 7 shares the notion that geographical coverage affects the valuation, and continues the reasoning about why patents covering smaller markets are perceived as less valuable, also due to the indirect protection against competitors that remains:

“What is the probability that we need to use our patent in Monaco? Or in Jamaica? Or in Iceland? Because for these types of countries, where the market is very small and where we also know that our competitors would not produce an advanced product to sell just in Jamaica, Iceland, or Monaco, then the patent will not be considered that valuable. You want these large markets so that it really pays off to produce a product. You want the US, you want some large European countries”.

A seventh aspect of qualitative parameters building up the qualculation framing is the (7) patent strategy. Through the interviews, it appears that IndOrg currently does not have a declared patent strategy, meaning there is no unified approach for how the patents are aimed to create value. Consequently, the divisions are found to have a mix of patents in their portfolios that fulfil different purposes. Respondents point out that this absence of a coherent approach might complicate their evaluation in the pruning decision, indicating the importance of this parameter when reviewing patent value, which IP professional 4 expresses as: *“If there is an obvious strategy, then of course it is easier to calculate the value of it and justify the costs”*. However, although the lack of a unified strategy might complicate the pruning process, the existence of patents with different purposes allows

for two important points. Firstly, the patent strategy impacts patent stakeholders' perceptions of patent value, and secondly, distinct strategies will influence the decision-makers' value assessment. In terms of the patent strategy, the empirical analysis identifies that patents which are licensed out are assigned a high value due to the income from licensing fees. IP professional 10, who has experience from licensing out patents, argues:

“If you’re currently licensing out a patent, you probably should not let it lapse. In fact, you might be obliged not to let it lapse due to a contract. You’re making money directly on it, and the money is probably more than the fee, so you probably keep it. Certainly, for licensing, that would be probably one of the only examples where I could say that I would never even go to the business and reflect over the possibilities to abandon it. If we are licensing out a patent, I’m not killing it”.

Apart from the interviewees' emphasis regarding how a license agreement impacts the pruning decision, it is further discovered that the relevance of licensing out a patent might differ depending on if a patent protects a mechanical or a digital solution. IP professional 2 argues:

“A digital solution is for sure more interesting to license out. Also due to the fact that mechanical ones are even more often implemented in our products, and then if we want to continue the production of that product, then we do not want that feature or invention to be used by others, because that would directly affect our sales. For digital solutions, we might sell our products more due to a combination of features”.

The patent strategy that stands out in terms of impacting the value assessment in the pruning decision is hence the licensing out strategy. Such patents are viewed as significantly valuable and are thus concluded to act as predominant frames during pruning decisions. When a patent is licensed out, there is a tendency to neglect other value parameters.

Lastly, the study has investigated additional parameters, referred to as the learning value through disclosure and citations, due to their frequent presence in previous studies (e.g. Grimaldi et al., 2015; Reitzig, 2003). However, the interviewees' responses for these parameters were consistent; they are not used to determine the value of patents in a pruning decision taking place 10 years or more after the first filing. Citations were however resonated about, in terms of potentially being a relevant factor to examine, as they perhaps can indicate whether competitors' inventions are similar or if IndOrg is early in the development within a specific field (see Appendix 7.4.3.).

4.4. External calculation

The empirical analysis shows that pruning decisions are not made without incorporating external collective aspects. Two external factors are found to impact how patent stakeholders engage in external calculation framing in the pruning decision, summarized

as (1) how competitors affect the assessment of patent value and (2) standard essential patents (SEP) as value determinants. The findings indicate that (1) patent value will be defined in relation to the company's competitors. The majority of the participants emphasize that as patents create business advantages relative to others, an essential part of the decision to abandon a patent is to understand how competitors are likely to react, to estimate the consequences of a decision in a preventive sense. The estimation of competitors' potential reactions takes place through watching competitors' inventive movements, revealed by examining their patent filings and product launches. Product manager 1 presents how the understanding of which direction competitors' businesses are moving is central for the assessment of IndOrg's own patents during the pruning process:

"We are also looking at the competitors. Have our competitors implemented something similar? Or filed for patents within the area? Unless they have not developed their products in this direction during the past 10 years, then it might not be interesting to continue paying for this patent either. Product managers and R&D managers are trying to have as good of an overview as possible of what the competitors are up to".

Before abandoning a patent, the findings also show that you need to appreciate whether competitors are likely to produce products that risk affecting the business operations of IndOrg negatively. IP professional 2 presents how competing products otherwise could destroy sales opportunities:

"Although we do not sell the products anymore with a specific feature protected by a patent, and instead have started to sell an updated version, we might not let the patent go due to the fact that then our competitors might start producing our old version with low R&D costs, and therefore can charge the customers a low price".

Assessing how the abandoning of a patent can lead to devastating consequences through potential reactions from competitors is however complex and an uncertain process. During the interviews, it is presented that it is impossible to know in advance which competitors that would develop similar products, that they currently are hindered from doing, if IndOrg would abandon a certain patent. All in all, the empirics show that there are difficulties in anticipating competitors' next moves as well as determining who the important competitors to keep an eye on are.

The findings further show that there is one situation when patent value in terms of external calculation framing becomes clearer, namely when patents are part of negotiating situations between IndOrg and its competitors. IP professional 8 argues that it is relevant to keep patents that have a strong connection to a litigation process, as they are the ones that, at a certain point in time, have proven to have a value in relation to the competitors: *"If there is any litigation or it has been litigated in the past, we tend to keep those patents strongly for historical reasons".* Product manager 6 additionally gives an example of a

patent that was not part of a litigation process, but to some extent led to competitors being upset about its existence. Consequently, the competitors' reactions were interpreted as value increasing for the patent, according to the patent stakeholder at IndOrg:

“What we have encountered a couple of times is that someone has opposed a patent that has been granted and that it is seen as a strong sign that someone dislikes that the patent went through, and that it therefore has a rather strong value. You are then prepared to spend quite a lot of money on protecting the patent and keeping it”.

The second external calculation factor, apart from competitors, that impact how patent stakeholders engage in patent valuation in the pruning decision is (2) if a patent is appointed to be an SEP. SEPs are patents defined as standards within a certain technology domain that need to be adopted by all participants within a standard developing organization (SDO) that use the specific solution (European Commission, 2023). IP professional 5 describes how the process for creating these standards takes place through interactions between multiple stakeholders within the industry, where the patent that is established as the standard, being the top solution for a certain issue, has been determined collectively:

“Companies discuss what’s next for the standard that everyone needs to follow. So, when the SDO is about to make this standard, every member just submit some contribution to solve some kind of issue. For the same issue, 10 or 20 solutions may be received that they need to discuss to decide which solution that is the best. If they choose our solution to write as the standard, then everyone will use it to solve a specific issue”.

