A STUDY OF CULTURAL INFLUENCE ON THE VALUATION OF PATENTS

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Abstract

The regimes of today that regulate and protect Intellectual Property Rights are based on Western cultural and philosophical values. This realization leads to the supposition that culture may influence the notion of patents. This raised the question of whether patent valuation would underlie a cultural bias. If patents are important in international business it is evident that a cultural impact on patent valuation would have significant implications and necessitate dedicated investigation.

A literature review confirmed a knowledge gap in this area. This work, therefore, aims to investigate cultural impact on patent valuation. A distinction is made between a valuation from an ethical point of view and an economic valuation.

Following a mixed methods approach, this research applies semi-structured interviews to create survey items for a questionnaire that then provides data that can be analyzed statistically and qualitatively. For quality assurance, a pre-questionnaire is used as an intermediate step. The results of the quantitative and qualitative analyses are subject to a between-method triangulation, which is interpreted in the following discussion in the light of relevant theory.

The findings of this investigation confirm that there is indeed a cultural impact on the notion of patents. Two cultural dimensions, “Uncertainty Avoidance” and “Institutional Collectivism” correlate significantly with ethical patent valuation. Furthermore, it is not the complete cultural dimension, “Future Orientation”, but a specific aspect of it that correlates with economic patent valuation. A relationship between standpoints towards the ethical valuation of patents and economic patent valuation could not be proven.

The research questions of what cultural dimensions have an impact on patent valuation and how and why they impact are answered. In addition, this work provides a model that represents cultural impact on patent valuation.

Author's Declaration

I declare that the work in this thesis was carried out in accordance with the regulations of the University of Gloucestershire and is original except where indicated by specific reference in the text. No part of the thesis has been submitted as part of any other academic award. The thesis has not been presented to any other education institution in the United Kingdom or overseas.

Any views expressed in the thesis are those of the author and in no way represent those of the University.

Signed …….. Date …….

Für Silvia

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Abbreviations

AES	Advanced Encryption Standard
AFTA	ASEAN Free Trade Area
AgeGr	Age Group
ANOVA	Analysis of Variance
CETA	Comprehensive Economic and Trade Agreement
CII	Computer-Implemented Inventions
CNSS	Committee on National Security Systems
Col1	Collectivism I (Institutional Collectivism)
Col1GP	Collectivism I (Institutional Collectivism) GLOBE Practices
Col1GV	Collectivism I (Institutional Collectivism) GLOBE Values
Col2	Collectivism II (In-Group Collectivism)
CVS	Chinese Value Survey
DCF	Discounted Cash Flow
EPO	European Patent Office
FRAND	Fair, Reasonable and Non-Discriminatory
FutO	Future Orientation
FutOGP	Future Orientation GLOBE Practices
FutOGV	Future Orientation GLOBE Values
GDP	Gross Domestic Product
GLOBE	Global Leadership and Organizational Behaviour Effectiveness Research Project
GM	Genetically Modified
GNI	Gross National Income
GNP	Gross National Product

ICC	Intra-Class Correlation
IDV	Individualism vs Collectivism
IPR	Intellectual Property Rights
IP	Intellectual Property
IPnet	Balance of Payments and Receipts for Intellectual Property
IT	Information Technology
IVR	Indulgence vs Restraint
JPO	Japanese Patent Office
M&A	Mergers and Acquisitions
MAS	Masculinity vs Femininity
MMR	Mixed Methods Research
MPV	Mean Patent Value
NAFTA	North American Free Trade Agreement
LTE	Long Term Evolution
LTO	Long Term Orientation
LTV	Labour Theory of Value
OTV	Objective Theory of Value
PatA	Patent Applications per Capita
Pat1	Ethical Patent Valuation Scale
Pat2	Economic Patent Valuation Scale
PDI	Power Distance Index
PowD	Power Distance
QR	Quick Response code
R&D	Research and Development
ROT	Real Option Theory
SME	Small and Medium-sized Enterprises

SPSS	Statistical Package for the Social Sciences
SSD	Solid-State Drive
STAM	Science, Technology, Agriculture and Medicine
STEM	Science, Technology, Engineering and Mathematics
STV	Subjective Theory of Value
SW	Software
TPP	Trans-Pacific Partnership
TTIP	Transatlantic Trade and Investment Partnership
UAI	Uncertainty Avoidance Index
UnAv	Uncertainty Avoidance
UnAvGP	Uncertainty Avoidance GLOBE Practices
UnAvGV	Uncertainty Avoidance GLOBE Values
USITC	United States International Trade Commission
USPTO	United States Patent and Trademark Office
WIPO	World Intellectual Property Organization
WTO	World Trade Organization
WVS	World Value Survey

CHAPTER 1: INTRODUCTION

1.0 Background, Statement of Problem and Definition of Terms

Interest in the subject of this work was prompted by frequent newspaper reports about patent litigations between technology "heavy weights", involving frivolous sums of money. It became clear from the reports that these juridical fights were serious business matters, whether over complex high-tech or quite trivial patents. How could a few patents, or even a single patent, be so extremely valuable? Additionally, how could the highly valuable patents be distinguished from those of low value? In any case, patent valuation is not a "hard science" and ultimately the market, a company, or a single person decides how much money a patent is worth. Thus, patent valuation is a very subjective act. The fact that today's Intellectual Property Rights systems are mainly based on Western philosophy and values evoked the question of whether patent valuation would underlie a cultural bias. This work investigates cultural impact on patent valuation. The terms "culture" and "patent valuation" must therefore be clearly defined.

Concept of Culture

According to Williams (1985, p. 87), "*culture is one of the two or three most complicated words in the English language"*. The term "culture" is particularly complex as its definitions and concepts vary widely across the different disciplines of social sciences and it designates certain commonalities at national/societal, organizational or group level. The presumed cultural differences that may influence patent valuation are connected to historic and philosophic development and so are most closely related to the societal level of culture. Organizational, religious, professional and social cultures or any sub-cultures may also influence patent valuation but these would require a different theoretical framework and access to a different sample than is available. This study refers to **societal culture** and leaves

investigations of other cultural levels for further research. It is therefore advantageous to discuss the results of this work in the context of some of the most notable cross-cultural studies on a societal level, such as Hofstede (1980) and the GLOBE project (House et al., 2004). Societal culture is not measurable but cross-cultural studies provide a number of tools in the form of cultural dimensions that are distinct enough to allow an etic approach for comparative purposes. Further discussion of the **concept of culture**, **cross-cultural studies** and **cultural dimensions** can be found in section **3.2**. This section also explains why the term “societal culture” is preferable to “national culture”.

Valuation of Patents

An investigation of patent valuation raises the question of what exactly is meant by “valuation” and how the concept of "value" can be defined. Current IPR systems have mainly been developed within the context of Western philosophy and culture. Therefore, this work argues that cultural aspects influence our ethical standpoint toward patents, whether or not we judge the concept of patents as being ethically justified. Furthermore, it argues that if a society’s underlying philosophy and values influence peoples’ ethical standpoint toward patents, this is reflected in their willingness to assign them with high monetary value. Consequently, there are two meanings of “value” relevant to this work; ethical value and economical value. This work investigates **ethical patent valuation** in a utilitarian sense, e.g. whether the patent system is beneficial for society. The second meaning of “value” in the context of this work refers to **economic patent valuation**. According to the "subjective theory of value" (STV), estimations of monetary value of patents are not determined by production costs incurred but by their subjective worth to a buyer (Menger, 2007 [1871]). Ethical and economic patent valuation is described in more detail in section **3.3**. Both types of patent valuation are investigated from the view of inventors and patent holders; a group of people represented by the sample of the final

questionnaire (individuals who work in the telecommunications sector with tertiary education in STEM[1] fields; for detailed explanation refer to section **6.1**).

1.1 Aim, Research Questions and Objectives

The **Aim of this Research** is to provide evidence of a cultural impact on our notion of patents and to develop a model to explain the influence of cultural dimensions on the valuation of patents. This model will support the target group of this study (patent portfolio managers, business controllers, M&A professionals, patent rating agencies and business analysts) in their valuation of patent portfolios.

To achieve the research aim, this work seeks to answer the following **Research Questions**:

1) What cultural dimensions influence the concept of patents?

2) How, and why, do these cultural dimensions impact the economic and ethical valuation of patents?

The research questions formulated above are directly linked to the following **Research Objectives**:

1) To investigate cultural impact on the concept of patents and to identify the relevant cultural dimensions.

2a) To elaborate a model that helps to understand the type and magnitude of impact of relevant cultural dimensions on the assessment of the economic and ethical value of patents.

2b) To investigate the reasons for cultural impact on the valuation of patents.

[1] Science, technology, engineering, and mathematics

1.2 Importance of the Research

Such cultural bias on patent valuation would have many important implications. Firstly, a cultural bias on economic patent valuation would need to be considered when comparing the patent portfolio values of companies. Secondly, different valuations from an ethical point of view might impact the motivation to apply for patents and thus distort the comparability of patent statistics. The number of patent applications is frequently used as a measure in order to analyze innovativeness, not only on a company level, but also on a country level (EIS, 2008; Greenhalgh & Rogers, 2006). Patent statistics are also one of the sources used by researchers for comparisons to investigate competitiveness (Eto & Lee, 1993; Schwarz & Sala-i-Martín, 2013). Consequently, the findings of this work will be relevant for future investigations in the area of innovativeness and competitiveness. Another implication of cultural bias could be the effect on the quality of patents in terms of depth, breadth and degree of innovation. This means culture would need to be considered as one of the many different factors that influence patent quality.

Given the importance of patents and the necessity to quantify their economic value, this work is also expected to have practical relevance for a specific target group consisting of patent portfolio managers, business controllers, M&A professionals, patent rating agencies and business analysts. This research is not aimed at inventors and patent holders in order to help them to estimate the value of their patents. Instead, it should provide additional insights that help the target group mentioned above to classify, grade and compare the values of patent portfolios when using patent renewal data or survey based methods (for a discussion of different patent valuation methods refer to section **3.3.2**).

1.3 Research Methods

Research philosophy relates to "*the development of knowledge and the nature of that knowledge*" (Saunders, Lewis, & Thornhill, 2009, p. 107). This work follows a **research philosophy based on a constructivist worldview**. The constructivist position and the conviction that the research questions play a major role in the choice of the conceptual structure of the research work led to the choice of a methodology commonly known as **Mixed Methods Research** (MMR). MMR combines qualitative and quantitative research methods from a broad portfolio of methods to gather multiple views of the observed phenomena. The relation between the philosophical standpoint, methodology and the choice of methods of this research is explained in **Chapter 4**.

Quantitative and qualitative data collection and data analysis methods were applied in the following sequence:

- Semi-structured interviews were used as a qualitative method to explore and investigate the factors affecting cultural impact on the valuation of patents (section **5.1**).
- Pre-questionnaire data was statistically analyzed and utilized to construct a valid and reliable questionnaire (section **5.2**).
- The data collected by means of a questionnaire underwent quantitative and qualitative analyses (sections **6.4** and **6.5**).
- A model of cultural impact on patent valuation was developed (section **8.3**).

An overview of the research approach and the sequence of applied methods is provided in **Figure 5** in section **4.4**.

1.4 Structure of the Research

This thesis is organized into the following nine chapters:

- **Chapter 2** gives some information about the contextual background of this work. It starts with a look at the growing importance of intellectual property rights in international business and the increasing number of legal disputes related to patent infringements. These juridical confrontations involve industry heavy weights and huge amounts of money and are already known as "patent wars". Patent litigations are one reason why companies are increasingly concerned with the value of patents. The second important aspect of the contextual background is the conjecture that today's IPR regimes are based on Western culture and philosophy. This aspect is discussed in two separate sections. The first presents the history of intellectual property philosophy and the second gives a short overview of the history of patents. Both sections support the assumption that philosophical fundaments of the intellectual property concept are embedded in different cultural traditions and that cultural aspects may indeed have a strong influence on current IP legislations and on the notion of patents. This is relevant if opinions about the ethical and moral justification of the patent system influence the economic valuation of patents.

- The literature review presented in **Chapter 3** consists of three parts: a systematic database search of the main online resources to evaluate whether the subject of this research has been investigated already or not. In this way, a knowledge gap concerning cultural influence on patent valuation is identified. The following two parts describe a critical literature review in the two areas that relate closely to the subject of this research: culture and patent valuation. The research questions and objectives are developed in a separate section, based on the identified knowledge gap and learning from the analysis of the academic literature about culture and patent valuation. This chapter ends with the development of a conceptual model of cultural influence on patent

valuation that leads to the final model elaborated in the light of the results of this work in **Chapter 8**.

- **Chapter 4** describes the chosen methodology and methods for this investigation. Starting from a research philosophy based on a constructivist worldview, this chapter explains the relationship between philosophical position, methodology and methods. It presents the chosen methodology of Mixed Methods Research (MMR) and the rationale behind it. MMR allows for a flexible combination of qualitative and quantitative research methods, which is considered beneficial to answer the research questions defined in the chapter above. This chapter describes the data collection methods, semi-structured interviews and questionnaires and the qualitative and quantitative data analysis methods applied. It also outlines the boundaries of the research, which are limited to the reach of the European Patent Office member countries. It ends with a section about ethical considerations.

- **Chapter 5** describes the development of the final questionnaire including separate parts relating to patent valuation and culture. The survey items for the patent valuation were created in two steps. A number of candidate survey items emerged from the data gathered by means of semi-structured interviews. These candidate items were subsequently tested and analyzed with the help of a pre-questionnaire. This two-step process provided a set of survey items that covered the patent valuation related part of the final questionnaire. The culture related survey items for the questionnaire were taken from the GLOBE project; the concerned items and the rational for the selection are described in a separate section. The final questionnaire is formed from both sets of survey items and described in the next chapter.

- **Chapter 6** presents the questionnaire sample and the choice of countries, followed by the questionnaire items and the data obtained from the questionnaire aggregated on a societal level. The two subsequent sections describe the analyses of the quantitative and qualitative data collected from

the questionnaire. The results from both analyses are presented, discussed and prepared for a final interpretation in the following chapter.

- **Chapter 7** discusses the results of the statistical analysis of the questionnaire data and the findings of the analysis of the obtained qualitative data and interprets these in the light of the relevant theory. The major findings confirm the influence of specific cultural dimensions on the notion of patents, as well as the impact of specific cultural aspects on concrete economic patent valuation. These results allow the elaboration of a new model for the influence of culture on the valuation of patents and a response to the research questions in the final chapter of this work.

- **Chapter 8** presents the **contribution to knowledge**, which consists of the answers to the research questions and the new model of cultural impact on patent valuation. The **results of this work** confirm the influence of cultural dimensions on the notion of patents, namely of 'Uncertainty Avoidance' and 'Institutional Collectivism'. They also show the impact of specific future related cultural aspects on concrete economic patent valuation. The conjecture that standpoints towards the ethical valuation of patents could also influence economic patent valuation could not be proven. This chapter also outlines the implications of this work as well as its limitations. It closes with recommendations for researchers and policy makers.

1.5 Summary

This chapter outlined the background of this work, the statement of the research problem, the resulting questions and aims, the importance of the research, the chosen research methods and how the thesis is organized. The following chapters present the literature review, philosophy, methodology and methods, development of questionnaire, main analysis and results, discussion of results, and conclusions. The next chapter provides the contextual background of this research into cultural impact on the valuation of patents.

CHAPTER 2: CONTEXTUAL BACKGROUND

2.0 Introduction

This chapter provides the contextual background of this work and is presented in three dedicated sections. The first relates to “patent wars”, the second to the philosophy of intellectual property and the third to the history of patents. The first section outlines why patent valuation is an important topic for international business and the subsequent two sections explain that the history of patents is closely connected to the history of the underlying philosophy. This leads to the conclusion that philosophical fundaments of the concept of intellectual property are embedded in different cultural traditions and that this relationship indicates that cultural aspects may indeed have a strong influence on current IP legislations and on the notion of patents. Overall, this chapter provides the rationale why a potential cultural influence on patent valuation is important for international business and constitutes a relevant subject for academic investigation.

2.1 Patent Wars

The growing importance of Intellectual Property Rights (IPR), especially patents, has been observed in international business for some time (Berman, 2002; OECD, 2004; Reber, 2004). This growing importance is reflected in a steady increase of annual filings for patents. The reason for this increase is not necessarily growing innovativeness: more companies consider patents as a type of tradeable asset, a shift from manufacturing to non-manufacturing industries (especially in the USA) and a growth in technology fields that are particularly vulnerable to patent litigations, such as IT and telecommunications (Molla, 2014, June 2). Globalization is also an important driver for patent applications, as companies are less limited to a regional and

protected market. Consequently, China is one of the countries with the highest growth rates in patent filings (WIPO, 2016a).

Patent disputes, that previously went unnoticed outside the groups of people primarily involved, have recently spread to a non-expert audience through international media. This is partly due to the disputed sums reaching astronomical levels and partly due to the sheer number of patent litigations. Consequently, most references in this section are related to articles in newspapers and news magazines.

Technology firms tend to fight their competitors in courtrooms with the accusation of IPR infringements, IPR and especially patents are used as a weapon against competitors (Anonymous, 2010, September 4; Duhigg & Lohr, 2012, October 7). For example, the number of investigations instituted by the United States International Trade Commission (USITC), based on complaints of intellectual property infringements, rose from 18 in 2003 to 42 in 2013 (USITC, 2014). Most prominent examples of legal disputes involve industry heavy weights such as Apple, Samsung, Google, Oracle, Microsoft and Nokia (Anonymous, 2011, August 20). These business fights taken to court are not limited to smartphone manufacturers, but are particularly intensive in this still fast-growing technology area. Fights are so fierce, that the media talk increasingly about “patent wars” (Anonymous, 2011, December 19; Charlton, 2012, December 18; Lohr, 2012, April 9), although this expression has already been used in the past (Warshofsky, 1994). The stakes are high: a defeat in court may well result in huge business damage. For example, in September 2011 Apple succeeded in a court decision that banned sales of Samsung's Galaxy Tab 10.1 in Germany[2] (LG-Düsseldorf, 2011; Mas, 2012), based on the claim that Samsung was violating one of Apple’s community designs. The last few years has seen three companies becoming leaders in the highly competitive smartphone market: Google with its now dominant Android operating system (82.8% in Q2 2015 unit shipments, according to the market analyst International Data Corporation (IDC, 2016a)), Apple with the highest gross profits (39% in Q1 2016, according to Forbes (Helft, 2016, January 26)) and Samsung with the highest smartphone market share (21.4% in Q2

[2] Düsseldorf Tribunal of first instance (Landgericht), case number 14c O 194/11

2015 unit shipments, according to the market analyst International Data Corporation (IDC, 2016b)). It is therefore understandable that the most prominent IPR battles are fought between Apple and Google (Gustin, 2012, October 12) and between Apple and Samsung (Lohr, 2012, July 29). Google and Samsung, however, are in the same boat – Samsung's smartphone sales leadership is partly due to the success of Android and vice versa (Lee & Cheng, 2014, January 27; Zucchi, 2015, October 28).

The most prominent legal disputes seem to be over at the moment, or they are continuing their way through judicial processes with less media attention. The fiercest battles started in 2010 and 2011, during the steepest increase in smartphone sales, over who was (or would become) the market leader in this lucrative business sector (Paik & Zhu, 2016). The few years between 2011 and 2015 saw the rise and fall of a number of smartphone manufacturers. Some former stock market stars fell badly (Nokia, Motorola, Blackberry), some other companies struggled and maintained an endangered position (Microsoft, Sony) and others gained a dominant position (Apple, Samsung, Google). "Patent wars" are far from over and will continue, not only in telecommunications, as technology and business evolve further and globalization continues (Finley, 2015, February 19; Siino, 2018, January 29).

In boardrooms, as well as in the media, Intellectual Property Rights are gaining more and more attention. Many international companies rise to the challenge and follow a more active patent strategy. In August 2011, Google announced that it had agreed to acquire Motorola Mobility (Taylor & Waters, 2011, August 16). The media reported that Google had primarily bought the company in order to get a valuable patent portfolio and to protect itself and its Android smartphone operating system from attacks by competitors over patent infringement (Waters, 2011, August 15). The Motorola patent portfolio consists of more than 17,000 patents and 7,500 patent applications and Google reportedly paid US $12.5 billion (Taylor & Waters, 2011, August 16). This would mean a price tag of roughly US $500,000 per patent (including patent applications) if the deal were judged as a pure patent portfolio deal. Interestingly, it was the same price per patent when CPTN Holdings[3] purchased 882

[3] CPTN Holdings is a consortium of companies including Microsoft, Apple, EMC and Oracle

Novell patents for US $450 million in 2010 (Letzing, 2010, December 17). An earlier purchase of 6,000 former Nortel Networks' patents resulted in a price of US $4.5 billion for Rockstar Bidco[4], which is US $750,000 per patent (Waters, 2011, July 15). All three of these patent portfolio deals reached significantly higher prices per patent than US $200,000 – US $300,000, which is considered a typical value for IT patents in similar deals on a smaller scale (Waters, 2011, August 15). A business strategy determined premium may explain this discrepancy, i.e. strategic reasons rather than the sum of the intrinsic patent values define the price a company is willing to pay for such a patent portfolio.

In addition to these "patent wars", in which patents can be used as a shield (against attacks from competitors) and sword (to attack competitors themselves, block them from market segments or force them to costly "design around" a patented solution), there are various motivations to file patents for inventions (Berman, 2002):

- Patents are tradeable assets that can be used as a financial tool for transfer of profits from one legal entity to another through intra-firm licensing. Unfortunately, this is very common among multinational companies in order to "optimize" their tax burden.

- A well-filled patent portfolio is a demonstration of innovativeness and competitiveness, which finds its way into analysts' reports that can perceptibly influence share prices. This influences a company's credit rating (cheap access to capital is a major competitive advantage), the ability to defend against hostile takeovers, the ability to buy other firms and, last but not least, the delight of shareholders.

- Patents are a source of income when "licensed out" and can avoid own licensing costs ("licensing in" for patents of other companies).

- Patents are also a currency for negotiations with (potential) partners, e.g. for cross licensing.

[4] Rockstar Bidco is a consortium of companies including Microsoft, Apple, RIM and Sony

In short, patents can be seen as investments into the business future with a certain degree of insurance. The different motivations for patent applications exist in an ever changing international business environment: Globalization, shorter product lifecycles, increasing specialization, knowledge as a decisive competitive advantage and the narrowing of gaps between companies concerning technological competence. These reasons result in the continuous increase of patent applications worldwide (WIPO, 2016a) and the rising importance of patents in business (Berman, 2002).

An important question evolves if patents are of growing business importance: How can a single patent or even an extensive patent portfolio be valued? In fact, there is no method to measure a patent's value in a reliable or objective way and there is no such thing as an established market value for a patent (Anonymous, 2011, August 17). Given that patent portfolios may account for a significant share of a company's total value, analysts and M&A professionals need guidelines to make a rough guess about the involved patent portfolio value. There are numerous methods to estimate patent values, but results vary considerably (Lanjouw, Pakes, & Putnam, 1996). Applying parameters such as industrial sector, average remaining run-time and license revenue appear to be quite obvious factors for estimating, but their practicability and accuracy is limited. Greenhalgh & Rogers (2007) propose estimating the IPR portfolio value as share of a company's market value. However, in the same article the authors point out that some country's patent systems follow more rigorous policies regarding patent grants than others, which distorts the comparability of patent values across countries.

Today, most companies recognize that quantification of the economic value of patents is of great importance and presents a real challenge to all stakeholders.

2.2 Philosophy of Intellectual Property

This research is based on the supposition that current worldwide IPR systems are based on Western cultural and philosophical values and the presumption that there is probably a cultural bias towards the concept of patents. How did the current concept of intellectual property develop and why is the current patent system based on Western philosophy?

What we call Western culture and philosophy today has evolved slowly over thousands of years. Philosophers in ancient times had already begun to think about property and arguably laid the foundations for the notion of property in Western cultures. This notion was further developed and fine-tuned over centuries. Christian values added to the process, followed by the Enlightenment, the industrial revolution and late modern history. The following overview does not claim to be complete, but outlines some important steps that developed the concept of intellectual property from its ancient beginning until modern times.

Ancient Greece

Great philosophical work with enduring impact was produced in the 4th century BC by Greek philosophers, such as Socrates, Plato and Aristotle. What did they think about property in general and about intellectual property in particular? Was it a subject of philosophical discourse at all? Socrates did not produce any philosophical work in written form and it was others, such as his student, Plato who conveyed everything we know about him and his views. It is quite difficult to separate the beliefs of Socrates from those of Plato. Socrates is believed to have represented the view, that knowledge is virtue and is the most valuable of all possessions and that he preferred knowledge to material wealth (Santas, 1964). He seems to have had a non-materialistic viewpoint, unconcerned with material questions such as property and property rights. However, in his work "*Oeconomicus*", Xenophon, another of Socrates'

students, describes Socrates as an expert in household and property management (Danzig, 2003).

Plato (Plato, Ferrari, & Griffith, 2000 [380 BC]) is more specific about property. In his book, "*The Republic*" (Book III), he describes how the ideal city-state and the ideal man should be. The city-state should be ruled and guarded by the most noble of all men:

> *"From our children, from our young and grown men, the one who under constant testing emerges as pure is the one who should be appointed as a ruler and guardian of our city."* (Plato et al., 2000 [380 BC], p. 107)

For those guardians of state he disapproves of private property, viewing them as decay and spoilage:

> *"… no one is to have any private property beyond what is absolutely essential."* (Plato et al., 2000 [380 BC], p. 110)

Restrictive regarding the right to private ownership of tangible assets, one can assume that Plato would have opposed the right of private ownership of intangible assets. He thought that ideas were universal, that they were subject to discovery and therefore impossible to be possessed by anybody. Plato's concept of an "idea" concerns the discovery of something existing rather than the creation or invention of something new, e.g. the "idea" of a tree as a universal representative of all trees. It can be assumed that the distinction between discovery and invention, engraved in today's IPR systems, derives from Ancient Greek philosophy (Granstrand, 1999).

Nonetheless, Plato's Greek contemporaries were concerned with copyright. An author was considered to hold the legitimate right to his ideas expressed in writing. For example, Aeschines, another disciple of Socrates, gave private lectures after the death of his master. Aristippus claimed, probably wrongly, that the dialogues that he read publicly were in fact the work of Socrates (Smith, 1867).

Aristotle (2013 [330 BC]) emphasized the importance of private property in his work, "Politics". He argued that private property is a precondition to fulfil social duties and to allow for liberality; hence serving a public utility:

> *"It is evident then that it is best to have property private, but to make the use of it common; but how the citizens are to be brought to it is the particular business of the legislator. (...) Besides, it is very pleasing to us to oblige and assist our friends and companions, as well as those whom we are connected with by the rights of hospitality; and this cannot be done without the establishment of private property, (...); liberality, which depends upon private property, for without that no one can appear liberal, or do any generous action; for liberality consists in imparting to others what is our own."* (Aristotle, 2013 [330 BC], p. 1263a)

Rome

Roman law did not formally define property, but did distinguish between different types of property. "*Dominium*" referred to a household and "*propietas*" to property attached to a person. Furthermore, it knew a right of a person in the property of another, or encumbrance that allowed certain usage, including servitudes and security interests. Possession ("*possessio*") was different from property. In principle, property was absolute in terms of possession, usage and usufruct (Görres-Gesellschaft, 1995). Cicero (1928 [44 BC]) argued that private property originated from occupation. As nature knew no private property, it came into existence either through first occupation of unoccupied land, or through victory in war, or through law, agreement or contract (Cicero, 1928 [44 BC]). Seneca (1969 [62 AD]) pointed out in his work, "*Epistulae morales ad Lucilium*", that wealth was despicable, derived from greed and was the cause of many evils, but that modest property was acceptable (Seneca & Campbell, 1969 [62 AD]).

The Middle Ages

The greatest thinkers in the Middle Ages were mostly theologians or members of religious congregations that ignored, or even rejected private property. Their main concern was the relation between faith and secular affairs. However, some scholars, especially Dominicans, such as Albertus Magnus and Thomas Aquinas, strived to introduce Aristotle's works into the Catholic doctrine (Böckenförde, 2006). In one of his best-known works, "*Summa Theologiae*", Aquinas (2013 [1273]) denied the notion that private property was a natural right. According to him, a natural rights view meant that all things were common property. However, he justified private property as a consequence of human rationality. He mentioned three rational reasons. Firstly, private property leads to greater care, secondly it defines responsibilities and thirdly it provides legal certainty. Private property is committed to the common welfare and includes an obligation to give charity to the poor. Human misery has a higher priority than private property. Theft is a sin, but it is not unlawful to steal in certain cases: "*in cases of need all things are common property*" (Aquinas, 2013 [1273], p. 1474).

Between the late Middle Ages and Modern History, the School of Salamanca played an important role with its philosophical considerations concerning private property. Francisco de Vitoria (Deckers, 1991) commented that private property was not founded on divine or natural rights, but on human legislature. Laws and rules on private property are subject to human disposition (Deckers, 1991).

The Age of Enlightenment

A more philosophical and conceptual clarification of "property" and "intellectual property" was initiated with the Age of Enlightenment, between the second half of the 17th century and the end of the 18th century. Advances in science and technology, in trade and in the socio-economic environment led to, and were fostered by, significant political changes (Spielvogel, 2010): The Glorious Revolution in England (1688), the enlightened absolutism, especially in Austria and Prussia, the Declaration of Independence of the USA (1776) and the French Revolution (1789). These changes

were accompanied and bolstered by politico-philosophical work concerning the theory of the state, mainly shaped by Hobbes and Locke in England, by Montesquieu, Voltaire and Rousseau in France, by Lessing and Kant in Germany (Spielvogel, 2010; Berlin, 1984 [1956]).

Hobbes (2004 [1642]) outlined those anarchic conditions where a "*war of all against all*" prevails and "*man is a wolf to man*" (Hobbes, 2004 [1642]), characterized by a "*state of nature*" that ignored property rights:

> *"…that there be no propriety, no dominion, no mine and thine distinct; but only that to be every man's that he can get, and for so long as he can keep it*." (Hobbes, 1996 [1651], p. 13.13)

A strong central power was required in order to enforce legal certainty and freedom of contract, thus property and justice. Such a situation could be achieved through a social contract, where every citizen transferred his civil liberties to a sovereign. He, as an absolute ruler, would then enact and enforce laws. Only the sovereign could concede and limit property rights - one could only consider as one's own what the sovereign considered as one's own (Hobbes, 1996 [1651]).

Immediately after the civil war and the Glorious Revolution of 1688, Locke (1823 [1690]) published his "*Two Treatises of Government*" where he argues against Monarchy in favour of Parliament. According to Locke (1823 [1690]), God gave the Earth to mankind for common usage and property derives from natural rights, not from contracts. Mankind is allowed to take possession of nature due to reasons of self-preservation. The divine commandment in Genesis 1:28 "*be fruitful and multiply; fill the earth and subdue it*" (Nelson, 1983, p. 2) can be fulfilled through labour - by working on natural domains one brings a part of oneself into nature and thus gives it a value. Water in nature belongs to nobody, but water in a jar is turned into the property of somebody. However, private property has natural limits:

> "*As much as any one can make use of to any advantage of life before it spoils, so much he may by his labour fix a property in. Whatever is beyond this is more than his share, and belongs to others*." (Locke, 1823 [1690], p. 5.30)

While property can be seen as a just reward of labour, the protection of property is the main reason for state-building:

> *"…great and chief end, therefore, of men's uniting into commonwealths, and putting themselves under government, is the preservation of their property*." (Locke, 1823 [1690], p. 9.124)

Hence, property already exists before formation of a state and therefore, a sovereign cannot dispose of the property of his or her subjects. In contrast to Hobbes, natural rights of life, freedom and property limit public authority. Interference in private property by the state power always requires the approval of the citizen (Locke, 1823 [1690]).

Rousseau (Rousseau & Gourevitch, 1997 [1754]) was quite critical of private property, but considered it indispensable for freedom. The formation of private property meant that Mankind left the Hobbesian state of nature:

> "*The first man who, having enclosed a piece of ground, to whom it occurred to say this is mine, and found people sufficiently simple to believe him, was the true founder of civil society. How many crimes, wars and murders, how many miseries and horrors Mankind would have been spared by him who, pulling up the stakes or filling in the ditch, had cried out to his kind: Beware of listening to this impostor; You are lost if you forget that the fruits are everyone's and the Earth no one's.*" (Rousseau & Gourevitch, 1997 [1754], p. 164)

Rousseau's opinion is similar to Locke regarding the creation of private property - only labour on a field constitutes the right to harvest, and only steady labour, from harvest to harvest, establishes property rights to the soil (Rousseau & Gourevitch, 1997 [1754]). Thus, property is originated from labour. Original owner is the community that permits individual possession and utilization that leads to private ownership. A first possession is justified if a piece of land is unoccupied, if it is limited to the extent that is required for self-preservation and if this possession is based on cultivation and labour (Rousseau, 2003 [1762]).

As Locke's works influenced the American constitution, especially the Virginia Bill of Rights of 1776 (Wills, 2002), so did Rousseau's writings on the French Revolution (Hunt, 2004). Article 17 of the "Declaration of the Rights of Man and of the Citizen" of 1789 states:

> *"Property being an inviolable and sacred right, no one may be deprived of it unless public necessity, legally determined, clearly requires such action, and then only under condition of a just and prior indemnity."* (Spielvogel, 2010, p. 360)

Hume (1751) concluded that private property was founded on original appropriation and on long-lasting possession through custom and practice.

The theory of property of Immanuel Kant (Kirchmann, 1870) is an integral part of his moral philosophy. He distinguishes between internal and external *"mine or yours"*. The internal means a right in one's own person, which is expressed in freedom. It is a natural right that exists "*a priori"*. In contrast, the external *"mine or yours"* means property, which is no natural right, but needs to be acquired, because it affects others (Kirchmann, 1870).

> *"That is rightfully mine (meum iuris) with which I am so connected that another's use of it without my consent would wrong me."* (Kant & Gregor, 1996 [1797], p. 37)

For the justification of property rights, it is irrelevant whether an object is in physical possession or whether it is necessary for self-preservation. Furthermore, neither a first capture or occupation, nor formation through labour, creates any rights against any other person *per se*. Kant disagreed with Locke's labour theory of property. The property rights of one person mean restrictions to the rights and freedoms of all other people; therefore, no object can become property without the agreement of all others. Hence, an external *"mine or yours"* can only exist in a civic society and private property without public authority can only be provisional (Kirchmann, 1870). Kant (1785) was also specifically concerned with copyrights. He wrote an essay to prove the illegality of reprinting. Here he argues that the author gave the exclusive right to

publish to his publisher and that any unauthorized reprinting would deprive the publisher of his legitimate profit (Kant, 1785).

The philosophical current of German idealism, represented by Fichte, Schelling and Hegel, demanded a constructive role for the state within civil society (Beiser, 2009). According to Fichte (1796), the fundament of property is not labour, but a person's right to assign an object to his/her own usage. Natural ownership is derived from the relation of the reasonable subject to the object. To be free means to be the master of one's own actions. Property right therefore is not the right to an object, but the right to options and freedom of action (Fichte, 1796). Limits of freedom are determined through limits of private property (Braun, 1991). Fichte's work was especially influential in the area of copyrights. He grounded the "*perpetual ownership of the text by its author*" (Fichte, 1793a, p. 445) on the argument that an author's work was simply inalienable from its owner:

> "*We are the rightful owners of a thing the appropriation of which by another is physically impossible. This is a proposition that is immediately self-evident and needs no further proof. And now to the question: Is there anything of this sort in a book?*" (Fichte, 1793a, p. 446)

Whereas other contemporary thinkers derived the right of intellectual property from tangible property legislation with the argument that fruits from "*mental labour*" are concerned, or "*sweat of the brain*" (Biagioli, 2011), Fichte did not use a derivation from tangible property to come to his conclusion. In fact, his logic is independent of tangibility or the way of production; property rights are not rooted in the content of the work, but in personal expression. Written work includes traces of the creativity of its author and creativity is inseparable from the genius of the author. According to Fichte (1793a), the authorship of a book involves three aspects of ownership:

> 1. The physical aspect, i.e. the printed paper. The ownership passed through purchase; the buyer of a book is its exclusive owner.
>
> 2. The ideational aspect of material, i.e. the content, the ideas. The ownership of ideas can be appropriated through reading, reflecting and studying; ideas

become a common property, shared by "*anyone who has enough brains and diligence to appropriate it*" (Fichte, 1793a, p. 449). The author gives up his exclusive ownership through publication.

3. The ideational aspect of form, i.e. the form or expression of an idea. Others cannot appropriate this, each person has a specific way to express ideas, inseparably linked to the personality of an author, to his genius, and thus it "*remains forever his exclusive property*" (Fichte, 1793a, p. 451).

In his work "*Elements of the philosophy of right*" Hegel (2012 [1821]) described property as an end in itself and as an expression of the external spheres of freedom, whereas the legitimate power of disposal defines the difference between possession and property. Nonetheless, he foresaw that property could be subordinated to the state. Originally something became property through taking possession, either by direct physical seizure, formation, or pure designation, whereas formation through labour was the most appropriate way of taking possession. In a developed society, these original ways of establishing property are increasingly replaced by acquisition of property through legal contracts (Hegel, 2012 [1821]).