As SEPs have been assessed by external parties before receiving a throned status, the empirics indicate that decision-makers within IndOrg, during a pruning decision, take this external judgement of the patent into consideration. IP professional 8 describes that:

“If we are able to claim a patent that becomes close to that particular legislation and even becomes a standard, we would never let go of it. Because until the standard changes, we tend to keep it”.

Due to the honored status of SEPs, this is analyzed to be a predominant frame for the patent valuation during the pruning decision. There is a strong agreement that if a certain patent would be appointed as an SEP, it would not be abandoned, motivating the dominance of this external calculative frame in the assessment of patent value.

4.5. The dynamics of framing plurality

As presented in section 4.1., patent stakeholders in this study consist of IP professionals, product managers, and technology managers, all participating in the pruning decision. The individual stakeholders are identified to create their own cognitive frames, based on

calculative, qualculative, and calqualative aspects, but the final decision-making occurs collectively. As exemplified by IP professional 8: *“I might present a recommendation based on my evaluation of the patent. But at the end of the day, it’s a group decision. I mean, it’s usually all three of us agreeing”*, implying that framing appears on two separate levels, both within an individual as well as between individuals, eventually leading to a final pruning decision. The study shows that individual framing plurality exists due to the complexity of the pruning process, where several parameters (presented in the previous sections) need to be taken into account to illustrate the full picture of patent value.

The empirics display signs of frame blending on an individual level, exemplified by the valuation journey of a patent stakeholder, taking off due to the need to pay a renewal fee. Thereafter, calculative, qualculative, and external calqualative aspects are taken into account, creating an individual frame blend of a patent’s value along the process. This blending of frames involves an incorporation of the value parameters mentioned in section 4.3., highlighted as important by the interviewees. Thus, a patent stakeholder will consider a mix of the value determining parameters stated, for instance the technical importance of the invention, how easy it is to invent around it, if it is difficult to prove infringement, and the portfolio position. The parameters individuals choose to examine will be dependent on their preferences, eventually leading to an overall evaluation of the value. The valuation will moreover possibly be impacted by the three predominant frames stated previously, summarized as the budget frame, the licensing out strategy frame, and the SEP frame. The budget is emphasized as a predominant frame due to how the notification of renewal fees has proven to trigger the emergence of a pruning process, as the renewal fees are dealt with due to the pressure from the budget constrain. In cases where a license agreement is connected to a patent, generating licensing income, or if the patent is appointed as an SEP, the individual’s framing process will however be disrupted. In such situations, the frame blending will result in a frame denial where parameters not defined as predominant frames will be neglected. Even though the other value determinants might not be fulfilled, the possibility to abandon the patent will be ignored.

Regarding the predominant frames, the study further show elements of frame shifting. The budget frame is analyzed to be a predominant one, always playing a role and acting as a catalyst for the pruning process. However, when a patent is licensed out, or serves as an SEP, the dominance of the budget frame shifts to the other two predominant frames. If there is a patent license agreement that generates income for the company, it does not matter whether the cost for renewing such a patent is high. The same holds for when a patent is appointed as an SEP, since the findings show that the patent then will be maintained regardless of the cost. Frame shifting is in addition presented related to the other value determinants, not acting as predominant frames. From the beginning of the pruning process, the patent stakeholders start the value assessment by examining the

distinct parameters, potentially leading to a hybrid frame blend that incorporates different aspects of patent value.

Apart from the individual framing, the findings depict collective framing activities happening internally at IndOrg during the pruning decision. This type of framing is defined as internal calculation and includes how patent stakeholders bring their individual frames into the meetings or the email conversations when deciding whether to prune a patent or not. The investigation shows a consistency across all divisions regarding that the pruning process always involve multiple stakeholders, contributing with knowledge from different fields, where the aim of the interaction is to enrich different viewpoints of patent value. IP professional 7 describes three types of roles that always need to contribute with their insights in the pruning discussion: *"You need someone who understands the patent itself, you need someone who understands the technology, and then you need someone who understands the business"*. This quotation implies a view of the necessity of creating a frame blend on the collective level, incorporating distinct patent stakeholders' knowledge and perspectives into the process.

Although the pruning decision is stated to be made by a group, there is always a possibility that disagreements between the participants emerge due to the uncertainty regarding how to assess patent value in different situations. Since participants of this study possess different roles, the tensions that may arise from conflicting views of patent value at the time of a pruning decision are of interest. The general perception found is that the technology-side is more open to abandon patents when it has been discovered that the product development will be discontinued. The marketing-side seems less likely to be in favor of abandoning patents, partly since there is a possibility for a positive sales contribution due to the patents. IP professional 6 emphasizes this view: *"In general, product marketing wants to keep it whereas engineering would be willing to cut it lose"*. IP professional 6 problematizes the view of product marketing representatives, as their will to maintain the patents might be related to the fact that they will not be in charge of paying, and thus, do not fully understand the high costs of the older patents. Instead, their role will always benefit from keeping patents, as this can be used for advertising products to be unique.

IP professional 4 adds to the internal calculation findings, describing that tensions between the participants of the group decision may rise, not due to a lack of understanding the patent value, but rather due to different time focuses where the time aspects of patents and the business in general are different:

"People from the IP and the technology-side versus people from the business-side might have different levels of willingness to invest in something that is far into the future, due to their areas of responsibility. When you work with IP, you work with quite long time frames since a patent can last for 20 years and you always want to protect for the future. This can sometimes create conflicts

because other roles often work with short time frames, like being responsible for the P&L or trying to reach this year's sales or growth targets. Then, when we argue that resources should be allocated to something because it might be important in five years, then the business-side might respond that they will have to focus on what will be important in half a year instead, since this directly impacts their results. People that have worked more sales or market-focused, they are used to be more here and now and might have a hard time to justify investments that will not pay off in a long time. This could be the case for patents protecting both digital and mechanical solutions, but perhaps mostly for digital solutions as there is even more uncertainty regarding the pay-off for such patent investments”.

Another reason behind potential disagreements can be connected to the understanding of the components of the protected feature. The study shows that digital products are more difficult to comprehend, thus, creating obstacles for a common ground for the patent stakeholders. This is presented by IP professional 7:

“There is a difference between how hard it is to come up with a joint decision about the patents due to their characteristics because the mechanical ones are so much easier to understand. They become more tangible when you can present and show how it looks and others in the group understand the invention as well. Whereas a digital one is a cloud, a process, a black box, an input and an output”.