Hegel (2012 [1821]) mentioned intellectual property explicitly. In his opinion, intellectual work is initially part of the inner personality and it becomes property when it is transferred to the external world. Hence, the transfer to the external and the designation as one's own is decisive, not the involved labour (Hegel, 2012 [1821]). Copyrights could be partly liberated in order to foster a work's usage and benefit, but still they remain its creator's property; copyrights should therefore promote intellectual work:

"*The primary and most important claim of trade and commerce is to give them surety against highway robbery. In the same way the primary though merely negative demand of the sciences and arts is to insure the workers in these fields against larceny, and give their property protection*." (Hegel, 2012 [1821], p. 21)

The 19th Century

The 19th century saw enormous economic and social cataclysms, following the first industrial revolution (roughly between 1760 and 1840). As a consequence, philosophy concerning property gained much more political importance and was dominated by political philosophers such as Proudhon, Marx and Engels. The avowed anarchist, Proudhon (1994 [1840]) asked in his treatise, *"What is property?"* and answered, *"property is theft"*. He argued that the concepts of property through occupation as well as property through labour were based on equality. As property leads to inequality, property is impossible, because it is a negation of equality. He questioned, in particular, whether it is possible to profit by property without one's own efforts, because adding value can only be achieved through labour. Profits not founded on labour represent exploitation of man by man (Proudhon, Kelley, & Smith, 1994 [1840]).

Marx and Engels (1967 [1848]) saw communism as a project for the *"abolition of private property"*. However, their criticism of property was targeted at property as a means of production, not at private property:

> *"Private property, as the antithesis to social, collective property, exists only where the means of labour and the external conditions of labour belong to private individuals. But according as these private individuals are labourers or not labourers, private property has a different character."* (Marx & Engels, 2013 [1867], p. 535)

Furthermore, Marx and Engels (2013 [1867]) argued against the conjunction of the terms freedom and property. The traditional notion of freedom, as represented by Locke and Adam Smith, referred to freedom of the property-owning bourgeoisie, not to freedom of the ordinary citizen. This egoistic freedom is geared to capitalist interests. Real freedom is participation in the commonwealth, where no property in means of production exists anymore (Marx & Engels, 2013 [1867], p. 535).

Other Cultural Regions

Looking into cultural regions outside the West, there was no comparable development of the notion of intellectual property, let alone a law system for its protection. Other regions of the world experienced great technological, scientific and economic progress in the 14th to 18th centuries, when the foundations of today's patent regimes were laid. The Islamic world flourished in Spain (Emirate of Granada), in the Caliphate of Cairo, the Mughal Empire in India and the Ottoman Empire (Ponting, 2001). The Hindu empire of Vijayanagara prospered on the Indian subcontinent, imperial China lived a golden age during the Ming dynasty and Japan experienced remarkable progress during the Azuchi–Momoyama era (Henshall, 2012; Iriye, Osterhammel, & Reinhard, 2014). The list of successful realms during this period is not exhaustive; it just mentions those with the supposedly best conditions for a similar development of intellectual property protection to Europe. However, such similar development did not occur. The reasons are manifold, but can be mainly traced back to different cultural settings.

Islamic Cultural Background

Islam determines virtually every aspect of daily life; it provides a very detailed ruling not only for religious but also for practical issues. Islam does not treat intellectual property explicitly, but rules property to be inviolable, because all property ultimately belongs to Allah and the current possessor is just his trustee (Vaughan, 1995). Already in the pre-Islamic era, as well as later in Muslim-Arab societies, literary works were highly respected and poets were remunerated by the ruler on publication (Malkawi, 2013). Literary and artisan works were not protected, but rewarded. For example, in Persia artists were rewarded for particularly artistic carpets by the honour of producing this product exclusively for the sovereign (Kurz, 2000). Islam demands wealth sharing ("*zakat*"), which includes the concept of knowledge sharing for the good of all (Vaughan, 1995).

Buddhist and Confucian Cultural Background

Buddhist and Confucian teachings, as well as the interwoven streams of Taoism and Zen, dominated religious life and philosophical thinking during past centuries in a large part of Asia. It also determined the notion of property and intellectual property in countries such as China, Korea and Japan (Vaughan, 1995). In China, Confucian philosophy considers imitation as a flattery. A pupil learns from a teacher by imitating, therefore knowledge is spread and the primary reward for the teacher is honour (Gisclair, 2008). This can explain why stealing a book was considered an elegant offence (Alford, 1995). In fact, there were certain restrictions on the unauthorized copying of books, but no IP protection existed before the Western coined notion of IP was introduced to China (Alford, 1993). Reproduction of scientific knowledge was forbidden in some areas, because it was considered a state secret and the motivation was not to protect the inventor's rights (Vaughan, 1995). The concept of intellectual property as well as tangible property was different in Confucian China, e.g. land was jointly owned by the family, not by individuals (Vaughan, 1995). In Korea as well, inventions were not seen as private property, but as a kind of collective property; the inventor was rewarded through esteem and honour (Vaughan, 1995). Early Japanese law derived from Chinese law and is also based on Confucianism, whereas Zen Buddhism built its cultural basis in Japan. In the very collectivist Japanese society, ideas should be a common good. Individuals have duties and responsibilities towards state and society. The notion that an individual could own an idea, that was also protected by a law, conflicts with Confucian principles (Vaughan, 1995). However, Japan was one of the earliest followers of Western thought among its Asian peers, the first monopolies for inventions were granted in 1871 and the first patent law dates from 1885 (Harris, 2002).

Hindu Cultural Background

The Hindu tradition in India considers education and knowledge as precious goods. Teaching knowledge was considered the most valuable form of charity. Nobody could own knowledge, it could only be given from teacher to student; later on the student

would become teacher and pass the knowledge down to his students and so forth (Ganapathi & Pulla, 2015).

In conclusion, it can be said that in the 14th to 18th centuries other advanced civilizations, including Arab countries, India, China and Japan, developed quite a different notion of property, particularly intellectual property, to Europe and North America. Consequently, they did not establish legal systems that would protect intellectual property.

Impact on today's IPRs

The philosophical debate about the concept of (intellectual) property, mainly between the 17th century and the middle of the 19th century, resulted in a solid anchoring in Western thinking and culture and led finally to the Paris Convention for the protection of industrial property in 1883 (Granstrand, 1999). One exemplary point proving the decisive influence of Western philosophy on today's IPRs can be found in Fichte's work (see above). He is considered the founder of the "*idea-expression dichotomy*" reflected in current IP legislation (Biagioli, 2011). The idea-expression dichotomy distinguishes between the idea itself and the expression of that idea. This differentiation is crucial in the debate about software patents, or more precisely "Computer-Implemented Inventions" (CII), e.g. the European Union takes the view that the idea for a certain software program is not patentable or protectable, but the software code is protected by copyright. This view is codified in the European Union Software Directive, Article 1.2:

> "*Protection in accordance with this Directive shall apply to the expression in any form of a computer program. Ideas and principles which underlie any element of a computer program, including those which underlie its interfaces, are not protected by copyright under this Directive*." (EU, 2009)

Although the directive appears to rule out software patents in principle, in practice patents can be granted for computer-implemented inventions by the European Patent Office (EPO) if technical problems are solved "*in a novel and non-obvious*

manner" (EPO, 2013). The U.S. Patent and Trademark Office (USPTO) used to take a less restrictive view towards CII (Knights, 2015), albeit limited by a ruling of the U.S. Supreme Court that decided in the case Mazer v. Stein, 347 U.S. 201 (1954):

> "*Unlike a patent, a copyright gives no exclusive right to the art disclosed; protection is given only to the expression of the idea -- not the idea itself*" (USA, 1954)

This decision was recently re-confirmed in the case Alice Corp. v. CLS Bank Int'l 573 U.S. (USA, 2014), which led to an invalidation rate of over 66% of challenged patents in court decisions citing the case within the two years after the U.S. Supreme Court decision (Tran, 2016) and brought the USPTO position closer to the EPO policy concerning CII (Knights, 2015). The philosophical foundation for the U.S. Supreme Court ruling, that distinguishes between idea and expression of an idea, was laid more than two centuries ago, e.g. by Fichte (1793a) and it is far from evident whether other cultural areas would follow the same reasoning.

Conclusion

An extensive philosophical and socio-cultural process is needed to differentiate between idea and invention originated in Ancient Greece (Granstrand, 1999), between possession and property developed in Ancient Rome (Görres-Gesellschaft, 1995), or between the idea and its expression (Fichte, 1793a); not to mention the process of the establishment of an abstract concept such as intellectual property (Hegel, 2012 [1821]). The history of IPR is closely intertwined with the history of the underlying philosophy. This section shows that even basic principles, such as the notion of intellectual property, differ significantly between cultural areas. The concept of knowledge sharing in Islam (Vaughan, 1995), the notion that ideas should be collective property in Buddhism and Confucianism (Vaughan, 1995), as well as the teaching in Hindu tradition that nobody can own knowledge (Ganapathi & Pulla, 2015) are contrary to the more individualist coined Western cultures that are willing to protect an individual's rights against societal aspiration.

The conclusion that philosophical fundaments of the concept of intellectual property are embedded in different cultural traditions leads to the argument that cultural aspects may indeed have a strong influence on the notion of patents. This is also reflected in the history of the patent system as presented in the next section.

2.3 History of Patents

The World Intellectual Property Organization (WIPO) differentiates between fields of intellectual property protections: patents, copyrights, trademarks, industrial designs, plant varieties and geographical indications (WIPO, 2004, 2016a). Although patents are only one specific type of IPR, they are the most relevant for this research work and therefore the following sections mostly refer to patents whenever intellectual property is mentioned.

Today's patent system developed over a course of centuries in Europe and later in North America and is rooted in Western thinking and culture. Precursors of modern patents were known to some extent in Ancient Greece and Rome. Around 500 BC, the Greek city of Sybaris (today southern Italy) is believed to have granted exclusive rights for inventors of new culinary receipts (Kurz, 2000). These are the first known traces of privileges that featured two important characteristics of patents: personal authorship of an invention and an exclusive right to use limited in time. Similar patent-like privileges were not handed down from Roman times, but it seems that exclusive rights for literary works and granted monopolies for a wide range of products were very common. Roman authors had the right to decide about the manner and time of the publication of their works but after publication they had no further exclusive rights on their works. However, the first use of the term "*plagiarism*" (from "*plagium*" in Latin, originally meaning "abduction") for theft of a literary work is known from the Roman poet Martial (Kurz, 2000). The grant of concessions and other (normally paid for) monopolies seems to have reached such an extent, that the Roman Emperor Zeno wrote an edict in 483 AD that prohibited monopolies (Granstrand, 1999).

Although there were early precursors of intellectual property rights in Ancient Greece and Rome it took centuries until these exclusive rights developed into modern patents.

During the Middle Ages, the rule of law and enforcement of judgements were mostly limited to a city, duchy or small kingdom so that exclusive rights on the use of inventions were probably less appealing than just keeping inventions secret. The term "patent" is derived from the Latin "*litterae patentes*", which means "*open letters*" (in contrast to sealed letters) and was used in the Middle Ages for decrees and edicts. These official enactments of the ruler were called "*letter patente*" in France and "*letters patent*" in England. Such documents were used in England since the 13th century for many purposes, e.g. for the appointment of an officer or to grant a concession (Burr, Stephan, Soppe, & Weisheit, 2007). In the 14th century, grants per "letters patent" were used to help introduce technology from continental Europe to England. For example, a Flemish weaver had such a protective letter in 1331 when he emigrated to England, two Brabant weavers received a grant in 1336 and three Delft clock-makers were persuaded to come to England in 1368 (David, 1994). Although a "patent" by name, these documents were actually security guarantees granted by the ruler and were not directly related to any invention. They were not meant to protect an invention against emulation, but to promote progress in craftsmanship through the emigration of skilled artisans. The primary objective of such "patents of importation" was to obtain jealously guarded production secrets from cities or countries that used to be known only by guild members. A liveryman who left his guild for another country was sometimes threatened with the death penalty in his home country, which implied a huge risk and therefore required an adequate incentive to convince him, e.g. a "patent" from the ruler of the destination country. For the recruiting country this arrangement implied no risk, as the profits from a related grant were only realized in the case of the successful introduction of the technology (Kurz, 2000).

The first patents that deserve this name in a modern sense were granted in the 15th century. Some Italian city-states started to grant privileges to inventors for the

exclusive right to use their invention. Two examples of early patents as protection for an innovation with a specific duration are documented from Venice and Florence. In 1416 Franciscus Petri was granted one of the first such monopolies from the city of Venice for his invention of a "structure of pestles for fulling fabrics" (Long, 1991) and in 1421 the city of Florence granted a patent to Filippo Brunelleschi, for his invention of a special transport ship (Burr et al., 2007). Half a century later, in 1474, Venice passed a first law that regulated the award and content of exclusive rights to use for inventors and is thus considered the world's first patent law (Long, 1991). Under this first patent law inventors were granted monopolies for the usage of their invention for 20 years. It is noteworthy that this first patent law should explicitly stipulate inventions (and discoveries) for the benefit of society:

> "*We have among us men of great genius, apt to invent and discover ingenious devices (...) Now, if provisions were made for the works and devices discovered by such persons, so that others who may see them could not build them and take the inventor's honour away, more men would then apply their genius, would discover, and would build devices of great utility to our commonwealth.*"
> (Granstrand, 1999, p. 32)

Although most of the early patents were granted in Italy, there are also known examples in other European countries around the same time, e.g. in the Netherlands (to Jehan van Coten for his mechanism to pump water, 1560), in France (to Abel Foulon for his invention of a type of rangefinder, 1551), in Germany (to Sigismund von Maltitz for his improved stamp mill, 1512, Electorate of Saxony) and in England (to Burkhart Cranick for his inventions in water art, 1563), however, these countries did not dispose of explicit patent laws at that time (Kurz, 2000).

England passed its first patent law ("*Statute of Monopolies*") in 1624. The main objective of this law was not the regulation of patent protection but as a measure to limit the excessive practice of awarding monopolies, which had become so commonplace that it provoked a protest movement in parliament. Granting privileges was a convenient way for the Crown to award loyalty and very often services were

paid with privileges instead of money (Mossoff, 2001). A flood of monopolies provoked the first English patent law, which annulled most existing monopolies. The "Statute of Monopolies" also reflects a political fight between parliament and the Crown: the former prohibited the latter to grant privileges. Remarkably, the exception in this context is that patents on inventions were explicitly excluded from this annulation:

> *"… shall not extend to any letters patents and graunts of privilege for the tearme of fowerteen yeares or under, hereafter to be made of the sole workinge or makinge of any manner of new manufactures within this Realme, to the true and first inventor…*" (Kurz, 2000, p. 171)

At this time, the exclusive right to use over 14 years was twice the length of the duration of an apprenticeship (Granstrand, 1999). The timely duration of earlier patents for inventions and also for the introduction of technologies had commonly been a multiple of the duration of an apprenticeship, either 7, 14 or, in the 16th century, 21 years. This should allow the instruction of 1 to 3 generations of apprentices to carry on the new craftsmanship or technology (Kurz, 2000). This is close to the 20 years of patent protection of Venetian law from 1474, which is in line with the 20 years protection period of modern patent laws. These two first patent laws (Venice and England) already contained some of the most important characteristics of modern patent laws: they provided protection for a period of time and an exclusive right to use and they were related to novel techniques (inventions, although also including discoveries). In some respects, one main objective of these early patent laws was to foster innovation, although the term "invent" had a slightly different connotation at that time. Firstly, it included not just the idea, but also the bringing into production and secondly, an invention needed to be something new in the concerned territory. It did not matter whether the same technique was already in use elsewhere. In a sense, innovation also meant technology transfer (David, 1994).

The first patent act came into force in the USA in 1790 (Burr et al., 2007), only shortly after independence from Great Britain. Previously, the English (or British after the Acts of Union 1707) colonies in North America followed the English/British practice

regarding “patents”, i.e. the granting of privileges and monopolies. The first registered patent in the colonies that referred to an own invention seems to be the one granted by the court of Massachusetts to Joseph Jenks for his lumber mill in 1646. Interestingly, Jenks refers explicitly to the “Statute of Monopolies” in his patent application (Kurz, 2000). At this time, one of the features of modern patent laws came into common usage, that of a useful description of the related invention and its publication. In fact, this can be seen as a mutually beneficial agreement between inventor and society: the inventor makes his invention publicly available to stimulate progress and innovation and society grants him exclusive rights of use for a determined duration of time. One early example is that of Henry Guest, who obtained a patent from Pennsylvania in 1780 for his invention in the area of making (whale) oil and blubber, where it was ruled that he had to publish the description of his invention in all his production facilities (Kurz, 2000). The U.S. American independence resulted in demands for their own legislations. Although patents and copyrights were probably not among the most urgent questions it can be considered an important milestone in the history of patents that the constitution of the USA that came into force in 1789, contained an explicit clause related to copyrights and patents (albeit not mentioned by name):

> “*The Congress shall have Power (…) to promote the Progress of Science and useful Arts, by securing for limited Times to Authors and Inventors the exclusive Right to their respective Writings and Discoveries;*” (USA, 2016, Article 1, Section 8)

The first patent law that the USA enacted in 1790 partly followed the English example, e.g. protection for 14 years, but also included some new features that freed it from protectionist elements and made it the most modern patent law of its time: the novelty of the invention was not limited to the USA, so that pure “patents of importation” were excluded and the patent did not comprise any obligation to be put into production, or to be implemented (Kurz, 2000).

In Europe, the next country that enacted a patent law was France. It came into force only two years after the French Revolution in 1791 (David, 1994). French patent law

presents a particular feature in so far as it was based on the patent rights of an inventor or author on the "natural rights" view:

> "*Any discovery or new invention, in all kinds of industry, shall be the property of its author; consequently, the law shall guarantee to him the full and complete enjoyment thereof, in accordance with the conditions and for the time to be determined hereafter.*" (Griset, Laborie, Bouvier, & Wassenberg, 2013, p. 23)

The author of the legislative proposal (which passed unchanged at the first reading in the French National Assembly) was Marquis Stanislas de Boufflers. He argued that invention was the source of all property, and hence can be seen as original property, while all other property was just based on conventions (Kurz, 2000). This viewpoint was widespread at the time in progressive and revolutionary circles. Boufflers justified the necessity of protection for inventions with Rousseau's "Social Contract", published in 1763, where he describes a mutual commitment between individual and society. The state grants the inventor exclusive rights and in return the inventor offers the first products to the state (Kurz, 2000).

Although granting patents was already widespread, albeit not a very frequent practice in 18th century Europe, it took until the first half of the 19th century for a number of further patent laws to come into force (Griset et al., 2013): 1812 in Russia, 1815 in Prussia, 1817 in the Netherlands (including Belgium), 1820 in Spain and 1825 in Bavaria, just to list the earliest in a series of patent laws across Europe.

Another important milestone in the development of the modern patent system was the "*Paris Convention for the protection of industrial property*" in 1883. In the 19th century patent protection was already considered as an effective means to protect national economic interests, e.g. against cheap imitations from other countries. However, differing rules per country were obstructive to growing international trade and necessitated international cooperation concerning IPR (Granstrand, 1999). The *Paris Convention* was the first international intellectual property treaty, based on the aim to harmonize national patent laws. It defined some basic common rules; it

provided the same rights for nationals of all member countries regarding patent protection and it established a so-called "priority right" that allowed an applicant to use the first filing date in one country for all other member countries (Griset et al., 2013).

In the same spirit, other international patent related treaties followed: The Hague agreement on the establishment of the "*International Patent Institute*" in 1947, the "*Strasbourg Convention*" ("*Convention on the Unification of Certain Points of Substantive Law on Patents for Invention*") in 1963, the convention that established the "*World Intellectual Property Organization*" (WIPO) in 1967 and the "*Patent Cooperation Treaty*" (PCT) in 1970 (Granstrand, 1999). Further international harmonization was pursued with the "*Patent Law Treaty*" (PLT) that entered into force in 2000 (WIPO, 2006) and with the proposed "*Substantive Patent Law Treaty*" (SPLT) that was put on hold in 2006 (Reichman & Dreyfuss, 2007; WIPO, 2016b).

The World's current patent regimes evolved in parallel with political and economic changes and are inextricably linked to historical development in Europe and, subsequently, in North America. This long process was not straightforward; it experienced ups and downs, headwinds and setbacks. Driven by a multitude of interests, the development of modern patent systems was always embedded in historical circumstances; it cannot be appraised without considering the historical and cultural context and without taking into account the close link to the prevailing philosophical currents of the time.

2.4 Summary

The second chapter explained the growing importance of intellectual property rights in international business, which is reflected in rising quantities of patent filings worldwide and an increasing number of legal disputes related to patent infringements. Some of these juridical confrontations involve industry heavy weights and huge amounts of money. They are fought hard and are covered extensively by

international media and have been referred to as “patent wars”. Patent litigations are one reason why companies are increasingly aware of the value of patents, but how can the exact value be assessed?

The history of the philosophy of intellectual property and patents is the second important aspect of the contextual background. The philosophical foundations of intellectual property are presented. These are relevant because this work argues that Western philosophy shaped the current patent system and deduces that Western culture played an influencing role in its development. Also, a short overview of the development of the current patent system in the course of history is presented, from the first precursors of patents in Ancient Greece to “letters patent” in Medieval England and the first international patent conventions in the 19th century. The fact that Western-thinking shapes the history of patents suggests that culture may influence societies’ position towards patents.

Combining these parts raises the question of whether culture may not only influence people’s opinion about patents, but also supposedly subjective economic patent valuation. This is the rationale for the following systematic literature review.

CHAPTER 3: LITERATURE REVIEW

3.0 Introduction

Various approaches to a literature review are described in academic literature and a variety of terms are used. A short digression about literature reviews should therefore clarify the most commonly used terms. Onwuegbuzie & Frels (2016) divide "systematic literature review" into four types: meta-analysis, rapid review, meta-summary and meta-synthesis. They contrast those with the four types of "narrative literature review": general review, theoretical review, methodological review and historical review. The main difference between the "systematic" and the "narrative" approach is that the former is a critical assessment of the body of existing literature about a determined topic, whereas the latter is more like a summary of existing knowledge. The same authors also describe an "integrative review" that combines elements of the "systematic" and the "narrative" approach. Jesson, Matheson & Lacey (2011) compare the "traditional review", which they also call "narrative", with the "systematic review", with "traditional" standing for a written appraisal of existing knowledge in the concerned area, without a specific predetermined proceeding. In contrast, "systematic" means a structured approach, including a synthesis and a meta-analysis. It builds new knowledge by combining the available information related to a specific topic. A "systematic literature review" can therefore be considered a research method in its own right. This is also expressed by Petticrew & Roberts:

> "*Systematic literature reviews are a method of making sense of large bodies of information…*" (2006, p. 2)

The term "systematic" might be quite misleading because the fact that this type of research work is performed in a systematic way is not the particularity. One would expect this to be an essential characteristic for any research work, or in the words of Fink:

> "*A research literature review is a systematic, explicit, comprehensive and reproducible method for identifying, evaluating and interpreting the existing body of original work produced by researchers and scholars*." (2013, p. 36)

The differentiator of the "systematic literature review" is the more comprehensive and analytic approach, which qualifies it to be considered as a stand-alone method that can be applied in a variety of studies (Booth, Sutton, & Papaioannou, 2016). Indeed, it is a powerful method in areas where, for example, a large number of studies are available that investigate dedicated aspects of a certain topic and where a synthesis of the collected data may lead to additional valuable results. It enables the researcher to see another picture by rearranging existing 'mosaic' pieces.

A narrative or traditional literature review should not just be descriptive, but follow a critical approach (Jesson, Matheson, & Lacey, 2011). The emphasis is on "critical", which means an intellectual examination of the existing knowledge in the relevant academic field. The aim of a "critical narrative literature review" is to reconstruct and interpret the combined knowledge of the relevant literature (Ryan, Scapens, & Theobald, 2002). The most important studies are identified and analyzed, which form the basis of a research area. Also, different opinions and perspectives, as well as existing gaps in the research area are discussed. A critical analysis of the literature implies a certain preference for the choice of methods, because the analysis is influenced by the researcher's philosophical position. Thus, it provides a rational connection between research methodology and methods (Ryan et al., 2002).

Criticism can be divided into "internal" and "external" criticism, analogue to internal and external historical explanation in the sense of Lakatos' "methodology of scientific research programmes" (Lakatos, Worrall, & Currie, 1980). According to Lakatos' theory, every philosophy of science theory represents a normative methodology on the basis of which the history of science is rationally reconstructed (Sommer, Müller-Wille, & Reinhardt, 2017). To the extent that the history of a scientific discipline can be reconstructed with the help of a normative methodology and can thus be rationally explained objectively, it is an "internal history". Since the history of a subject can be explained in this way only partly, according to Lakatos, any rational

reconstruction needs to be supplemented by an empirical or socio-psychological "external history" (Lakatos, 1970; Schneider, 1991). Consequently, a critical review of the relevant literature can apply internal and external criticism (Ryan et al., 2002), whereas internal criticism refers to issues within the chosen methodological framework (e.g. a critical review of how cross-cultural scholars like Hofstede conducted their research) and external criticism concerns issues outside the scope of the chosen methodology (e.g. whether the mentioned cross-cultural scholars started from the right assumptions).

Criticism is not objective, but subject to the researcher's subjectivity, thus it is essential that the philosophical position of the critic is made explicit. The process of critical evaluation of a research literature should start with a self-evaluation of methodological preconceptions and the philosophical position of the researcher (Ryan et al., 2002).

The rational reconstruction of the knowledge of the relevant literature includes then internal and external criticism, i.e. within and outside the methodological framework. A critical literature review in this sense consists of two main elements, the identification of relevant academic works and the critical analysis of those works.

Finding all or at least the most important of the relevant studies requires an efficient search in the available body of knowledge. Such an efficient search usually is a step-by-step approach, starting with the identification of key terms (Creswell, 2012) and the locating of one or more principal or anchor works. Then the search spreads from there through references to other less prominent works. The search path can be symbolized by a tree, where the search starts from a strong branch and then extends in all directions until all main parts of the tree are covered. Alternatively, or in addition, digital technologies allow systematic database searches.

The structure of this Literature Review

The literature review forming part of this work consists of three parts that, in the sense of the description above, all belong to the traditional or narrative sort of literature review.

The **first part** (section **3.1.1**) was a time limited, but intense and systematic search in the main online resources. Its aim was to identify the potential knowledge gap. A systematic database search is judged the most appropriate to prove whether a knowledge gap exists in the area of investigation. This part of the literature review was actually performed twice: first when the investigations started (April 2013) and second when the work had progressed to a point that the preparation of the thesis started (January 2016). This second review updated the findings, because there were almost 3 years in between. It checked whether any relevant work had been published in the meantime that would be worth mentioning and whether the identified knowledge gap had been closed. Such a case would have required a redirection of this research work. Appropriate databases were searched systematically in this phase; the details are described in section **3.1.1**.

The identification of a knowledge gap led to the exploration of related areas of academic literature. This investigation is based on the conjecture that cultural aspects may influence patent valuation. Hence, “culture” and “patent valuation” are two academic areas that are directly related to this research and require a dedicated review of the relevant literature. The literature reviews in the areas of culture and patent valuation follow more a traditional approach, whereas database searches are included as auxiliary means. Apart from the identification of relevant works, a main focus is here on a critical analysis of the identified literature in the sense of a critical narrative literature review described above. The critical appraisal starts from a constructivist position of the researcher (see also **Chapter 4**) and progresses with advances in building and defining the research topic.

The **second part** (section **3.2**) of the literature review concerns culture and the question how to capture cultural influence. This part presents the concept(s) of

culture (section **3.2.1**) and the cross-cultural studies (section **3.2.2**) that are most relevant to this work. Furthermore, the concept of "cultural dimensions" (section **3.2.3**) is introduced as a means to access and compare determined aspects of culture.

The **third part** (section **3.3**) of the literature review explores and analyzes patent valuation. It clarifies the terms "ethical value" and "economic value" in the context of this work and it discusses ethical and economic valuation of patents (sections **3.3.1** and **3.3.2**). Furthermore, the latter section presents different methods of economic valuation of patents.

The critical appraisal of the body of knowledge in these areas built the basis for the final formulation of the aim of this research and the research questions and objectives (section **3.4**). It also led to the creation of a conceptual model of the relationship between cultural and other factors and patent valuation that represents the current understanding of the topic under investigation (section **3.5**).

3.1 Literature Review: Gap Analysis

The analysis of the potential knowledge gap started with the identification of the most appropriate and useful resources for the work. The following section **3.1.1** describes the systematic database search that confirmed the existence of a knowledge gap concerning cultural influence on patent valuation (section **3.1.2**).

3.1.1 Systematic Database Search

The subjects of valuing patents, cultural background of IPR systems and cultural dimensions are very broad, with vast bases of literature. This part of the literature review consists of a systematic database search concerning academic work about cultural influence on patent valuation. Although the course of action is very systematic, the approach is quite a traditional narrative literature review in the following **7 steps**:

1. Identification of resources – potentially relevant and accessible databases were tested for their relevance and the most suitable databases were selected
2. Identification of search terms – the most efficient key words were identified through multiple simulation runs and comparisons of the search results
3. Identification of potentially relevant literature – searches were performed systematically in the selected databases; search results were stored
4. Selection of relevant literature – the search results were scanned through, mostly by reading the abstract, and relevant articles and books were selected
5. Assess quality of selected literature – the quality of the article or book was appraised and evaluated; step 4 and 5 together led to a list of articles and books for further review

6. Review content of selected literature – the relevant part of the selected articles and books were carefully read and the respective significance for the present work was briefly subsumed

7. Summarize findings – the findings from the selected body of academic literature were analyzed and discussed

As described above, a systematic database search was conducted in a step-by-step approach in order to scan all relevant, reliable and available data, concerning the guiding question of whether culture influences the valuation of patents. The search was repeated in a second cycle in order to update the findings of the first cycle that were conducted almost three years before and to incorporate the findings obtained in the meanwhile. Preparative enquiries in a large number of available databases (refer to **step 1**) led to the decision to conduct the systematic search in the following resources:

- ABI/INFORM
- Bavarian State Library
- Business Source Complete
- Discovery Service
- EBSCO eBook
- EThOS
- Google Scholar
- Lexis Library
- Library Catalogue
- MyiLibrary
- Open Access Theses and Dissertations
- PsycINFO
- Science Direct
- Web of Science (ISI)

The exact search terms that were used for the systematic search in the online databases mentioned above were identified through a series of pre-investigations (refer to **step 2**). The aim was to determine how specific these terms could be at a maximum to provide a useful quantity of results with a satisfying quality. Most modern online databases provide powerful search engines that employ Boolean logic, i.e. multiple search terms can be inserted in search forms that are logically combined

with Boolean algebra operations (AND, OR, NOT). Some initial investigations led to the conclusion that the search terms “interculture”/“intercultural” and “cross-culture”/“cross-cultural” focussed too specifically on intercultural or cross-cultural studies, whereas some other studies that compared different cultures were not detected. Therefore, the search term “culture”/“cultural” was combined together with “patent” and “intellectual property” in the systematic database search. A broader search, such as for “intellectual property”, “patent” or just for “culture”, delivered too many and too unspecific results, whereas a narrower search, such as for “patent value” in combination with “cultural dimensions” did not deliver any useful results.

Each online database listed above was searched with the appropriate search terms, which were varied dependent on the available search filters (refer to **step 3**). The search results were stored and then inspected individually. In total, the systematic search in all chosen online databases provided approximately 10,000 results.

After the search in the databases the results were further filtered concerning their relevance for this work (refer to **step 4**). In many cases a quick look at the title of the article or book revealed whether it was relevant to this work or not, in all other cases the abstract was read to judge the article’s or book’s relevance. In this way, the number of search results was filtered down to 128 relevant results. All search terms, search fields, original search results and relevant results (column “selection”) were recorded in **Table 1**:

source	search terms	search fields	results	date	selection
ABI/INFORM	cultur* AND (patent OR intellectual property)	- anywhere except full text - peer reviewed	545	13-01-16	25
Bavarian State Library	cultur* AND (patent OR "intellectual property")	1.) title (2000 – 2016) 2.) subject (2000 – 2016)	1.) 1400* 2.) 3070*	15-01-16	2
Business Source Complete	cultur* AND (patent OR intellectual property)	1.) title 2.) subject terms 3.) abstract 4.) author-supplied keywords	1.) 15 2.) 166 3.) 525 4.) 51	14-01-16	26
Discovery Service	cultur* AND (patent OR intellectual property)	1.) title 2.) subject terms	1.) 1192* 2.) 1672*	14-01-16	23
EBSCO eBooks	cultur* AND (patent OR intellectual property)	1.) subject 2.) category 3.) title	1.) 3 2.) 1 3.) 1	13-01-16	2
EThOS	cultur* AND (patent OR intellectual property)	- no specific selection	2	13-01-16	0
Google Scholar	a.) culture AND "intellectual property" b.) cultural AND "intellectual property" c.) culture AND patent d.) cultural AND patent	- in the title of the article - no patents - only English - articles dated 2000 - 2016	a.) 170 b.) 343 c.) 29 d.) 19	16-01-16	24
Lexis Library	cultur! AND patent OR "intellectual property"	All Subscribed Journal Sources - article title	7	15-01-16	2
Library Catalogue	cultur! AND (patent OR intellectual property)	- all fields	8	14-01-16	0
MyiLibrary	a.) intellectual property b.) patent	- full text search with exact phrase - refine with keywords: culture	a.) 19 b.) 62	15-01-16	0
Open Access Theses and Dissertations	cultur* AND (patent OR intellectual property)	- all fields	31	15-01-16	1
PsycINFO	a.) cultur* AND patent b.) cultur* AND intellectual property	1.) title 2.) subjects 3.) abstract	1a.) 2 1b.) 7 2a.) 6 2b.) 26 3a.) 57 3b.) 159	13-01-16	12
Science Direct	cultur* AND (patent OR intellectual property)	- abstract, title, keywords	160	15-01-16	4
Web of Science (ISI)	TI=(cultur* AND (patent OR intellectual property))	- title	273	15-01-16	7

* only 200 most relevant checked

Table 1: Online databases search results

These 128 relevant search results were then organized to exclude double or multiple 'hits'. It turned out that only 85 were unambiguous, as many of the articles and books were found in multiple online databases.

In the next step, results were excluded in case of quality concerns (refer to **step 5**). For example, if an article was published some years ago and was never cited in other

academic work, if the article was just a book review or the article was simply out-dated. The search itself applied quality criteria whenever the related online database provided appropriate options (e. g. the search in ABI/INFORM was restricted to “peer reviewed” articles).

The content of the selected literature was reviewed individually (refer to **step 6**). Going through the 85 selected results, further exclusion criteria were applied. A number of articles were excluded that seemed to be relevant, but were actually judged irrelevant after a more thorough read. A considerable number of search results were related to IP piracy (software, music, motion pictures) and counterfeiting. These phenomena have a major economic impact, whereas the affected companies are primarily multinationals of the most developed countries, e.g. Microsoft (USA), Sony Music (Japan), Warner Brothers (USA) and Lacoste (France). The economic interest in reducing IP piracy and counterfeiting is enormous and the related academic studies abundant. However, these objectives differ from those of this work and therefore only those studies related to IP piracy and counterfeiting, that investigate cultural dimensions, were included. Another large group of search results related to the question of how to protect cultural expressions under IPR, for example indigenous or traditional artwork. These search results were also considered irrelevant for this work and excluded from further analysis. Other articles were excluded due to a different focus, for example cultural dimensions concerning:

- intellectual capital
- innovation and innovativeness
- notion of authenticity
- enforcement of IPR regimes
- corporate culture

Applying these additional exclusion criteria decreased the amount of relevant articles and books further to 35.

Last but not least, the content of the selected articles and books was taken as research material for the following analysis and discussion (refer to **step 7**). The extracted 35 articles all investigate cultural impact on the notion of intellectual property. Most compare Western culture to Asian, especially Chinese culture and all conclude that there is indeed a cultural impact that should be taken into

consideration. This is a relatively small number in comparison to the large number of original search results.

In line with the large amount of academic writing on IP piracy in general, a significant amount of the articles identified investigate cultural impact on IP piracy. The main assertion of 15 of those articles is that the level of IP piracy (copyright violations, CD piracy, software piracy, counterfeits) is significantly influenced by underlying cultural values (Boon, 2010; Chavarria & Morrison, 2014; Franses & Lede, 2015; Gopal & Sanders, 1998; Husted, 2000; Marquez, 2004; Marron & Steel, 2000; Moores, 2008; Mun, 2009; Rawlinson & Lupton, 2007; Reardon, Auruskeviciene, Salciuviene, McCorkle, & Skudiene, 2008; Simmons, 2004; Wan et al., 2009; Whalen, 2014; Yang & Sonmez, 2007).