The individual frames, leading to differences in understanding, are further distinguished through different interpretations of qualculation while the calculation frames are more straightforward. This is due to the nature of the quantifiable characteristics of the calculative aspects.

An additional dimension regarding why discussions about valuation of patents might show opposite views is related to different individuals' emotional attachment to the patents. From this perspective, some individuals might cognitively frame the patent value in an irrational way due to their personal connection to a certain patent, rather than having an unbiased view of calculation and qualculation framing. IP professional 3 resonates:

“Inventors are emotionally implied with the patents or with the developments and more reluctant to cut out because of that. They love their product and have patents they believe protect them. The IP side is more neutral and says, do you actually have any business justification to keep paying?”.

Even though the pruning decision is a joint discussion between different stakeholders pursuing relevant knowledge, someone needs to be in charge of making the final decision, especially in cases of opposing views within the group. The individual who makes the final call is shown to have slightly different titles across the divisions, but they seem to have two similarities, a favorable hierarchical position and/or is the carrier of the financial burden of the renewal fee. IP professional 7 describes how the hierarchical position defines who will make the final decision:

“King beats jack. It is whoever is at the top of the hierarchy, regardless of whether or not that person actually understands what they are saying. The recommendation based on expertise and through the gathering of different views therefore has to be created by the IP manager, which most often the decision-maker follows”.

IP professional 3 further illustrates how the carrier of the cost plays a role in making the final call: *“It is the patent owner that decides, which will be a product manager or owner, the guy paying the bill. That’s how simple it is. Who pays decides in the end”*. In the group discussions, if the decision-maker’s initial opinion contradicts someone else’s judgement, it will be crucial for instance for the IP professional to convince the decision-maker of converting this initial frame to be in line with the IP representative’s recommendation. For this to succeed, it is presupposed that the IP professional transforms abstract thoughts about the patent value into concrete arguments, following a potential frame shift of the decision-maker’s value frame. If this persuasion fails, it will however lead to a frame denial of the counterpart’s frame.

All in all, Figure 3 below displays the dynamics during the pruning decision process, including calculation, qualculation, and calculation framing. Framing has been proven to occur at two levels, both within an individual and between individuals, showing signs of frame blending, frame shifting, and frame denial. The dotted arrow at the top demonstrates how the pruning process begins with the need to pay a renewal fee, and then ends with a pruning decision. Moreover, three predominant frames have been identified as well as framing plurality tensions. In this way, the illustration summarizes how patent stakeholders engage in patent valuation in the pruning decision, supporting the management control for older patent portfolios.

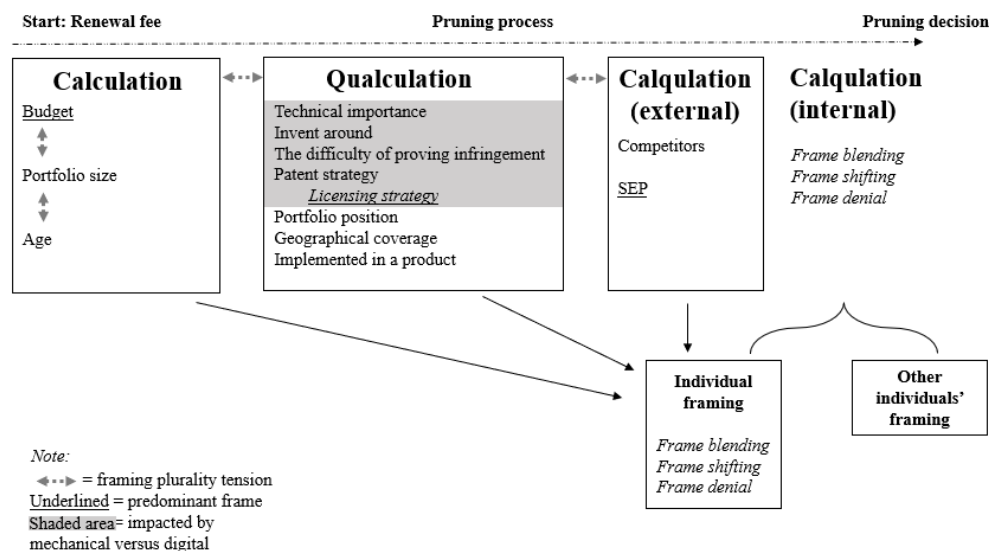


Figure 3. Summarizes the empirical analysis of patent stakeholders’ engagement in patent valuation.

5. Concluding discussion

In this chapter, the three main findings that this thesis contributes with will be presented under 5.1., 5.2., and 5.3. With a point of departure in the research question, *How do patent stakeholders engage in patent valuation in the pruning decision?*, the empirics firstly illustrate patent stakeholders' courses of action during pruning decision processes after a patent has reached an age of 10 years. Secondly, the patent stakeholders' cognitive framing practices when determining patent value, categorized into calculation, qualculation, and calculation, are presented. Applying a framing perspective is proven to enable a deeper understanding of previously found parameters' impact on stakeholders' perceptions of patent value. Thirdly, the last contribution involves the patent stakeholders' approaches to assessing patents that protect mechanical versus digital solutions. Finally, the limitations of the study will be acknowledged as well as the recommendations for future research, in section 5.4.

5.1. The pruning decision process

This study's first main contribution relates to the illustration of the pruning process for older patents (age 10-20 years) and how this decision generally is made every year due to recurring renewal fees that have to be paid. The review is done in an informal way, involving several stakeholders that have the ability to impact the process to a great extent, as part of optimizing the monitoring of patent portfolios. Instead of abandoning a patent completely, the empirical findings show that there is a tendency to reduce the scope of the patents by removing certain countries. There is a lack of previous research investigating patent valuation in regard to the pruning decision, more specifically when a patent reaches the age of 10-20 years. Prior papers examine the assessment of patent value and what factors that potentially could be considered in such a review (e.g. Grimaldi et al., 2015; Reitzig, 2003), however, these are not limited to pruning decisions after a patent reaches the 10-year mark. This thesis therefore gives a broader view of the patent value assessment, specifically during the pruning decision process, contributing with interesting insights for companies' management of patent portfolios in general.