Hofstede's national culture dimensions "Power Distance Index (PDI)", "Individualism (IDV) vs. Collectivism", "Uncertainty Avoidance Index (UAI)", "Masculinity (MAS) vs. Femininity" and "Long Term Orientation (LTO)" (Hofstede, 2001) are used in a number of these works. Husted (2000) and Marron & Steel (2000) conclude that there is a significant correlation between software piracy and the cultural dimension of individualism-collectivism. In his empirical study, Marquez (2004) comes to the conclusion that cultures with high collectivism and femininity levels show the highest rates of software piracy. Simmons (2004) conducted an empirical study on three dimensions - IDV, PDI and LTO - and found that all three are cultural predictors of attitude towards software piracy. A step towards quantifying cultural impact on software piracy was undertaken by Mun (2009) who found that collectivism was the third most important predictor of software piracy after national income and institutional capacity of property rights protection. Yang & Sonmez (2007) conducted an empirical study where the variables that measured culture explained approximately three quarters of the variation in software piracy. Moores (2008) confirmed the relationship between economic wealth, culture (IDV and MAS) and levels of software piracy. He concluded in more detail that levels of software piracy decline with increasing economic wealth and that the rate of decline in software piracy depends on the cultural dimensions PDI and UAI, whereas power distance

reduces the decline in SW piracy and uncertainty avoidance increases the decline. Chavarria & Morrison (2014) do not base their investigation on the cultural dimensions derived from Hofstede, but on those defined and utilized by the GLOBE project (House, Hanges, Javidan, Dorfman, & Gupta, 2004). They found that two cultural dimensions correlate on a statistically significant level with IP piracy: "In-group Collectivism" positively and "Performance Orientation" negatively.

Slightly more of the selected articles are not focussed on IP piracy, but on the impact of culture on the notion of intellectual property (Andrews, 2009; Arewa, 2012; Brey, 2007; Budde-Sung, 2013; Burch, 1995; Fritzsche, 2011; Garmon, 2002; Hann, 2015; Lehman, 2006; L. Li, 2010; Martinsons & Ma, 2009; Ocko, 2013; Pandita, 2012; L. Shi, 2006; W. Shi, 2006; Swinyard, Rinne, & Kau, 1990; Tarr, 1993; Tian, 2009; D. Yang, 2008; F. Yang, Shaw, Garduno, & R. Olson, 2014). All of these works confirm the supposition that cultural dimensions are among those parameters that determine our notion of intellectual property and whether we judge them as fair or unfair. Intellectual property rights are, together with privacy and freedom of information, key values in information ethics, which are judged as culture-relative by Brey (2007). He also notes that, for example, the traditional Chinese value system does not include any intellectual property rights. Lehman (2006) points out, that the European notion of intellectual property, which emerged in the 17th and 18th centuries, is very different to the traditional Chinese view. Ocko (2013) supports this perception in his work. In their opinion, intellectuals had a dedicated role in society that was incompatible with a construct like intellectual property. They argue that it was immoral and undignified to profit from artistic production. Shi (2006), Li (2010) and Swinyard (1990) explain that Confucianism advocates open and broad access to knowledge as common heritage and ignores the concept of private property in spiritual and creative work. Budde-Sung (2013) argues that accusations towards certain countries regarding their weak IP protection do not take into account cultural variables. His work closes the circle of the notion of intellectual property and IP piracy.

The following **Table 2** shows an overview of the identified studies that report a relation between culture and IP piracy or the notion of intellectual property:

Studies that report a relation between culture and …	
…IP piracy	**…the notion of IP**
1. Boon, 2010; 2. Chavarria & Morrison, 2014; 3. Franses & Lede, 2015; 4. Gopal & Sanders, 1998; 5. Husted, 2000; 6. Marquez, 2004; 7. Marron & Steel, 2000; 8. Moores, 2008; 9. Mun, 2009; 10. Rawlinson & Lupton, 2007; 11. Reardon et al., 2008; 12. Simmons, 2004; 13. Wan et al., 2009; 14. Whalen, 2014; 15. Yang & Sonmez, 2007	1. Andrews, 2009; 2. Arewa, 2012; 3. Brey, 2007; 4. Budde-Sung, 2013; 5. Burch, 1995; 6. Fritzsche, 2011; 7. Garmon, 2002; 8. Hann, 2015; 9. Lehman, 2006; 10. L. Li, 2010; 11. Martinsons & Ma, 2009; 12. Ocko, 2013; 13. Pandita, 2012; 14. L. Shi, 2006; 15. W. Shi, 2006; 16. Swinyard, Rinne, & Kau, 1990; 17. Tarr, 1993; 18. Tian, 2009; 19. D. Yang, 2008; 20. F. Yang et al., 2014

Table 2: Overview of identified studies of interest

This literature review revealed a number of works about the influence of culture on the notion of intellectual property in general and on IP piracy in particular. It confirms the supposition that cultural dimensions are among those parameters that determine whether we judge the concept of intellectual property as being ethically justified or not. However, no research work could be found that explicitly addresses the question of whether culture influences patent valuation.

3.1.2 Identified Knowledge Gap

Cultural impact on the valuation of patents appears to be unexplored and is identified as a knowledge gap. The literature review carried out as a systematic database search provided substantial evidence supporting the conjecture that a cultural bias exists concerning our notion of intellectual property rights. Nonetheless, the specific nature

and consequences of this bias and its influence on the value and valuation of patents remains unknown, no academic works seem to focus exactly on that question. It seems worthwhile to further investigate this identified knowledge gap.

Based on the identified knowledge gap, the research question and objectives are defined and formulated in section **3.4**. In order to collect further necessary and helpful information for this step, the literature review will be extended to the related academic fields of culture and patent valuation in the following sections. A "critical narrative literature review" will be applied, as explained in the first section of this chapter.

3.2 Literature Review: Culture

The systematic database search described in the previous section found evidence for the influence of culture on the notion of IPR in general and on IP piracy specifically. This work aims to uncover cultural aspects that influence patent valuation. One desired outcome of this investigation is to discover whether groups representing different societal cultures differ significantly in patent valuation, both in an economic and an ethical sense. As this subject is huge and heterogeneous, it is necessary to limit and specify exactly what is investigated.

The term "culture" is frequently used in everyday life. However, it is also used to denote a broad variety of meaning. It seems advisable to specify what is meant by culture and cultural dimension in relation to this work before progressing further. This section starts with a definition of culture, followed by an overview of important cross-cultural studies and ends with an explanation of cultural dimensions.

First of all, a short explanation of terms regarding "societal culture" and "cross-cultural studies" will help to avoid ambiguity in the further course of this section. Hofstede (1980) uses "national cultures", whereas the GLOBE project (House, Hanges, Javidan, Dorfman, & Gupta, 2004) prefers the term "societal cultures". The term "society" is more flexible because national frontiers sometimes do not match cultural boundaries. This work follows the GLOBE approach and "societal" instead of

"national" culture is used. For example, the GLOBE project found statistically significant cultural differences between the French and the German speaking part of Switzerland (House et al., 2004).

There is a similar division with the utilization of the expressions "intercultural" and "cross-cultural" in academic literature. Although there are some differences in meaning, e.g. "intercultural" suggests interaction between societal cultures, such as intercultural communication and "cross-cultural" is more focussed on comparisons of societal cultures, both terms are very often used synonymously (Fries, 2009). For the sake of clarity, this work follows the GLOBE project (House et al., 2004), which prefers the term "cross-cultural", based on the argument that the objective is more a comparison than an issue of interaction.

3.2.1 What is Culture?

When asked what "culture" means, many people would probably answer that culture is the complement to nature, i.e. all that is made by humans is culture, the rest, untouched by humans, is nature. This simple, dichotomous divide gives a hint of the broad and unspecific understanding and usage of the term. For the present purpose, a much more precise determination is required.

Emerging from the Latin term, *cultura* (to cultivate, to till, to plough), the concept of culture was first used in a non-agricultural sense by Cicero as *cultura animi*, i.e. "cultivation of the soul" (Cicero, 1886 [45 BC]). It then took quite a long time until culture was used in 17th century Europe to describe the refinement of individuals (e.g. through education). Hobbes was one of the first European philosophers to manifest himself in that direction:

> "*…the labour bestowed on the earth is called culture; and the education of children, a culture of their minds.*" (Hobbes, 1996 [1651], p. 31.38)

Roughly one century later, Rousseau argued the following in his discourse, "*On the Origin of Inequality*":

> "*…education not only makes a difference between such as are cultured and such as are not, but even increases the differences which exist among the former, in proportion to their respective degrees of culture.*" (Rousseau, 2005 [1754], p. 58)

In contrast to Hobbes and Rousseau (and the predominant viewpoint in Great Britain and France), Kant differentiated between civilization and culture in his work "*Idea for a Universal History with a Cosmopolitan Purpose*", published in 1784:

> "*We are cultivated to a great extent by the arts and the sciences. And we are civilized to a troublesome degree in all forms of social courteousness and decency. But to consider ourselves to be already fully moralized is quite premature. For the idea of morality is part of culture. But the use of this idea, which leads only to that which resembles morality in the love of honour and outward decency, comprises only mere civilization.*" (Kant & Reiss, 1991 [1784], p. 8.26)

The explicit distinction between culture and civilization can be considered a particularity of German thinking in the 18th century. A number of influential German thinkers (e.g. Herder, von Humboldt) established culture as a term to characterize whole peoples or nations (Velkley, 2002). In the English-speaking world, civilization and culture were used synonymously (and to a lesser extent still are, for instance in Huntington's 1996 book, "*The Clash of Civilizations and the Remaking of World Order*"). This was also the case in the first definition of culture based on scientific knowledge provided by the anthropologist Tyler:

> "*Culture, or civilization (…) is that complex whole which includes knowledge, belief, art, morals, law, custom, and any other capabilities and habits acquired by man as a member of society.*" (Tylor, 1871, p. 1)

Botz-Bornstein (2012) discusses the differences between culture and civilization in detail and concludes that there is no culture without civilization and vice versa.

Nonetheless, in social sciences and cross-cultural research, the term culture is more commonly used than civilization. Responding to a strongly increasing significance and usage in the first half of the 20th century, especially in the social sciences, Kroeber & Kluckhohn (1952) undertook a critical review of the concepts and definitions of culture. They identified more than 160 definitions of culture at the time (Kroeber & Kluckhohn, 1952). It can be assumed that the number has significantly increased since then. Two of these later definitions are exemplarily presented in the following due to the relevance of the authors for this work. The first one is from Hofstede (2001), who defines culture as "*the collective programming of the mind that distinguishes the members of one group or category of people from another*" (Hofstede, 2001, p. 9). The second exemplary definition of culture stems from the GLOBE project:

> "*… shared motives, values, beliefs, identities, and interpretations or meanings of significant events that result from common experiences of members of collectives that are transmitted across generations.*" (House et al., 2004, p. 15)

Both definitions, albeit different in wording and detail, express similar views on culture that are shared by the present work. They are broad enough not only to include societal cultures, but also sub-cultures of any kind: groups that distinguish themselves along regional, ethnic, social, or any other differences. This work investigates the societal level of cultures. The most notable cross-cultural studies (refer to the next section) all investigate societal cultures and it seems wise to discuss this work's results in the light and context of these studies.

3.2.2 Cross-Cultural Studies

Cross-cultural studies have impacted business (science) ever since Hofstede published his highly influential work, "*Culture's Consequences*" (1980). It is the most renowned cross-cultural work (Northouse, 2013), with more than 54,000 citations by June 2010 (Tung & Verbeke, 2010). Nonetheless, his work was questioned by other scholars and criticized for profound methodological flaws. For example, only data from a single

multinational company (IBM) was analyzed and Chinese culture estimations were only derived from Taiwan and Hong Kong, but not from mainland China (Ailon, 2008; Gerhart & Fang, 2005; McSweeney, 2002a, 2002b; Shi & Wang, 2011). Despite the criticisms, it developed into one of the most utilized cultural values frameworks (Kirkman, Lowe, & Gibson, 2006; Rapp, Bernardi, & Bosco, 2010). Hofstede et al. (2010) defined six dimensions[5] of societal culture (see also next section). His approach influenced many other researchers. One of those researchers was House, who founded the "Global Leadership and Organizational Behaviour Effectiveness Research Project" (GLOBE). It was partly based on Hofstede's work, but broadened its research to include nine cultural dimensions (see also next section), each in two variants: societal practices and societal values (Chhokar, Brodbeck, & House, 2007; House et al., 2004). GLOBE developed into a huge international research project focussing on leadership, involving 17,000 managers from 62 countries. GLOBE has some advantages over Hofstede. Its research is theory-driven and based on broad academic work, not only Hofstede's but also the work of Kluckhohn & Strodtbeck (1961) and others (House, Javidan, & Dorfman, 2001).

An alternative cultural values framework was provided by Trompenaars et al. who built a model of culture with seven dimensions in three categories (2012), whereas five dimensions concern how humans deal with each other[6], one concerns how we deal with time[7], and one how we deal with our environment[8].

The "World Values Survey" (WVS) offers a very different approach. The WVS (Inglehart, Basáñez, & Moreno, 1998) is a global research programme about beliefs, values, the motivation of people worldwide and the changes over time. It started in 1981 and is currently undertaking a seventh wave of surveys. A wide range of aspects is considered, for example "Aspiration for Democracy", "Empowerment of Citizens",

[5] Hofstede first defined 4 dimensions (1980), then added a 5th (1991) and even a 6th dimension (2010)

[6] "Universalism vs. Particularism", "Individualism vs. Collectivism", "Neutral vs. Emotional", "Specific vs. Diffuse" and "Achievement vs. Ascription"

[7] "Sequential vs. Synchronic"

[8] "Internal vs. External control"

"Globalization and Converging Values", "Gender Values", "Religion" and "Happiness and Life Satisfaction". Results from the WVS suggest that there are two major dimensions of cross-cultural variation, "Traditional vs Secular-rational Values" and "Survival vs Self-expression Values" (Abdollahian, Coan, Oh, & Yesilada, 2012; Esmer & Pettersson, 2007; Inglehart, 2004; Inglehart et al., 1998). There is a huge publicly accessible database and customized online data analysis is also available.

Another early and influential milestone of cross-cultural research is the work of Kluckhohn & Strodtbeck (1961), which deals specifically with different value orientations. Hall's book "*Beyond Culture*", which introduced the concept of high and low context cultures (Hall, 1976), is also noteworthy and can be considered as a foundation of cross-cultural communication (Rogers, 2002). The cross-cultural researcher, Schwartz created the "*Theory of Basic Human Values*" whereby humans share ten universal values but the values are pronounced differently between cultures (Schwartz & Bilsky, 1990; Schwartz, 2012). The last three mentioned works are not directly related to the present investigation, but influenced other important works, especially the GLOBE project (Chhokar et al., 2007). The latter is the most relevant cross-cultural study for this investigation, followed by Hofstede's (1980). Both will be referred to frequently throughout this research work.

3.2.3 Cultural Dimensions

Given the difficulty of properly defining culture, it is evident that measuring and comparing societal cultures is a real challenge. Hofstede (1980) tackled this problem by introducing "cultural dimensions", whereby a dimension is "*an aspect of a phenomenon that can be measured (expressed in a number) independently of other aspects*" (G. Hofstede, G. J. Hofstede & Minkov, 2010, p. 516). These independent aspects of culture have been identified empirically. From Hofstede's original, four cultural dimensions, two ("Power Distance" and "Uncertainty Avoidance") were based on theoretical concepts and two ("Individualism vs. Collectivism" and "Masculinity vs. Femininity") were derived from factor analysis (R. H. Franke, Hofstede, & Bond, 1991). During the years, Hofstede defined two more dimensions ("Long Term Orientation" and "Indulgence vs Restraint"), so that his model consists of six dimensions in total. The complete set of dimensions make up the model that describes the phenomenon, i.e. observed differences between societal cultures (Hofstede et al., 2010).

The cultural dimensions paradigm introduced by Hofstede (1980), to compare societal cultures, has been followed by other scholars, such as Schwartz (1999), Trompenaars et al. (2012) and GLOBE (House et al., 2004). The latter developed the system of cultural dimensions further, rather than developing a completely new one. Thus, the GLOBE project's cultural dimensions can be considered in some respects an enhancement rather than a completely different alternative to Hofstede. The following **Table 3** compares Hofstede's (2010) and the GLOBE project's (House et al., 2004) set of cultural dimensions:

Hofstede	GLOBE
"**Power Distance**" measures the strength and role of hierarchies in a society; the degree of unequally shared power.	
"**Uncertainty Avoidance**" addresses a society's inclination to avoid unpredictable, unexpected events and the degree of reliance on norms, rituals and traditions. It is a measure of tolerance of ambiguity.	
"**Individualism vs. Collectivism**" is not separating the group level of collectivism but capturing individualist and collective aspects of culture in general; the range between "I" and "we".	"**Institutional Collectivism**" ("Collectivism I") is concerned with the degree to which members of a society support collective action and agree to distribute resources collectively. It can be seen as a collective attitude towards a larger and more abstract group, such as a company, or society as a whole.
	"**In-Group Collectivism**" ("Collectivism II") reflects the extent to which members of a society focus their solidarity, cohesion, pride and loyalty on their families and in-groups.
"**Masculinity vs. Femininity**" concerns the predominant value system with regard to gender roles, whether alleged feminine values like cooperation and solicitousness prevail, or alleged masculine values like achievement and assertiveness.	"**Gender Egalitarianism**" refers to the degree to which societies reduce gender discrimination and differences between typical gender roles.
"**Long-term Orientation vs. Short-term Orientation**" originally derived from Chinese culture related studies (Hofstede & Minkov, 2010). It describes whether a society is focussed on long-term (thrift) or short-term planning (flexibility).	"**Future Orientation**" expresses how much a society is future minded in terms of planning, investing, saving and refraining from short-term thinking and acting.
"**Indulgence vs. Restraint**" measures if own wishes and impulses can be freely followed or if they are subject to the control by social norms.	No directly corresponding dimension
No directly corresponding dimension	"**Performance Orientation**" identifies the extent to which a society values, encourages and rewards performance improvement and excellence.
No directly corresponding dimension	"**Humane Orientation**" measures the extent to which fairness, altruism, generosity and kindness to other people are encouraged and rewarded in society.
No directly corresponding dimension	"**Assertiveness**" is characterized by the degree of assertive, aggressive and confrontational behaviour in social relationships.

Table 3: Comparison of Hofstede's and the GLOBE project's cultural dimensions

Despite the similarities, even the common cultural dimensions “Power Distance” and “Uncertainty Avoidance” differ in detail, e.g. how they are measured. Hofstede’s “Individualism vs. Collectivism” is split in the GLOBE project into two dimensions: “Institutional Collectivism” and “In-Group Collectivism”, whereas “Masculinity vs. Femininity” and “Long-term Orientation” were redefined and renamed by the GLOBE project (“Gender Egalitarianism” and “Future Orientation”) so that Hofstede’s and the GLOBE project’s dimensions investigate similar phenomena from a different perspective and thus cannot be expected to deliver the same results. All other cultural dimensions shown in **Table 3** are unique either on Hofstede’s or the GLOBE project’s side.

Sets of cultural dimensions from other scholars, such as Schwartz (1999) and Trompenaars et al. (2012) are judged to be less relevant for this research, because none of the studies identified in the systematic database search (see section **3.1.1**) uses them to investigate cultural influence on IP piracy or the notion of IP (see **Table 2**) and they are also not referred to in any of the studies related to cultural influence on innovativeness presented further below in **Table 4**. The decision as to which cultural dimensions will be used in the further course of this research is therefore limited to Hofstede and the GLOBE project at this point.

The usefulness of cultural dimensions can be clarified with an example: If a survey found out that Finns are on average more patent friendly than Spaniards, what would that mean? Even if we assume that the observed difference is grounded in culture, the only valid conclusion would be that Finnish culture seems to be more patent friendly than Spanish culture. This result would certainly not allow for any generalization, such as a transfer to other countries, e.g. the deduction that Sweden (because of its supposed proximity to Finland) would probably be more patent friendly than Spain. Therefore, the conclusions that could be drawn from an unspecific comparison of societal cultures would be very limited, or, in the words of Huntington, "… *if culture includes everything, it explains nothing”* (Harrison & Huntington, 2000, p. xv). If, in contrast, the results of a survey showed that a certain aspect of culture is directly related to a specific patent friendliness, then these results

could suggest, provided that survey design and statistical analysis have been conducted properly, that cultures where this aspect is strongly pronounced tend to be patent friendly. A certain amount of generalization would be reasonable, so that conclusions could be drawn about the expected patent friendliness of countries that in fact have not actually been investigated. That means, a reduction of the subject of interest to its constituent parts, or building blocks, allows for a certain generalization that would otherwise not be possible. The utilization of cultural dimensions in cross-cultural studies is widely used, because societal cultures are too general to be related to specific behaviour or positions, whereas cultural dimensions can be specific enough to provide definite results. Cultural dimensions are defined with the aim of getting to the essence of a culture, to specific building blocks that cannot be further broken down.

Cultural dimensions described in academic literature only cover some aspects of culture. Others are either uncovered, difficult to grasp, or of less academic interest, as they may play a negligible role in leadership or other business aspects. If we consider culture as defined by Hofstede or GLOBE (see above), it becomes clear that it cannot be wholly represented by a number of cultural dimensions, which are in fact determined measurable aspects of the phenomenon called “culture”. This means that this investigation cannot expect to identify all cultural aspects that may influence patent valuation, but only the specific aspects that are represented by determined cultural dimensions. Therefore, one important task of this work is to identify the most appropriate cultural dimensions that can be used subsequently for the related survey.

The systematic database search described in section **3.1.1** could not identify any studies on the influence of cultural dimensions on patent valuation, but found some works about the influence of culture on IP piracy and the notion of IPR. As outlined in that section the level of IP piracy (copyright violations, CD piracy and software piracy) is significantly influenced by underlying cultural values. These are represented by cultural dimensions, such as Hofstede’s "Individualism (IDV) vs. Collectivism", "Power Distance Index (PDI)" and "Uncertainty Avoidance Index (UAI)". An overview of

studies that utilize Hofstede's cultural dimensions to investigate cultural influence on IP piracy is provided further below in **Table 4**.

In addition to the studies related to IP piracy and the notion of IP, there is another interesting topic in academic literature that is judged relevant for this work: the relation of cultural dimensions and innovativeness. A number of studies in recent years investigated the relationship between Hofstede's cultural dimensions and innovation. Although innovation and innovativeness are not in the direct focus of this work, they are of an indirect interest, because many studies base their measure of innovativeness at least partly on the number of patent applications. Even though this approach may lead to useful data, it seems to be an oversimplification as innovativeness may result in many activities other than just patent production. Also, innovativeness is a necessary but not a sufficient condition for patent production. The relation between innovativeness and patent production is multi-factorial. Various factors support innovativeness, e.g. creativity, trying new things, learning orientation, knowledge diffusion, market orientation, entrepreneurial orientation, technological capabilities, knowledge management and institutional quality (Ferraresi et al., 2012; Goldsmith, 2011; Renko, Carsrud, & Brännback, 2009; Rhee, Park, & Lee, 2010; Tebaldi & Elmslie, 2013), but they may also result in things other than patents, e.g. design, artwork, literature, new ways of cooperation etc. Furthermore, as the number of patent applications is only one indicator of innovativeness, patent production for its part may well be stimulated deliberately by companies, organizations or countries, e.g. through patent funding policy (Zhang & Luo, 2009), patent promotion and patent subsidy policies (Li & Xia, 2011) and patent application grant policy (Guo & Yang, 2010).

However, the relation between innovativeness and culture provides some useful indications for the purpose of this work. Some studies investigate direct cultural influence on the number of patent applications (Kaasa & Vadi, 2010; Shane, 1992), others utilize R&D expenses and other parameters as indicators for innovativeness (Efrat, 2014; Vecchi & Brennan, 2009). **Table 4** provides an overview of studies that

report either a relation of Hofstede's cultural dimensions with IP piracy (as discussed above), or with innovativeness:

Studies that report a relation between Hofstede's cultural dimensions and …	
…IP piracy	**…innovativeness**
Individualism vs. Collectivism (IDV): Husted, 2000; Marron & Steel, 2000; Marquez, 2004; Simmons, 2004; Mun, 2009; Moores, 2008; Yang & Sonmez (2007)	**Individualism vs. Collectivism (IDV):** Efrat, 2014; Halkos & Tzeremes, 2011; Kaasa, 2013; Kaasa & Vadi, 2010; Rinne 2012; Shane, 1992; Shane, 1993; Vecchi & Brennan, 2009; Williams 2010; Williams & McGuire, 2005
Power Distance Index (PDI): Simmons, 2004; Moores, 2008	**Power Distance Index (PDI):** Efrat, 2014; Halkos & Tzeremes, 2011; Kaasa, 2013; Kaasa & Vadi, 2010; Rinne 2012; Shane, 1992; Shane, 1993; Vecchi & Brennan, 2009; Williams 2010; Williams & McGuire, 2005
Uncertainty Avoidance Index (UAI): Moores, 2008	**Uncertainty Avoidance Index (UAI):** Efrat, 2014; Halkos & Tzeremes, 2011; Kaasa, 2013; Kaasa & Vadi, 2010; Shane, 1993; Shane, 1995; Vecchi & Brennan, 2009; Williams 2010; Williams & McGuire, 2005
Masculinity vs. Femininity (MAS): Marquez, 2004; Moores, 2008	**Masculinity vs. Femininity (MAS):** Efrat, 2014; Halkos & Tzeremes, 2011; Kaasa, 2013
Long-term Orientation (LTO): Simmons, 2004	

Table 4: Overview of studies that utilize Hofstede's cultural dimensions

It is striking that a considerable number of studies reported a significant influence of the cultural dimensions "Individualism vs. Collectivism" (IDV), "Power Distance Index"

(PDI) and "Uncertainty Avoidance Index" (UAI) on innovativeness. The same cultural dimensions were also found to be related to IP piracy in other studies.

Concerning Hofstede's cultural dimension "Masculinity vs. Femininity" (MAS) the picture is more inconsistent; a number of studies came to very different results. Halkos & Tzeremes (2011) and Kaasa (2013) report a negative correlation of MAS and innovativeness, whereas Efrat (2014) came to the opposite conclusion, a positive correlation between MAS and innovativeness. The opposing results are explained with different arguments: Kaasa (2013) concludes that more feminine societies are characterized by focus on people, socio-emotional support and trust, which have a positive effect on innovation. Efrat (2014) justifies a positive correlation between MAS and innovativeness with a stronger aspiration for achievement and acknowledgement in more masculine societies. The picture becomes more blurred by adding another study: Shane (1993) also investigated the relation of MAS and innovativeness and came to the conclusion that there is none.

Two studies were identified that report a relation of MAS with IP piracy. Marquez (2004) explains a negative correlation with higher importance of property and material values in more masculine societies. In contrast, Moores (2008) expected a positive correlation due to the expectation that a more ambitious and competitive masculine society would lead to a higher degree of corruption and thus to more IP piracy. However, his study proved the opposite, a negative correlation between MAS and IP piracy.

In summary, the identified studies that investigated the relation between the cultural dimension "Masculinity vs. Femininity" (MAS) and IP piracy on the one hand, and innovativeness on the other hand, show an inconsistent picture.

Another cultural dimension seems to be interesting with regard to this research: "Long-term Orientation" (LTO). The fact that only one study listed in **Table 4** reported this dimension to influence IP piracy may derive from the circumstance that LTO was much less investigated, because it was introduced later than the first four cultural dimensions (Hofstede & Minkov, 2010). Also, LTO originally derived from Chinese

culture related studies and its suitability for cross-cultural research is more contested than for the original four cultural dimensions, e.g. Fang (2003) argues that LTO has a philosophical flaw related to the underlying Confucian values. The corresponding cultural dimension from the GLOBE project "Future Orientation" (see **Table 3**) was developed without this focus on Confucian values (Ashkanasy, Gupta, Mayfield, & Trevor-Roberts, 2004) and stands on a stronger theoretical fundament, whereas it captures slightly different aspects on the past-present-future timeline (Venaik, Zhu, & Brewer, 2013).

For all other cultural dimensions listed in **Table 3** there is no indication of their relationship with IP piracy, the notion of IP, innovativeness, or any other aspect that would suggest an influence on patent valuation.

This section of the literature review explains the usefulness of the concept of cultural dimensions for this research and provides a pre-selection of those cultural dimensions that are judged relevant for the further course of this work. The former is taken into account for the formulation of the research questions in section **3.4** and the creation of the conceptual model in section **3.5**, whereas the latter is considered when selecting the appropriate research methods and when carrying out the research in the next chapters.

3.3 Literature Review: Patent Valuation

When investigating the valuation of patents, the question immediately arises as to what exactly is meant by “valuation”. It is not "Valuation" as “*the act of placing a value on the nature, character, or quality of something”* (Merriam-Webster, 2016) that needs a definition in the context of this work, but the concept of "value". Different disciplines, such as philosophy, psychology, sociology and economics, aim to understand what value means to people and how and why they value things, where things can refer to persons, ideas, objects, actions etc. Value as a concept of worth (in contrast to value in the sense of quantity, amount, or entity) may designate value in the sense of ethics or in the sense of economics, which are the two meanings that are relevant in this work. They are elaborated in the next two sections, whereas the last one also provides an overview of common approaches to assess the monetary value of patents.

3.3.1 Ethical Valuation of Patents

Ethics is a major area of philosophy that is concerned with morals. In ethics, value is a property assigned to physical and abstract objects (such as actions), representing their level of importance. Within philosophy there are three important fields that are dedicated to aspects of ethical value:

- Axiology as the philosophical study of value aims to explain the nature of values, why something is considered valuable and the fundaments of these judgements
- Deontology aims to judge the morality of an action, independent of its consequences, based on its underlying rule
- Utilitarianism is concerned with the consequences of our actions, we act ethically when we maximize utility

Axiology is a relatively new philosophical discipline, even though the underlying philosophical questions concerning virtue and morals go back to Ancient Greek philosophy and were, for example, important subjects of Socrates' and Plato's thinking (Plato, Ferrari, & Griffith, 2000 [380 BC]). "Value" originally designated the worth of something in the economic sense, e.g. that is the meaning of the term "value" in Adam Smith's work *"The Wealth of Nations"* (2005 [1776]). However, this meaning was expanded considerably at the turn of the 20th century, when various philosophers used the term with different signification. Axiology was shaped, by Nietzsche, who called for a *"Revaluation of all values!"* (2015 [1894]), von Hartmann with his work *"Outline of Axiology"* (1908), Scheler, who elaborated a hierarchy of values (1973 [1913-1916]) and Perry with his work *"General Theory of Value"* (2013 [1926]), among others. A prevailing differentiation is made between instrumental value, i.e. what is good as a means, and intrinsic value, i.e. what is good as an end. Dewey made a pragmatic interpretation in his work, *"Theory of Valuation"* (1939), where he tried to overcome the dichotomy between means and ends. In "*The Structure of Value"* (1967), Hartman, the founder of a formal axiology, introduced a scientific system that applied mathematical formulas to measure value in the sense of good or bad.

Deontology determines what to do and how to live from an ethical perspective. Kantian ethics is considered to be one of the most influential deontological ethical theories. Its most notable arguments are that only acting from duty means acting in the morally right way and that it is not the consequences of an action that determines whether it is morally right, but the person's motives for this action. Only one thing is truly good, that is good will. Kant's central deontological philosophical concept is expressed in his "categorical imperative":

> *"so act as if the maxim of your action were to become by your will a universal law of nature."* (Kant, 2011 [1785], p. 71)

Nietzsche later heavily criticized basing moral action on obligation or duty, without the consideration of self-interest:

> "*What destroys a man more quickly, than to work, think, and feel without inner necessity, without any deep personal desire, without pleasure - as a mere automaton of duty?*" (Nietzsche, 2015 [1894], p. 11)

Utilitarianism, as a branch of consequentialism, is a theory in normative ethics that is very much concerned with the consequences of an action and judges the value of something on how it can be utilized. The ethical aim of an action is to maximize utility, i.e. to maximize happiness and to reduce suffering. The two most influential contributors to classic utilitarianism were Bentham and Mill. In his work, "*A Fragment on Government*", Bentham states *"it is the greatest happiness of the greatest number that is the measure of right and wrong"* (Bentham, Burns, & Hart, 1988 [1776], p. 134). Mill's main work on the subject bore the title *"Utilitarianism"* (Mill, 2004 [1870]) and explicated his standpoint that it was not the acting person's own greatest happiness that mattered *"but the greatest amount of happiness altogether"* (Mill, 2004 [1870], p. 13).

Regarding this work, Axiology is more of theoretical interest, but with no immediate practical usage. Deontology, in the sense of Kant's "good will" and "categorical imperative", also does not directly apply to the investigation of the ethical valuation of patents. This is because the notion of the ethical value of patents is more closely related to the perceived consequences of the current patent regime than to the original intentions that led to its creation. Hence, the utilitarian approach, in the sense of Bentham and Mill, is more relevant to this work. The ethical value of patents should aim for the greatest positive effects on the greatest numbers, which means the underlying patent policy should foster prosperity and well-being and serve the common good. The investigation into ethical patent valuation aims to capture the notion of the ethical value of patents, i.e. do people think positively or negatively about patents? Therefore, the part of the investigation concerning the ethical valuation of patents will be conducted from a value perspective in a utilitarian sense.

3.3.2 Economic Valuation of Patents

In Economics, the "theory of value" aims to explain how the value of goods and services can be determined and hence, prices set. This theory can be subdivided into two main categories: the "objective (or intrinsic) theory of value" (OTV) and the "subjective theory of value" (STV).

The first holds that the value of goods or services is based on their intrinsic properties, e.g. determined by its production costs. A specific variant of this theory is the "labour theory of value" (LTV), a classical Economics' approach which was founded and developed during the 18th and 19th centuries.

In his magnum opus, *"The Wealth of Nations",* Adam Smith (2005 [1776]) laid the foundations of the LTV. He distinguished between a value "in use" which refers to the utility of a commodity and a value "in exchange" which designates the relative value in comparison to other commodities, i.e. how much the owner would get in exchange for this commodity. Such value "in exchange" is relative to labour and corresponds to the price. It is measured in labour (toil and trouble) that the buyer spares himself through the purchase. The value measured in labour, consists of three parts: the labour, the investment needed to produce the commodity and the profit for the seller. Smith concluded that the value of any product could be measured in labour:

> *"The value of any commodity (...) is equal to the quantity of labour which it enables him to purchase or command. Labour therefore, is the real measure of the exchangeable value of all commodities. The real price of every thing, what every thing really costs to the man who wants to acquire it, is the toil and trouble of acquiring it."* (A. Smith, 2005 [1776], p. 31)

Ricardo (2001 [1821]) refined this thought by asserting that a precondition for any value was utility. Goods that have no utility are of no value at all, irrespective of how much labour was applied for their production. In a letter to Jean-Baptiste Say he stated more precisely that, whereas utility is a precondition for value, the value itself is determined by the labour for its production:

> *"A commodity must be useful to have value but the difficulty of its production is the true measure of its value. For this reason Iron though more useful is of less value than gold."* (Ricardo, 2013 [1815], p. 259)

Marx and Engels (2013 [1867]) defined the intrinsic value of a commodity as the *"socially necessary labour time"*, a rather abstract measure of the average amount of labour units that are embodied in a produced commodity. This value expresses the exchange value and the price of a commodity (Marx & Engels, 2013 [1867]). Marx (2005 [1875]) also pointed out, that use value could be independent of labour.

In contrast, the "subjective theory of value" (STV), claims that the value of goods or services is independent of its inherent properties, as well as of its production costs. Instead, its value is determined by the subjective utility to a buyer. In contrast to the LTV, the STV does not condemn profit as leading to exploitation. As both the buyer and the seller agree on a price voluntarily and both believe that they get a higher value than they give up every trade is mutually beneficial. This also means that as every trade increases total wealth, that additional value can be created by transferring ownership of a commodity to someone who values it higher. This view is most prominently represented by the Austrian School of Economics. In his *"Principles of Economics",* one of its members, Menger (2007 [1871]), provided some important basics for the STV and contributed to the development of the so-called "theory of marginal utility". The marginal utility designates how much additional usefulness, in the sense of ability to satisfy human wants, would be created by a marginal increase in quantity of goods or a service. Prices for those goods and services would develop according to their marginal utilities (Menger, 2007 [1871]).

The STV is just a short step away from the term "price equivalent". The amount of money that a consumer is willing to spend on goods or a service corresponds to the subjective value that she/he associates with the possession of that commodity. If the actual price is higher than his/her "price equivalent", she/he will not purchase the good or service and if the actual price is lower or equal, then the trade will be successful (Whitaker, 2001 [1904]).

Both the "objective theory of value" and the "subjective theory of value" view value from a different angle and the different economic schools did not succeed in unifying them. Buchanan et al. (1987) lamented that Economists failed to build a synthesis between STV and OTV.

When it comes to valuation of a product or service in a sales environment, there are still two basic approaches: either “cost-based pricing” (adapted from the OTV), or “value-based pricing” (adopted from the STV). From a company's viewpoint, the following is a legitimate question: “What would it cost to create a patent portfolio by ourselves and what would it be worth?” If a company has to decide whether to invest in patents, such business decisions would most probably be based on a business case that would reflect the estimated costs and the estimated benefits.

Personal experience suggests that large technology companies, at least in the telecommunications sector, such as Nokia, Ericsson, Telefonica and Vodafone, clearly prefer value-based pricing if their customers accept it. This provides opportunities for higher margins; however, a true cost-based pricing is an illusion in practice, because in a large company a product’s virtual share of the overheads and other common costs requires estimations, weighing factors and allocation keys. It therefore becomes as subjective as the value-based pricing method.

With respect to this work, the STV approach seems to be more appropriate for various reasons. Firstly, this work holds a constructivist position, with an underlying subjectivist epistemology (see also section **4.2**). Therefore, a judgement of value is subjective per se. Objectivity would be ideal, but it is an illusion. Secondly, it is more realistic to assume that major patent portfolio deals, like those that are referred to in section **2.1,** involve value-based pricing rather than cost-based pricing. Thirdly, even if companies wanted to apply cost-based pricing for their patents it would be difficult, because the primary task of R&D departments, at least in large technology companies like Philips, Samsung, LG, Huawei or Siemens[9], is to develop new products and only in the second place is it to create related patents. There are exceptions, of course, e.g.