One part of the findings from this study concerning the patent value assessment during the pruning decision involves the informality of the process, mainly due to patent value being highly dependent on the specific context. Therefore, it is difficult, or perhaps even useless in some cases, to have a too standardized way of reviewing patent value after reaching the 10-year mark. This context dependency confirms previous literature within the patent valuation domain (Lagrost et al., 2010; Striukova, 2007), supporting the idea that there is no point of having a checklist which determines the pruning decision, based on how many boxes a patent can tick on the list. Instead, the valuation needs to be adapted

to the specific situation, possibly guided by a mix of the presented value determinants. Moreover, prior papers mention how the difficulties in assessing the value of intangible assets have been dealt with through adding separate reports (Edvinsson, 1997; Giuliani & Marasca, 2011; Grimaldi et al. 2015). However, this study shows that patents are not assessed in a similar way as other intangibles.

In addition to the informality and the context dependency in regard to the pruning decision, this study shows that there are several stakeholders involved in the decision process when determining whether to abandon a patent or not. This involvement of multiple internal stakeholders, including employees that have knowledge about IP, knowledge about the business, as well as knowledge about the technology, validates previous literature (e.g. Conley et al., 2013; Dolfsma, 2011; Fisher & Oberholzer-Gee, 2013; Reitzig, 2004). However, prior studies do not examine if this actually is implemented in practice. It is confirmed that within the case company in question, patent value assessments are not solely made by one single person, but rather a small group of employees pursuing different roles that contribute with distinct perspectives. This is in line with ideas from previous papers about the necessity of having an integrated approach towards patent valuation (e.g. Conley et al., 2013; Dolfsma, 2011; Fisher & Oberholzer-Gee, 2013; Reitzig, 2004). The stakeholders' frames have shown to be blended, but the final decision is made by the person who possesses a favorable hierarchical position and/or bears the cost, hence, other frames risk being denied.

A final point related to this thesis' contribution regarding the pruning decision after a patent has reached an age of 10 years or more encompasses the common idea to reduce the scope of a patent, by removing certain countries, rather than abandoning a patent completely. Market coverage is mentioned in prior research (Grimaldi et al., 2015) but in a different way than what is shown through this study's empirical findings. Grimaldi et al. (2015) put forward the idea that a broader coverage implies a wider protection, however, this thesis indicates that it is not the number of countries that determines the importance level of the coverage, but rather which countries those are and their market sizes. This study suggests that the aim is to keep patents in countries that have large markets, however, if the sales levels are low, there might not be any justification for maintaining a certain patent in those countries. The empirics have also proven that the patent stakeholders have preconceived perceptions about which countries that are more valuable to keep. Smaller countries are considered indirectly protected through the belief that no competitor will create a solution only for a small market in isolation. Therefore, an important managerial implication in this thesis is that solely focusing on patenting in as many countries as possible does not necessarily mean a more extensive coverage, but rather to invest in the most appropriate countries.

5.2. Calculation, qualculation, and calculation framing in the pruning decision

Similar to how Cochoy (2008) illustrates how a shopping process includes more cognition than might be obvious at a first glance, this thesis shows how multiple abstract frames impact the pruning process. This leads to the second main contribution of the study, the identification of calculation, qualculation, and calculation framing during value assessments for pruning decisions, involving a variety of abstract ideas and cognitive processes. Currently, there is a lack of studies examining patent valuation from a framing theory perspective, where this thesis contributes with the empirical finding that all three sorts of framing play a role in the decision. To our knowledge, the only paper that combines framing and patent valuation is written by Burk (2021), however, this author takes a law perspective. Other previous studies involving a qualitative assessment include a quantitative coding of qualitative variables (Grimaldi et al., 2015; Reitzig, 2003), thus, they exclude information about how different valuation frames are created as well as how they are related to each other. Our methodology of investigating qualitative variables on a deeper level allows us to find differences in how these variables are impacted when trying to initiate change. Additionally, how stakeholders engage with others during pruning processes can be separated into internal and external calculation, enabling an understanding of the framing plurality dynamics in the decision-making process.

Due to the exclusion of incorporating a framing perspective when investigating the domain of patent valuation in prior studies, it is clear that this thesis uses another methodological approach and a different type of data collection. Previous research papers involve questionnaires or a quantitative coding of five qualitative features (Grimaldi et al., 2015; Reitzig, 2003), implying a less open and exploratory approach in comparison to this study. Such methodologies miss out on how framing impacts how patent stakeholders engage in the pruning process. This thesis' open and exploratory research approach firstly allows for the discovery of distinct framing activities of calculation, qualculation, and calculation during pruning decisions. Secondly, it enables a deep-dive to understand value parameters mentioned in prior papers and an exploration of additional determinants that are viewed as relevant to examine. This differs from Grimaldi et al. (2015), that assumes that the five parameters the authors investigate all need to be examined in a standardized way during an evaluation of patent value. It also differs from the findings by Reitzig (2003) regarding technical importance being the most important value determinant, followed by invent around and learning value through disclosure. Our study finds that a greater mix of determinants needs to be taken into consideration in a standard value assessment. However, this changes if a predominant frame appears, such as the strategy of licensing out or a patent being appointed as an SEP, for which the value justifies the cost and no further evaluation is needed. Thirdly, the chosen methodology facilitates an understanding of the framing plurality dynamics, namely frame blending, frame shifting, and frame denial, both on an individual level and collectively. All in all,

these framing dynamics are important managerial implications since they illustrate how certain frames predominate the process and thus, affect the pruning decision.

Moreover, through applying the framing perspective by Cochoy (2008), this study contributes with the finding about how the three categories of framing differ in terms of their impact on patent valuation. When it comes to calculation, it is possible to see that respondents have similar viewpoints creating a more standardized way of evaluating patent value quantitatively. The costs trigger the pruning decision and cognitive analyses are not involved to the same extent as during qualculation and calculation. Qualculation framing is in contrast shown to be much more based on experience and the distinct cognitive frames that different stakeholders possess. As Cochoy (2008) presents how sugar on a shopping list unconsciously can mean either brown or white sugar, although not stated, similar patterns can be seen within IndOrg's qualculative assessment, for instance regarding geographical coverage. If a patent stakeholder is pressured to reduce the coverage of a patent, the empirics show that this person will have a preconceived picture of what countries that are better to keep. This is an important practical finding since distinct qualculation perspectives among stakeholders impact the opportunities for creating a standardized structure in terms of how to assess qualitative elements of patent value. Thus, it is easier to standardize the evaluation process regarding calculation, however, for qualculation, the variety in cognitive value frames could potentially lead to a resistance towards a standardization. It is necessary to take this into account for a corporation such as IndOrg, where the organizational structure is decentralized with autonomous divisions, if trying to develop a cross-divisional joint management control process for patents. A managerial implication if aiming to influence the patent valuation process during pruning decisions is therefore to consider how changes in calculation versus qualculation activities might be interpreted differently.

This thesis also shows that calculation framing takes place both internally within IndOrg as well as externally. There is a lack of information in previous literature about how distinct perspectives of patent valuation will be impacted by what role a certain stakeholder has, and how tensions may arise if the actors involved in the pruning decision do not agree with each other. Since the qualculation framing activities have shown to be subjective to a large extent, there is a probability that people possess different cognitive value frames that potentially can lead to disagreements. Moreover, Striukova (2007) highlights that value can be shaped by market and non-market relationships, suggesting that competitors, as an external part, can play a role in the patent value creation. This thesis contributes with the idea that during the value assessment of patents, taking the competitors into account will be necessary.

5.3. Approaching the valuation of patents with distinct technological characteristics

The third contribution is the indication that patent stakeholders' engagement in patent valuation during pruning decisions is impacted by the technological characteristics of the protected invention. The empirical analysis allows for a separation of patents into two distinct categories, patents protecting inventions with mechanical characteristics and patents related to digital features. Although the process is presented as the same for both kinds of patents, the findings show that how the value parameters are perceived or used will depend on whether a patent protects a mechanical or a digital solution. Consequently, the technological characteristics affect which cognitive frames that are considered to be relevant and the reflections about what value managers recognize in each individual patent. Additionally, there are indications of differences in technological maturity as well as how easy or difficult it is to comprehend patents protecting mechanical versus digital inventions. This contribution is considered to be of particular importance for corporations undergoing a change in the nature of technology they engage in, as new ways to interpret inherent patent value in pruning decisions, as well as the frequency of these decision, may be in demand of change.

The separation of patents protecting mechanical versus digital solutions has been identified when comparing responses from interviewees belonging to different divisions with diverse experiences of dealing with patents for digital inventions. Although IndOrg is an industrial company going through a digital transformation, some of the divisions have come further in their digital developments than others. Consequently, differences in the pruning processes between the divisions can be expected to some extent to be explained by this finding. Prior research examining patent valuation (e.g. Grimaldi et al., 2015; Reitzig, 2003) does not present any indications of how value parameters are interpreted depending on if the patent protects a mechanical or a digital product, suggesting this to be a unique finding.

The characteristics of the protected invention, mechanical versus digital, impact several of the value determining parameters presented by prior studies, according to our findings. The value determinants that are proven to be impacted by the technological characteristics of a patent are technical importance, invent around, the difficulty of proving infringement, and licensing out as a patent strategy (e.g. Grimaldi et al., 2015; Grimaldi et al., 2018; Reitzig, 2003; Somaya et al., 2011). Firstly, the empirics show that how the patent stakeholders view the technical importance of an invention concerns the perception of a patent's useful lifetime. It is hard to establish whether a mechanical or a digital solution is expected to have a longer lifetime since the interviewees have presented individual interpretations of how this impacts their view. Some argue that the duration of a technology will be longer if a product is mechanical while others believe that a digital solution has a longer lifetime. Secondly, the parameter invent around has proven that it is

easier to work around a patent that protects a digital feature, for instance through minor changes in a code to reach similar results using another method. Thirdly, the difficulty of proving infringement is considered more challenging when it comes to digital solutions, due to the narrower modifications that make it hard to detect if someone is infringing on your patent. Lastly, the patent strategy of licensing out is more suitable for patents protecting digital features, according to the interviewees. All in all, the usefulness of these value determinants is concluded to differ depending on the technological characteristics.

In relation to the parameter technical importance, our findings additionally support previous literature about there being a connection between technological cycles and patent value, and that patent value develops during different phases (Grimaldi et al., 2015; Kotler & Bliemel, 1995, cited in Reitzig, 2003). Without any confirmed direction of the technological characteristics' impact, we add to the literature within this field, indicating that the length of technological cycles, and hence, the patent value, will be affected by the technological nature of the patent. This is exemplified through interviewees stating that the technological standpoint shifts much quicker for digital products. In addition, this implies that the need of recurring pruning processes might not efficiently correlate with the renewal fees as of today, but should rather be framed by the technological characteristics the patents involve. If different useful lifetimes of mechanical and digital products can be established, how often distinct patents are reviewed should perhaps be adapted to align with the expected useful lifetime.

Apart from the finding that technological characteristics impact the individual viewpoints of patent value, there is an additional effect on the collective decision-making. Tensions might appear between patent stakeholders in the pruning decision due to difficulties in comprehending digital products, creating obstacles for a common ground for the patent stakeholders. If the participants are not able to reach a shared understanding for patents related to digital features, there is a risk that the necessary collaboration between different roles (e.g. Conley et al., 2013; Dolfma, 2011; Fisher & Oberholzer-Gee, 2013; Reitzig, 2004) is harmed. In conclusion, it seems even more difficult, both on an individual level and on a collective level, to make pruning decisions for patents protecting digital inventions.

5.4. Limitations and recommendations for future research

The findings in this thesis are relevant for practitioners in charge of managing older and larger patent portfolios, however, the limitations with the investigation need to be acknowledged. The first limitation with the thesis is due to the investigation being a single-case study, only involving one case firm that belongs to a specific industry. Thus, the generalization of the results for industrial companies going through digital transformations needs to be done with caution. This single-case study solely investigates

one specific company size, implying a patent portfolio of more than 10 000 patents in total. An examination of organizations of other sizes or with other patent holdings would potentially have led to different findings, explaining this limitation. Additionally, the case firm belongs to a specific industry, thus, the prudence principle needs to be applied if generalizing the results for organizations within other sectors that are distinguished from IndOrg's industry. Finally, the second limitation of this research important to acknowledge relates to the second phase of the data collection, involving the 19 formal semi-structured interviews that have been conducted (plus one written formal interview). The distribution of these interviewees' roles consists of a majority of IP professionals, six product managers, and two technology managers. Due to this distribution being uneven, there is a risk that the perspective from IP professionals has been emphasized more than the others', potentially causing a bias in the representation of how different patent stakeholders view patent valuation during the pruning process.