[9] Top 5 patent applicants at the EPO in 2015 (EPO, 2016b)

companies whose business model is more focussed on IPR such as ARM[10], or so-called "patent trolls"[11]. Therefore, a virtual split of R&D costs into a product development related part and a patent related part would provide misleading results.

Independent of this work's position, if people are asked about their estimate of an economic patent value, they may think cost-based or value-based. This will be taken into account when investigating the cultural influence on economic patent valuation in the following chapters.

Given the importance of patents for business (refer to section **2.1**); there is a high demand for assessment of the economic value of patents. A variety of patent valuation methods exist for this purpose. However, every method has its problematic aspects and reliable and consistent results cannot be expected. Munari & Oriani (2011) list a number of critical issues that complicate proper patent valuation:

1. Intangibility: No established market value for a specific patent, difficult fair value allocation in terms of financial reporting

2. Contribution to value creation: It is very difficult to determine the specific business impact of a patent, i.e. a comparison between two scenarios, one with and the other without the patent

3. Market and technical uncertainty: In general, it is very difficult to estimate the returns from innovation

4. Legal uncertainty: In the case of patent infringement by a third party, the following litigation implies the risk of invalidation of the patent and involves high costs for the lawsuit

Munari & Oriani (2011) conclude that there is no method that addresses and overcomes all critical issues. Apart from the specific disadvantages of each method,

[10] ARM calls itself "*The world's leading semiconductor intellectual property (IP) supplier*" (ARM, 2016)

[11] A patent troll is a "*patent owner who does not intend to exploit a patent but who enforces his patent rights against purported infringers*" (EPO, 2007, p. 113)

patent valuation in general is difficult to apply due to limited availability of necessary data and know-how:

> "*One would be hard-pressed to find a major investment bank that employs even one individual with experience in evaluating patent portfolios. (…) as matters stand now, 'due diligence' regarding patent assets is usually more myth than reality.*" (Rivette & Kline, 2000, p. 163)

Lemley & Shapiro (2005) compare patents with lottery tickets, due to their intrinsic uncertainties (see above). They even refer to patents as "probabilistic rights" (Lemley & Shapiro, 2005, p. 95).

Despite the shortcomings of existing patent valuation methods, they are still very useful and can provide reasonable results if applied correctly. The best method may depend on the specific purpose and on the available data, as well on personal preferences. An overview of patent valuation methods is provided in the following.

Overview of patent valuation methods

Due to the (growing) importance of patent value, there are numerous approaches to valuing patents described in the academic literature. Apart from "facts" such as costs, number of citations, renewal statistics etc., there are also admittedly "subjective" parameters, e.g. judgements of inventors or patent owners. The list of methods described below is not complete, but contains the most commonly used and the most frequently mentioned methods in the relevant literature. Systematic overviews of patent valuation methods are available from many researchers, e.g. Gassmann & Bader (2011), Yang (2008), Reitzig (2002), Grimaldi et al. (2014), Lagrost et al. (2010) and Munari & Oriani (2011), although they differ in their systematic approach and also partly in naming. The overview presented in this work is based on a unique systematization, adapted to the specific focus of this investigation. Some authors, e.g. Lagrost et al. (2010) and Munari & Oriani (2011), distinguish between qualitative and quantitative methods, according to the type of results they provide. In this sense, qualitative methods do not aim to derive concrete monetary values, but rather to

obtain a rating of patent qualities, such as legal aspects, technology level, geographic coverage and a rough value categorization like “very high value” or “key patent”. An example of such a qualitative method is the use of a tool called “IPScore”, provided by the European Patent Office, which helps to analyze strengths and weaknesses of patents (Lagrost, Martin, Dubois, & Quazzotti, 2010; Munari & Oriani, 2011). As these so-called qualitative methods are not addressing the economic value of patents directly, they are not presented in more detail. The methods described in the following all deal directly with the economic valuation of patents and thus belong to the quantitative category according to the distinction above.

Renewal data based method:

Patent protection is usually granted for 20 years, starting with the data of filing. However, a patent only remains in force if the patent owner is willing to pay a yearly maintenance fee, which ranges for a patent application at the European Patent Office from €470 for the third year up to €1,575 for the tenth year onwards (EPO, 2016a). Once a patent is granted, a yearly renewal fee is paid to the national patent offices of those countries where this patent is valid. If, for example, a patent grant is valid in France, Germany and the UK, the yearly renewal fee starts with a few hundred € and reaches more than €3,000 by the 20th year. In order to keep the patent valid for all EPO member states the patent owner needs to pay several thousand € per year (EPO, 2016a). The patent owner has to decide every year whether he judges the patent worth the renewal fee to be paid. Therefore, the renewal data gives some valuable information about the owner’s judgement of the patent’s value. This policy of renewal fees that increase year by year is comparable in the USA. Lemley & Shapiro (2005) mention in their article that between 55% and 67% of U.S. patents are not maintained in force until the end of their 20-year term, i.e. the patent owners decide that the value of the patent’s remaining run time does not exceed the required renewal fees. The patent valuation method, based on renewal data, assumes that patent holders act as rational market participants, analyze their willingness to pay renewal fees and derive a value estimation from this (Baudry & Dumont, 2012). A clear advantage of this method is its relative simplicity and the easy availability of

renewal data. There are disadvantages as well. Renewal fees are too low to provide any information about high value patents (Hall & Harhoff, 2012). Furthermore, this method leads to some biased results, e.g. patents from small companies are valued much lower than from large companies, U.S. patents are more valuable than European patents and litigated patents are more valuable than others, according to this renewal data based method (Bessen, 2008). This does not mean that, for example, small companies' patents are of lower value on average, rather that one can assume that smaller companies are more cost sensitive than large companies. The most interesting aspect regarding this work is that this method is based on judgements of the patent holders themselves, not on the opinions of analysts, patent professionals, or other experts.

Market based method:

The market based method compares historical prices of similar patents in order to estimate a market price, or uses actual prices in an active market, if available (Lagrost et al., 2010). This method is simple in theory, but involves some challenges in practice, e.g. the uniqueness of each patent makes comparisons difficult and sometimes misleading. Information about transaction prices is not readily available and the condition of an active patent market is very rarely fulfilled. Serrano (2005) found in his study that only 20% of U.S. patents are traded during their lifetime and Sneed & Johnson (2009) confirmed that auctions are a useful means to determine the market value of patents, even though auctions only capture a small portion of patent deals.

Cost based method:

This method takes either historic costs, incurred when the patent was developed into consideration, or reproduction costs, i.e. an estimation of how much it would cost to develop a similar patent, or the estimated replacement costs, i.e. how much it would cost to purchase the patent from a 3rd party (Lagrost et al., 2010). This quite simple approach clearly follows the "objective theory of value" (OTV) as presented above. As mentioned above, cost estimations involve the specific challenge of virtually splitting

R&D costs into a product development related part and a patent related part, which jeopardizes the reliability of the results.

Income based method:

The income based method actually offers differing possibilities:

- The forecast of **discounted cash flow (DCF)**, whereas risks and specific interest rates are taken into account. A precondition is that the attributable cash flow can be determined with reasonable accuracy (Bader, 2008; Lagrost et al., 2010).
- Similar to the DCF, the estimation of the **incremental cash flow** compares future cash flow for two scenarios – one with the active usage of the patent and the other without owning the patent or using it (Goddar & Moser, 2011).
- The evaluation of the financial impact from a **relief from royalty payments**, estimating the license fees that had to be paid if the patent would belong to a 3rd party (Lagrost et al., 2010).
- **Multi-period excess earnings** are based on the assumption that patents mostly generate profit in combination with other assets. Therefore, it is assumed that the other necessary assets are rented or leased from a 3rd party and these costs are subtracted from the profits of the combined assets. The remaining share can then be attributed to the patent (Bader, 2008).

These income based approaches are all based on expert know-how and on data that is not easily available; they are also relatively expensive and not reproducible by others, thus they lack full transparency (Omland, 2011).

Patent data based method:

Some patent data is publicly available and can therefore be easily accessed for patent valuation purposes. In this respect, interesting parameters are legal status, i.e. patent age and remaining runtime, technology scope and patent family size, number of citations, legal disputes and number of claims (Neuburger, 2005; Reitzig, 2004). Remaining runtime is quite an obvious parameter; however, it only provides auxiliary

information in combination with other parameters. Furthermore, the other mentioned parameters are also of limited utility if not combined. Consequently, the patent data based method normally uses all available parameters together to estimate a patent's value. Nonetheless, this method is more applicable to determine the value of patent portfolios, rather than individual patents (Omland, 2011). The number of citations can be applied, however, without other patent data parameters to gain some useful indication about a company's patent portfolio value (Hegde & Sampat, 2009). Studies from Hall, Jaffe & Trajtenberg (2005) and from Harhoff, Scherer & Vopel (2003) showed a positive correlation between citation-weighted patent portfolios and their companies' market value. The patent data based method is the method of choice for analysts in order to evaluate the intellectual capital of companies, e.g. benchmarking, ranking and in case of M&A (Ernst & Omland, 2011). Its main advantages are that it is reproducible and transparent and that the required data can be relatively easily accessed from patent office databases. It is well suited for an automated method to evaluate large patent portfolios (Omland, 2011). Within the boundaries of a constructivist worldview, this method can be considered "objective" in so far as the analysis itself does not need to involve personal opinion or experience, but can be conducted by computer algorithms (Neuburger, 2005).

Real option based method:

The intrinsic uncertainties that led Lemley & Shapiro (2005) to compare patents with lottery tickets (see above) are specifically addressed by the real option based method. Profits and thus value of a patent are uncertain and volatile, which is similar to a number of other financial assets that can be traded as options. This method applies the Real Option Theory (ROT) and presumes that the value of patents needs to take into account the flexibility that a patent offers to its owner. The patent holder has the right, but not the obligation to invest in the related technology (Leone & Oriani, 2007). In comparison to financial options, this flexibility has a business value offering the holder the options to wait, abandon, expand, renew or use, which stands for call and put options. Just like call or put options, patents lose their value within a determined period of time and they unfold their full value only when used actively

(Oriani & Sereno, 2011). Although there are several approaches and formulas to calculate the patent value based on real options, the most commonly used is the Black-Scholes model (Black & Scholes, 1973). The corresponding, complex formula includes a number of parameters such as the value of the underlying asset, the standard deviation of the value of the underlying asset, the further investment needed to obtain the additional cash flow, the time to maturity (remaining time of the opportunity), the risk-free interest rate and the cash flow distribution rate (Oriani & Sereno, 2011). The main difficulty in applying this method is that some required parameters may not be available or be based on rough estimations. Thus, the formula may suggest a certain mathematical accuracy, but the reliability of the results ultimately depends on the quality of the input parameters.

Survey based method:

The survey based method aims to access patent values through a survey among patent holders. It is a purely qualitative method, on the basis of subjective judgements of inventors. For example, a large survey among European inventors (more than 9,000 questionnaires) had been undertaken as part of the EU project, "PatVal" (Gambardella, Harhoff, & Verspagen, 2008). One of the questions in this survey was directly addressed to patent value:

> "*Suppose that on the day in which this patent was granted, the applicant had all the information about the value of the patent that is available today. In case a potential competitor of the applicant was interested in buying the patent, what would be the minimum price (in Euro) the applicant should demand?*" (Munari & Oriani, 2011, p. 64)

The respondents were asked to choose between ten different value ranges between less than €30,000 and more than €300,000,000. The survey based method requires time and effort and it is therefore less appropriate for analysts or M&A experts. Due to its pronounced subjectivity, it is intrinsically biased if applied to single patents or for one determined patent portfolio. Its strength lies in comparing investigations, e.g. between countries or patent policies of companies (Gambardella et al., 2008).

However, such comparisons may include, apart from bias induced by individual subjectivity, a cultural bias, as outlined in section **3.2**. Thus, this work argues that cultural influence needs to be taken into account when comparing patent values between countries based on surveys. This method is particularly interesting for this work as it seeks to capture subjective judgement concerning patent value and to investigate cultural differences.

Other methods:

There are some other methods, apart from those described above that are worth mentioning, although they are not directly relevant to this work. The "conjoint analysis" derived from applications in marketing is based on the assumption that patents provide a specific add-on for the underlying products that can be determined (Neuburger, 2005). The "pay-off" method combines different value scenarios with real options (Collan & Heikkilä, 2011) and the so-called "fuzzy pay-off method for real option valuation" also uses fuzzy logic and fuzzy numbers (Collan, Fuller, & Mezei, 2009). The list of methods is still incomplete, because there are many variations and methods for very specific applications. However, they are judged to be irrelevant for this work and are therefore not discussed further.

Distinction between direct and indirect methods

This work investigates cultural influence on patent valuation with a mixed methods approach, including interviews and questionnaires. In this respect, this section on the economic valuation of patents provides some theoretical foundations. The challenge is not only *how* to capture cultural influence on patent valuation, but also *from whom* to get this information. The different patent valuation methods described above are conducted by different groups of people with different perspectives e.g. business analysts and patent owners. Some of the methods are more prone to personal experience and opinion, whereas others are supposedly based more on "facts", such as development costs or number of citations. With regard to the objectives of this work, it appears to be reasonable to distinguish valuation methods according to their

immediacy or directness, i.e. whether a method is based on the immediate judgement of people, or immediately through patent data. The former is expected to be directly influenced by personal experience and opinion, whereas the latter is based on "facts" that are only indirectly influenced by subjective judgement.

The "survey based method" clearly belongs to the direct category as the data it produces is based directly on the inventor's judgement. The "renewal data based method" also directly reflects the judgement of the patent holder, because it is his yearly decision whether the patent value is worth the renewal fee or not. Thus, the method observes the behaviour of the patent holder. The other patent valuation methods described are quite indirect, e.g. based on costs, income, market, patent data or real options. Despite their indirectness, these methods are appropriate for estimating an average patent value (e.g. for comparisons between countries or industries) or the value of a patent portfolio. They are less suitable for estimating the value of individual patents (Munari & Oriani, 2011).

This work neither intends to use any of the described methods in order to compare or improve them, nor to develop a new method. The aim is to capture personal experience and opinion, because these are more likely to reveal cultural bias than anonymous patent data.

Starting from a subjectivist epistemology, this work argues that subjective judgements are indeed the basis for any indirect valuation (e.g. costs are mostly not clearly assignable and therefore ultimately estimated; citations can be counted, but it is people who decide whether to cite or not). Cultural dimensions may therefore ultimately influence indirect valuation as well. The distinction between direct and indirect valuation methods is important when it comes to the assessment of the findings of this research in **Chapter 8**. In which context does cultural bias make a difference and in which circumstances do cultural differences need to be taken into account? The relevance of the results and their applicability in practice depend on the objectives and on the context.

3.4 Aim, Research Questions and Objectives

Starting from the premise that the assigned "value" of a patent is highly subjective, this work supposes that culture may be one of the influencing factors that lead a person to judge a patent to be worth a determined value. **Chapter 2** ("Contextual Background") explains that IPR regimes that evolved in Europe and the USA are significantly influenced by Western philosophical and cultural values. Adding the proposition that culture influences all aspects of our values and beliefs, it can be presumed that the cultural background of people who estimate patent values[12] would make a difference. If this is the case, it is important to know how culture influences patent valuation, because, as outlined in **Chapter 2**, IPR are of increasing significance in business and the evaluation of patent portfolios has vital importance.

This study seeks to identify if there is a cultural bias concerning patent valuation and whether knowledge about cultural differences can help estimate the value of patents.

The first part of the literature review (section **3.1**) identified a knowledge gap concerning the presumed influence of cultural aspects on patent valuation. The literature review revealed lots of evidence that the notion of intellectual property is indeed dependent on cultural dimensions (sections **3.1** and **3.2**), but the specific nature of this influence remains unexplored and it seems worthwhile to further investigate the consequences of this cultural bias concerning the valuation of patents. This work argues that a culturally different notion of intellectual property relates to our moral judgement of patents and consequently the importance and value that we assign to them. Section **3.3** provides a clear distinction between value from an ethical and from an economic perspective as well as a clarification of terms.

Based on learning from the review of the academic literature depicted above, this work deduces the research questions and objectives about whether cultural

[12] A patent is ultimately valuated by the inventor or patent holder, e.g. indirectly through the decision to pay the annual renewal fee or directly through an estimation that they provide to their management (see also section **3.3.2**).

dimensions influence the moral and financial aspects of the valuation of patents, as well as the nature and consequences of this influence.

Research Questions:

1) What cultural dimensions influence the concept of patents?

2) How, and why, do these cultural dimensions impact the economic and ethical valuation of patents?

Research Objectives:

1) To investigate cultural impact on the concept of patents and to identify the relevant cultural dimensions.

2a) To elaborate a model that helps to understand the type and magnitude of impact of relevant cultural dimensions on the assessment of the economic and ethical value of patents.

2b) To investigate the reasons for cultural impact on the valuation of patents.

The aim of this research is to provide evidence for a cultural impact on our notion of patents and to develop a model that helps to explain the influence of cultural dimensions on the valuation of patents. A conceptual model is elaborated in the next section **3.5**. The final model (see section **8.3**) will support the target group of this study (patent portfolio managers, business controllers, M&A professionals, patent rating agencies and business analysts) in their valuation of patent portfolios.

3.5 Conceptual Model

The aim of this research, as formulated in the previous section, includes also the development of a conceptual model that represents the influence of cultural and other factors on patent valuation. The literature review in the area of culture (section **3.2**) led to the conclusion that the most promising way to capture and measure cultural influence is the utilization of academically sound and clearly defined cultural dimensions. The same section also provides a pre-selection of cultural dimensions that are considered most likely to influence patent valuation. However, the conceptual model still leaves open which cultural dimension may influence either ethical or economic valuation of patents, or even both. Also, a relation between ethical and economic patent valuation is presumed. Other cultural aspects, which are not covered by the cultural dimensions under investigation, or which are even not measurable with the means available, may influence patent valuation as well. Then, it is a safe assumption that there are also other than cultural factors that influence patent valuation, e.g. personality, educational background, economic situation (GDP per capita, R&D expenditure…), or other country specifics (economic policies, educational system, political system…). However, the potentially influencing factors outside the scope of this work are only included in the model for the sake of completeness.

The conceptual model depicted in **Figure 1** shows schematically the different influencing factors on ethical and economic valuation of patents, without naming the concrete influencing cultural dimensions. This is only possible at the end of this study, after the cultural dimensions of influence have been identified and confirmed. The presumed relation between ethical and economic valuation of patents is also under investigation and will be confirmed or discarded based on the results of the analysis in **Chapter 6**. The results of this study will then be utilized to elaborate the final model in section **8.3**.