As previously mentioned, there is currently a lack of research within the field of managing intangible assets, and an even greater gap regarding the monitoring of patent portfolios specifically. No prior studies examine pruning decisions when a patent has reached an age of 10-20 years in particular, motivating the suggestion to explore this further in future papers. Different kinds of companies could potentially be examined and comparisons between distinct organizations can be investigated. This expansion, or increase in comprehensiveness surrounding the study, implies conducting research regarding patent valuation during pruning processes for firms within different industries, of different sizes, as well as with distinct business models and organizational structures. Moreover, the empirical finding regarding that patent valuation can differ depending on if a patent protects a mechanical or a digital product needs to be further researched since no prior literature highlights this distinction. Due to the digitalization, industrial companies will be required to adapt by incorporating digital aspects into their businesses. This motivates why this topic would be both relevant and interesting to investigate further within future studies. An appropriate method for such studies, to confirm our findings, could include a collection of patent portfolios with distinctive characteristics of protecting mechanical and digital solutions. This would allow managers to separate the value assessments where differences could be more clearly observed. Using this approach could lead to a more comprehensive understanding of how the value parameters need to be examined, especially for patents protecting digital products since this study indicates a greater uncertainty regarding these. Lastly, it should be acknowledged that several of the prior papers within the patent valuation domain might be outdated, due to the number of years since they have been published. A suggestion could therefore be to complete further twin studies of these, examining if the findings from previous literature still are relevant.

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7. Appendix

7.1. Definitions

Citations: Can be separated into forward- and backward citations. Forward citations means when other patents refer back to an existing patent and cite it as prior art. Hence, as a parameter, this is only possible to measure after a patent has been granted for a while, and similar features perhaps have been developed by others. Backward citations refer to patents that are mentioned in patent applications, as prior art that the new feature to some extent differ from (Chang, 2012; Fisher & Leidinger, 2014).

Digital/software solutions: The classification of digital solutions in this study involve data processing and analytics solutions. These are also referred to as software products.

Intellectual capital (IC): Intangible and knowledge-based assets that a company is in control of. IC covers traditional intellectual property rights such as patents, trademarks, and copyrights (Ocean Tomo, 2020) as well as human capital. In this thesis referred to when focusing on the intangible asset of human capital.

Intellectual property (IP): An umbrella term for trademarks, patents, designs, and copyrights (European Patent Office & European Union Intellectual Property Office, 2022).

Invent around: Creation of a similar feature or product as a patent protected, but with using a different method that isn't covered by the patent claims and hence do not infringe on the patent. As patents aim to block competition, possibilities to invent around is considered negative. (Reitzig, 2003) Also referred to as design/work around.

Mechanical/hardware solutions: The classification of mechanical solutions involves mechanical products as well as electromechanical products. Such inventions are also referred to as hardware solutions.

Patents: Exclusive protection of technical inventions, including products and processes. For an invention to be eligible for patent protection, it must fulfill some specific criteria: novelty, inventive step, and industrial applicability. Requires a detailed disclosure of the invention during the application process, serving as a valuable source of technical information. When granted, the owner is in control of the patented invention and can prevent others from using the same invention. (European Patent Office, 2024a) Part of the umbrella terms IC and IP.

Patent family: This includes several patents that all protect one specific invention, since a product can involve multiple patents (European Patent Office, 2024d).

Patent portfolio: A patent portfolio is a collection of all patent families that belong to a certain company or division (European Patent Office, 2024e).

Portfolio position: A patent's position in relation to other patents within a portfolio, owned by the same company and controlled by the same division. A patent can have a close relationship to other patents in the portfolio, designed to cover something similar to broaden the claims, but for which the original patent acts as a base (Reitzig, 2003).

Standard developing organizations (SDO): The organization that adopts standard essential patents and publishes proposed regulations of standards. They are also referred to as standard-setting organizations (SSO) (European Commission, 2023).

Standard essential patent (SEP): A patent that covers a certain technology where a specific solution has been appointed as the standard, thus, everyone using the specific technology will be required to apply the standardized solution (IP Europe, 2024).

7.2. List of formal interviews

Interview	Role	Date	Length (min)
1	IP professional 1	08-mar	51
2	IP professional 2	08-mar	61 + 57
3	IP professional 3	11-mar	71
4	Product manager 1	13-mar	50
5	IP professional 4	15-mar	81
6	IP professional 5	18-mar	49
7	IP professional 6	18-mar	58
8	IP professional 7	19-mar	41 + 12
9	IP professional 8	21-mar	44
10	Product manager 2	21-mar	43
11	Product manager 3	22-mar	43
12	IP professional 9	25-mar	45
13	IP professional 10	25-mar	60
14	IP professional 11	26-mar	42
15	Product manager 4	27-mar	Written
16	Technology manager 1	02-apr	54
17	Product manager 4	02-apr	42
18	Product manager 5	04-apr	46
19	Technology manager 2	04-apr	71
20	Product manager 6	09-apr	41

7.3. Interview guide

Introduction

1. What role do you have at the company?

Pruning decision

2. How often do you formally review whether to abandon or to keep a patent? Does this process differ depending on if the patent is for a mechanical or a digital solution? Does the useful lifetime of the patent depend on the if the patent protects a mechanical or a digital solution?
3. How is the pruning decision made? Is more than one person involved and what roles do the people involved have? Does the need for input from other stakeholders change if the patent covers a mechanical versus a digital solution? Who makes the final call?
4. What type of information and input do the patent stakeholders need to make a decision? Is the information delivered through written documents or verbally?
5. Do different stakeholders' opinions differ more or less if the patent protects a mechanical versus a digital solution?

Valuation of patents

6. Can you explain when you last decided to abandon a patent that was older than 10 years and what the reasons were? Could you also explain when you last decided to keep the patent and why?
7. How important do you view these factors for the value of a patent in the pruning decision?
 - a) Technical importance – the importance of the patented product for current development as well as for the future.
 - b) Invent around – how easy or difficult it is for competitors to invent around a certain patented invention.
 - c) Learning value through disclosure – if competitors are able to benefit from the technical knowledge being disclosed due to the information becoming part of the public domain after a patent is filed for.
 - d) Portfolio position – if a patent serves as a base or core patent, acting as a basis for other additional patents.
 - e) The difficulty of proving infringement – how easy or difficult it is to prove that someone is infringing on your patent.
 - f) Citations – if citations ever are examined from an external perspective as a determinant for the value or interest for others.
8. Are there any additional parameters that you view as important to determine the value in the pruning decision that have not been mentioned?

Patent strategy

9. Do you generally use different patent strategies (exclusivity, liberty, mitigating, or commercial) depending on if the patent is for a mechanical versus a digital solution?

10. How does the patent strategy impact the pruning decision after 10 years or more?
Is it more common to abandon patents that have a specific strategic usefulness out of the four?

7.4. Additional quotes

7.4.1. Pruning decision

Role	Code	Quote	Comment
IP professional 8	Renewal fee	<i>“Renewal bills every month to pay, right. Some patents get granted every month, so we do it on a monthly basis”.</i>	Explaining that every month, some of the patents’ annual renewal fees will need to be paid.
Product manager 2	Pruning process	<i>“Normally, this is part of having a physical or digital meeting where we take a look at business data. So KPIs that we have on the products that take advantage from the patents. Usually this would mean volume, contribution margin, production volumes in the different production facilities”.</i>	Describing the pruning decision meetings where they often include information about the sales for the product in question.
IP professional 7	Pruning process	<i>“We gather information from different sources and then compile it and present it to the decision-making group [...] But the older a patent gets, the more information we have. So it becomes easier to decide [...] We are much more based on experience and feeling”.</i>	Information from people with different roles and knowledge is gathered, and the older a patent is, the more information will be available, however, a lot is based just on experience and feeling.
Product manager 1	Pruning process	<i>“We try to make the decision together here and see the product as a system so to speak, which consists of both software and mechanics [...] Whether we should terminate or continue to pay for a patent, we have an open discussion about”.</i>	Commenting on the fact that pruning decisions are made collectively.

IP professional 9	Pruning decision	<i>"I'm not really the decision-maker. I can only advise that "we should have this because it is good for protection" or something like that, but it is still the product owners who have to pay for this. So the decision lies with the product owners".</i>	Clarifying how IP representatives view their own role, not as decision-makers but as experts to describe what the patent is actually protecting.
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7.4.2. Calculation

Role	Code	Quote	Comment
IP professional 7	Budget, Age	<i>"As for the renewal fees, they are usually annual, except for the US which is every 3,5 years. So, in the US, I would say that then it is 11,5 years and especially after 17,5 years I think because it is the third renewal fee. And then you pay, for example if you first would pay 1000 dollars, for the second 3500 dollars, then you pay 7500 dollars for the last one".</i>	Discussing the increasing renewal fees throughout a patent's lifetime.
IP professional 2	Budget, Age	<i>"Based on the fact that the annual fees for a patent rise continuously, so in the first years it is negligible what it costs to maintain a patent, but after a few years, the patent's annual fee increases more and more. It becomes a bigger and bigger cost for the older part of the portfolio versus the newer part of the portfolio [...] The costs are easy to calculate, while the value is a lot harder and a lot of parameters have to be taken into consideration".</i>	Stating how annual fees for keeping patents increase and how the older patents thus are more expensive than the newer ones. Additionally, stating a need of looking into multiple parameters.
IP professional 5	Budget, Age	<i>"The other factor we need to think about is the cost, because in different countries, the cost is different, and in different ages of the patent, the cost is different. So if it costs very much, we might prune it".</i>	Explaining costs as an important factor to consider in the pruning decision, increasing with age, and the differences of costs in different countries.

Technology manager 2	Budget	<i>“If overall result are a bit less good, everyone is searching or looking to make some cost-cutting”.</i>	Suggests when the consideration of costs becomes extra important.
IP professional 3	Age	<i>“When we really start to be stricter is after 15 years because then the price is really going up and it is also preparing for the death of the patent because it's clear that by 18 years, 19 years, why are you at all paying for the patent? Because anyway, your competitor can just wait two years and then start to copy you [...] The 15th year is more about preparing for the end of it, so we know that we are probably not going to pay the last two years of the patent”.</i>	Presenting how there is a tendency to abandon older patents that approach the end of their lifetimes.
Product manager 4	Age	<i>“The older the patents are, the more are the costs for the patents. So then, most patents we drop after 17-18 years”.</i>	Describing that the value might not be able to justify as the patent gets older.
Product manager 1	Portfolio size	<i>“Another way of looking at this is to build a patent portfolio, a bit like a bomb carpet. You build up several patents in an area, so that it becomes more difficult for competitors to navigate around this”.</i>	Discussing the idea about how it can be beneficial to have a large patent portfolio, acting as a defense.
Product manager 3	Portfolio size	<i>“Build a large patent portfolio to look strong in comparison to the competitors so yes, in a deterrent way”.</i>	Illustrates how a large patent portfolio could create a strong defense against competitors.
Technology manager 1	Technological characteristics	<i>“The technology development has not stopped but is rather exponentially improving, which means that the lifetime, in general I think, it feels like the validity of a patent is shorter today than what it was 20 or 30 years ago”.</i>	Regarding the fact that technology constantly develops which shortens the lifetime of patents that protect certain solutions.

7.4.3. Qualculation

Role	Code	Quote	Comment
Product manager 3	Technological characteristics	<i>“I believe that the digital ones have a shorter lifetime and I base this on the technology development, which is faster there so after 10 years, I think many of the protected inventions can be found in other versions in society and perhaps even have been further developed so the level of invention has disappeared”.</i>	Discussing the belief that the lifetime might be shorter for patents that protect digital solutions compared to mechanical ones.
Technology manager 1	Technological characteristics, Invent around	<i>“A software patent is much easier to invent around which results in, or at least my thought is that if you have a software patent that has lived for a couple of years, it is almost always obsolete. The technology is moving so much faster there, and it is much easier to work around the original solution”.</i>	Explaining that it is easier to invent around a patent for a digital invention without infringing on someone else’s patent.
Product manager 3	Technological characteristics, Invent around	<i>“It is much easier for a digital product. It is easier to do a design around and therefore you need a larger patent mat there”.</i>	Supporting the belief that you can easily invent around a digital solution.
Product manager 5	Technological characteristics, Difficulty of proving infringement	<i>“I’m saying that in those digital protection patents, what I have seen is that even though you are infringing on that patent during the valid time of the patent, I would say that it’s almost impossible to find that someone is actually doing it [...] That is basically the reason we don’t have those software patents at all”.</i>	Regarding the idea that it is much harder to prove that someone is infringing on a patent that protects a digital solution, thus, demotivating the patenting of such products.
IP professional 6	Technological characteristics, Difficulty of	<i>“For a mechanical solution, get your hands on the product and that’s the best you can do. I can think of one digital solution where we were trying to determine infringement. We had to</i>	Giving an example of when an effort was made to prove infringement on a digital product, however, it was

	proving infringement	<i>hire a consultant and we spent, I think about 25000 dollars, and the conclusion was that we think there is a 95% chance there is no infringement, but we cannot say with certainty. So, if you think about that, it's just much harder to determine".</i>	unsuccessful due to the difficulty and uncertainty.
IP professional 2	Technological characteristics, Difficulty of proving infringement	<i>"To prove infringement, it is easier for a mechanical product than a digital one as it is a lot easier to examine the mechanical one".</i>	Stating that it is easier to prove infringement on a mechanical invention because it is more tangible than a digital one, so you could just examine it.
IP professional 7	Citations	<i>"We do not look at citations. But I understand why it could be interesting. If we have a patent that is very much cited, then we are very early in the development. Then they will have a value due to that".</i>	Presenting the reasoning of why patent citations could be relevant to use to determine the value, however, not used as of today.
IP professional 2	Citations	<i>"Citations could be relevant to look into, from the perspective that we could then distinguish how relevant others seem to believe the area the patent is protecting is. If it is often cited, it means that our patent is prior art, and then others seems to be close in the area and then we might also need to look into when it has been cited. If it was mostly cited 10 years ago, then the area might not seem so relevant for others right now".</i>	Supporting the idea of looking at citations, also from the perspective of displaying information about competitors' technological activities, although they do not use this approach right now.
IP professional 9	Geographical coverage	<i>"Often remove the number of countries after a while, where you remove the countries where you do not sell a product with the patent in or intend to sell in. Or if the patent protects a production method, then it is important to look at where the product is produced".</i>	Regarding that the pruning process often means decreasing the geographical coverage, not letting go of the patent protection everywhere at the

			same time. The remaining countries are often related to sales or production.
Product manager 2	Geographical coverage	<i>“In most of the cases, we start by reducing the regional coverage and keep in markets where we have a high market share and then even sometimes only for commercial marketing purposes, while letting patents lapse in regions where we have a limited representation or where products have been discontinued”.</i>	Supporting the reduction approach of markets, for which some markets are considered more important to keep than others.
IP professional 11	Geographical coverage	<i>“We don’t have so many multi-country patents. Mostly in China, some in South-East Asia. Therefore, we seldom reduce countries, it’s either to abandon them entirely or to keep them”.</i>	For divisions with a narrow focus, the gradual reduction of geographical coverage disappears.
Technology manager 1	Technological characteristics, Strategy (licensing)	<i>“Licensing out, that is typical for software I would say. You don’t license out hardware in the same way”.</i>	Supporting the difference between the licensing strategy’s relevance to create value for patents protecting mechanical versus digital solutions.
Technology manager 2	Strategy (licensing)	<i>“Obviously, for a few countries where we do have a license, there is no question. We cannot stop renewing. We cannot make any decision for that patent because it’s related to the contract”.</i>	Regarding that the licensing strategy causes a frame denial, as no other aspects need to be included into the decision of keeping or letting go of a patent when this strategy is used.
IP professional 2	Strategy (licensing)	<i>“Just an interest from others to license could be enough to keep the patent. Because then you know that others have an interest or would like to enter the areas”.</i>	Describes how others’ interest of using the invention through licensing can be enough to motivate the inherent value.

7.4.4. External calculation

Role	Code	Quote	Comment
IP professional 8	Competitors	<i>“A part of these meetings is a monthly watch as well, on the competitors, what they file for. So it’s sort of clumped together, so to speak. For the monthly watch, we tend to keep an eye on what the competitors are filing. So that gives an indication of if we have to keep, where they are progressing, and what sort of patents we need to keep, that helps”.</i>	Describes how they often look at competitors to know their technological field, interesting for valuing their own patents.
Product manager 3	Competitors	<i>“An example is an invention that we chose to let go after 10 years because we could not say that we would implement the solution in the nearest 50 years. We would never choose to do it and we also made the assessment that probably no competitor would do it either because it would require such a large investment, and we don’t have that many competitors who would be ready to make that investment”.</i>	Presents how their valuation judgement is based on competitors’ possibilities to develop products based on the invention and how it will affect their decision-making.
IP professional 6	Competitors	<i>“My recollection was that we weren’t even using the technology, but the engineering analysis was that one of our competitors may have been and for that reason, we maintained it because there was a chance that we could go after this competitor”.</i>	Describes the connection between the difficulty of proving infringement and how patents are judged based on competitors, additionally, highlighting the importance of multiple internal stakeholders’ involvement.
IP professional 8	Competitors	<i>“I mean, it’s very, very difficult. Say for example, if you had a product line, it’s gone, you still have a patent. And the competitor hasn’t released the</i>	Describes the uncertainty surrounding the pruning decision, as it is hard to estimate

		<i>product. It is very difficult to envisage whether they're going to come up with a product that's going to infringe on your patent at a later stage".</i>	competitors' next move and therefore the real value of protecting an invention.
IP professional 9	Competitors	<i>"It's hard to estimate how much a patent actually is protecting. Because it's impossible to know which competitors that would develop a similar feature and that are hindered by the patent. That's just something we can speculate about".</i>	Discussing the uncertainty in assessing how competitors will react if a patent is abandoned.
IP professional 7	Competitors	<i>"We look at, for example, where are we? Where are competitors? And if there is a fight, where do we fight? Often, we then end up in the US or Germany. Because in the US, we have the business and we have the competitors, and they have a system of justice. Therefore, it is not common that we kill our patents there".</i>	Explaining an approach towards trying to find a suitable market coverage.
Product manager 1	Competitors	<i>"The landscape of competitors will change quite a bit going forward for industrial businesses. We kind of see that those who come up with digital solutions are not necessarily the traditional competitors that we have. So that could mean that the dynamics of the market change and then it could mean that we need to adapt our patent strategy here as well, perhaps include licensing as an alternative for digital solutions in the future. But we are not there yet".</i>	Presents how it is not obvious which competitors to keep an eye on, as the competitive landscape moves due to technological developments.
IP professional 5	Standard essential patents	<i>"If it's easy to go around, it's not valuable for us. That's the reason why SEP is so important. Because no one can go around it if they use this standard".</i>	Emphasizing the dominance of the SEP frame.

7.4.5. Internal calculation

Role	Code	Quote	Comment
IP professional 10	Frame blending	<i>“Typically, what I would do is to reach out to the product managers in the area. At least, I would definitely always involve the business”.</i>	Presents the importance of always involving someone from the business-side in the decision-making.
IP professional 4	Frame blending	<i>“Patents or IP should be enablers for the business, so it should in some way be used within the business”.</i>	Motivating why there is an important connection between IP and the business.
Product manager 2	Frame shifting	<i>“In the end, it’s me who makes the final call. But of course, I don’t do this sitting on my desk. It is a group discussion where we present the business case, what’s the current sales, what’s the revenue, what’s the margin of the products, where is the patent used? It’s more of a counsel”.</i>	Emphasize the collective decision making in the pruning process, where the decision-maker takes counterparties views into consideration.
IP professional 1	Frame denial	<i>“We from IP don’t have any money so we can’t make the decisions. It is the people out in the business that also will take the costs for our portfolios. They are the ones who make the final call”.</i>	Presents the relation between the cost framing and the decision-maker, connecting calculation framing with the dynamics in the calculation framing.