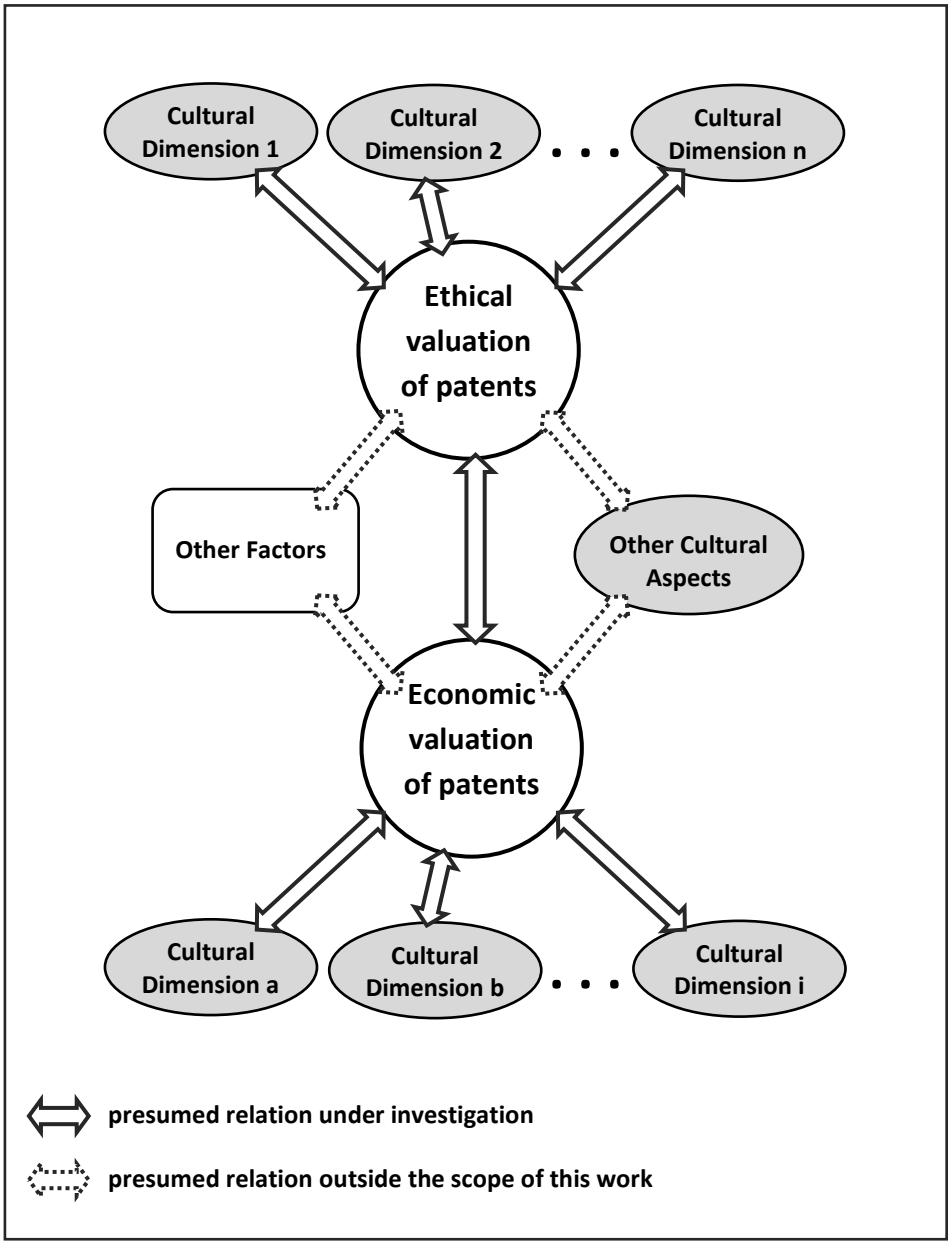

Figure 1: Conceptual model of cultural influence on patent valuation

The two types of arrows shown in the figure above distinguish the presumed relations under investigation from those that are outside the scope of this work.

The conceptual model constitutes, together with the research questions and objectives from the previous section **3.4**, the fundament for the choice of methods for the subsequent analysis of this investigation.

3.6 Summary

This chapter presented the literature review, how it was conducted and which results it provided. The review of academic literature touches on various theoretical fields, whereas the main fields are the concept of culture and the concept of value with regard to patents. It provides a definition of terms and what exactly is meant with culture and patent valuation in the context of this work.

Academic research works in the area of cross-cultural comparisons provide a theoretical framework that allows access to cultural aspects across different societies. The most relevant cross-cultural studies for this study are those of Hofstede (1980) and the GLOBE project (House et al., 2004). These are briefly introduced in section **3.2** as is the concept of cultural dimensions that is utilized in the further course of this work.

The terms “ethical value” and “economic value” are defined in section **3.3** in the context of this work and the main methods of economic valuation of patents are presented.

The literature review identified a knowledge gap that led to the formulation of the research questions and the research objectives for the present work in section **3.4**. It also resulted in a conceptual model in section **3.5** that constitutes the presumed influencing factors on ethical and economic patent valuation. The following investigation was undertaken with the goals, firstly to answer the research questions and secondly to validate and refine the conceptual model.

This is the basis for the following chapter, which explains the approach that was chosen to answer the research questions.

CHAPTER 4: PHILOSOPHY, METHODOLOGY AND METHODS

4.0 Introduction

This chapter describes the intellectual process that led to the choice of the research methods. These methods should comply with academic standards, they should be feasible and effective – and they should be in line with the researcher's philosophical standpoint.

A first section lays the foundation with the description of the principal relation between philosophy, methodology and methods. The following sections explain in a logical sequence this work's philosophical position, the rationale for the chosen methodology and the choice of methods. Section **4.4** presents an overview of the research design and the sequence of applied methods (see **Figure 5**). It also provides descriptions of the chosen data collection methods "semi-structured interviews" and "questionnaires", as well as the quantitative and qualitative data analyses methods. The chapter ends with a section concerning ethical considerations.

4.1 Relation between Philosophy, Methodology and Methods

A certain biased opinion regarding the choice of methods is already given by the way in which the literature is analysed, as it is influenced by the philosophical position of the researcher (see previous chapter). Thus, the philosophical standpoint predetermines both the literature review and the choice of methods - ideally, both fit together seamlessly. The conceptual model developed at the end of the previous chapter postulates an influence of cultural dimensions on ethical and economic valuation of patents. It also assumes a relation between both types of patent valuation. The choice of the methodology and the methods needs to comply with the requirements resulting from the research questions and objectives, but it also needs

to be in line with the framework determined by the conceptual model (**Figure 1**). Thus, the main objective of the chosen methods is to empirically validate the model.

The relation between philosophy, methodology and methods is explained efficiently by Easterby-Smith, Thorpe, & Jackson (2012). They use a metaphor of tree-rings to illustrate the link between ontology, epistemology, methodology and methods. The heart of the tree represents ontology, the next ring epistemology, followed by methodology and finally covered by methods and techniques, represented by the bark of the tree.

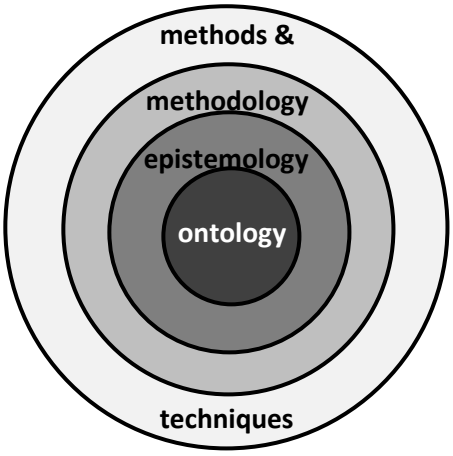

Figure 2: Relationship between ontology, epistemology, methodology and methods & techniques according to Easterby-Smith et al. (2012, p. 18).

The path from ontology to methods and techniques depends on the philosophical traditions or paradigms that one follows. Among these are positivism, post-positivism, critical theory, critical realism, hermeneutics, constructivism, pragmatism and others. Although there is no unambiguous relationship between the different steps from ontology to methods[13] and no compulsory path to follow, the respective philosophical paradigm plays a predetermining role when it comes to the choice of research methodology and methods.

[13] Easterby-Smith et al. (2012) use the terms "methods" and "techniques" synonymously, e.g. for data collection (interviews, questionnaires) and analysis (content analysis, narrative analysis, factor analysis). To avoid any confusion, this work only uses the term "method" consistently, but distinguishes, whenever appropriate, between two types of methods: "data collection methods" and "data analysis methods".

Before the next section, which describes this work's position regarding philosophical paradigm, ontology and epistemology, a brief digression into philosophical basics shall be made. Positivism and constructivism can be considered to be the most prevalent paradigms, even though both are perceived as irreconcilable opposites (Burrell & Morgan, 1979; Easterby-Smith et al., 2012).

The main idea of positivism is that reality is external and objective (ontological proposition) and that knowledge is based on observations of reality (epistemological proposition). Positivism goes back to Comte, who declared, *"there be no real knowledge but that which is based on observed facts"* (2000 [1853], p. 29). The observer holds an objective position when observing phenomena and any interference should (and can) be avoided. Positivist research is typically experimental with hypotheses and logical inference, such as deduction and induction. These two types of reasoning are commonly acknowledged as an appropriate means to attain theory from empirical evidence and vice versa. Inductive reasoning uses observation and provides the logical bridge from specific instances to general principles, whereas deductive reasoning predicts specific instances based on general principles. This relationship is illustrated in **Figure 3**:

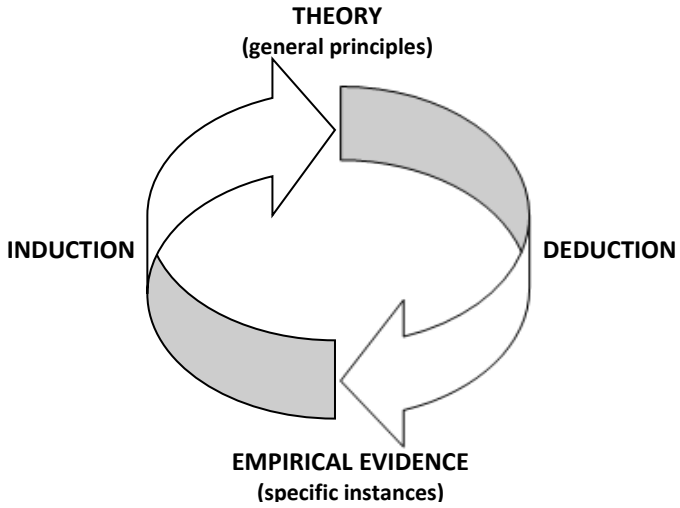

Figure 3: Relation between induction and deduction

A conjecture or hypothesis is a piece of unproven theory. A hypothesis itself does not emerge from nowhere, but is based on experience. These experiences are made of specific instances and are generalized into a hypothesis by inductive reasoning. A

hypothesis then uses deductive reasoning to predict specific phenomena, which are then observed. The prediction is therefore tested and the hypothesis can be proven or rejected by means of inductive reasoning (Popper, 2002 [1935]).

Many prominent scholars question the main advantage of positivistic approaches in scientific research - the assumed objectiveness. Habermas (2005) critiques "*the positivistic self-understanding of the sciences*" (2005, p. 320) and argues that objectivism is destroyed by "*the connection of knowledge and interest*" (2005, p. 320).

In contrast, the constructivist paradigm assumes that reality is constructed by a collaboration of our minds with the outside world (Morin, 1986). Our individual reality and meaning are always a construction of our perception and our memory (based on earlier perceptions). Perception and memory are always subjective and knowledge cannot therefore provide an objective image of the real world, but a subjective construction that "matches" the world. Constructivists believe that our understanding of the world depends on our interpretation, which is coined by our language and social environment. There is always interdependence between researcher and subject (von Glasersfeld, 2005).

Following the model depicted in **Figure 2**, the constructivist position matches with relativist ontology and subjectivist epistemology. Ontological relativism takes the view that there is no absolute truth, but truth depends on the viewpoint of the observer. Therefore, truth is subjective; there are many truths, reflecting differences in individual perception and consideration. The truth of each statement cannot be proved because it is based on conditions whose truth is again based on conditions and so forth. A secure knowledge of the world is impossible (Baghramian & Carter, 2016).

The broad scale that is spanned between positivism and constructivism provides enough space for most researchers to find a position within its borders with which they can identify. Furthermore, many researchers combine methods derived from

both philosophical traditions, positivism and constructivism, which is contested by some scholars, but supported by others (Easterby-Smith et al., 2012).

4.2 Own Philosophical Standpoint

A researcher's philosophical position influences, if not predetermines, the choice of methods for a given research endeavour. Therefore, a researcher should clearly determine his or her position in order to be conscious of the resulting influence and also be transparent about their choice towards the outer world.

The researcher's philosophical standpoint derives from personal convictions and opinions that are founded in own experiences, findings and reflections. Ontology concerns existence and reality and basically asks the all-embracing question "*what exists?*", whereas epistemology concerns knowledge and asks "*what can we know about it?*" This researcher's ontological and epistemological positions are characterized by the belief that nothing is absolute, all is relative and that nothing is objective, but all is subjective. The real world exists or may only exist in our imagination, or even only in one's imagination and there is no means to prove whether or not. Both, the inner world, i.e. the world of subjective experience (Solms & Turnbull, 2002), and the outer world are subject to perpetual change. The world is changing constantly and so do we. We are always changing due to daily experience, learning (and forgetting), successes and setbacks. This is expressed concisely by the famous aphorism assigned to Heraclitus (also spelt Heracleitus) of Ephesus: *"everything flows"*[14]. It is difficult to believe that something exists in absoluteness if it is undergoing transformation processes permanently. In any case, our intellectual capabilities and sensory organs can only understand at best a portion of the representation of the real world. The better the knowledge, the better it fits to the observed phenomena and the better the forecast that it provides when applied.

[14] This phrase cannot be traced back to a direct quotation, but it was Plato who stated that it was "*the opinion of Heracleitus, that all things flow and nothing stands"* (Plato, 2008 [360 BC], p. 55).

Creating knowledge can happen through a broad variety of approaches and methods but reliability may vary. There is nothing that is absolutely true. This sentence is a contradiction in itself, just like the famous phrase attributed to Socrates, "*I know that I know nothing*". Although it is unclear whether this sentence was formulated by Socrates (or Plato) and whether the creator meant it in the way it is commonly interpreted (Fine, 2008), it fits quite well with this work's epistemological position. This does not mean that science is invalid or worthless. In fact, science is the best way to progress, to advance technology and to create new knowledge, even if knowledge is neither absolute, nor objective.

Objectivity and Free Will

A precondition for objectivity is free will, because how could we take objective decisions or hold objective views if our will is influenced by something that is unconscious and beyond our control? Consequently, one's opinion about free will and the process of decision-making is essential for the question of whether one's epistemological position is objectivist or subjectivist.

We know from experience that in some situations it is harder to make decisions than in others, and we also know that some people seem to have difficulty making decisions in general while others seem to decide quickly and easily. Apart from individual differences based on personality and thus related to psychology, there are common characteristics of decision-making that can be better explained by neuroscience.

People, who do not feel pain, e.g. due to a genetic pain disorder, are deprived of an important protective mechanism and risk injuring themselves unintentionally (Gerritsen, 2009). Analogous to this, people with an emotional disorder, e.g. caused by a brain injury suffered in an accident, may make self-damaging decisions (Damasio, 1994). There is a clear connection between emotional disturbances and the inability to decide, an apparently inextricable link between rational decision-making and feelings. Neuroscience provides evidence that the ability to make decisions is

influenced by “somatic markers” that are a kind of automatic system for evaluating predictions within our brain:

> "*Somatic markers are a special instance of feelings generated from secondary emotions. Those emotions and feelings have been connected, by learning, to predicted future outcomes of certain scenarios.*" (Damasio, 1994, p. 174)

Negative somatic markers exclude alternatives with a potential damaging outcome from further evaluation, thus reducing the alternatives from which to choose. Conversely, positive somatic markers foster alternatives with an expected rewarding outcome. The judgement as "damaging" or "rewarding" is based on our experience. The decision-making process is influenced insofar as our emotional memory acts as an automatic corrective when mentally simulating different alternatives. As part of this process, emotions that would be triggered by specific decisions are also simulated and taken into account, often un-consciously (Damasio, 1994).

Decisions are related to emotions, they cannot be objective or purely rational. Thus, decisions are always subjective, not based on facts, but based on interpretations of facts and emotion related experiences.

The discourse about decision-making raises two very closely related questions; whether the world is deterministic and whether human beings have free will. Determinism is seen by many scholars as contradictory to the existence of free will (Franklin, 1968). Indeed, causal determinism in its purest form postulates that, if the position and movement of all particles in the universe were known exactly, the future could be predicted completely (Laplace, 1995 [1814]) and consequently leaves no space at all for non-causal decisions and thus free will. This absolute predictability was questioned in the following century by two emerging theories in particular; quantum mechanics and chaos theory. Quantum mechanics affirms that reality is not determined in absolute terms, but in terms of probabilities. Heisenberg's uncertainty principle states that the precision to predict events on a particle level is limited as a matter of principle, e.g. that the more exact a particle's position can be measured, the less exact its momentum can be determined, and the other way around

(Heisenberg, 1927). Consequently, quantum mechanics constitutes a severe challenge for adepts of determinism. However, if we think of determined probabilities instead of determined events we can still maintain the idea of determinism. One representative of such a position is Hawking:

> "*Quantum physics might seem to undermine the idea that nature is governed by laws, but that is not the case. Instead it leads us to accept a new form of determinism: Given the state of a system at some time, the laws of nature determine the probabilities of various futures and pasts rather than determining the future and past with certainty*." (Hawking & Mlodinow, 2010, p. 72)

In a different way than quantum mechanics, but similarly in terms of non-predictability of events, chaos theory weakened the convincibility of determinism. Chaos theory, most commonly known through the butterfly effect, although deterministic in its mathematical sense, explains the unpredictability of real life in practice, independent of whether the world is deterministic or not (Lorenz, 1963, 1972).

There are a number of varieties of determinism, where some are in fact compatible with the concept of free will, denoted as compatibilism (Doyle, 2011). This research is of a determinist nature in Hawking's sense as stated above, i.e. acknowledging that our predictions need to take into account probabilities, irrespective of how precise the available data are. In any case, one would object to the idea that human will can be really free. Many people insist that their will is free and would judge a negation of the existence of free will as a humiliation of their self-perception. Nobody wants to be a robot and the idea of just following a pre-defined destiny is not very attractive. However, if we look a little deeper into the question of what free really means in this sense, we may come to another conclusion. The term “free” has an absolutely positive connotation, especially in Western cultures: unbound, not enslaved, not incarcerated, not oppressed, not dominated. A free person can do what they want, not limited or constrained by any other person. Nonetheless, a "free person" would not complain of "non-person-related" limitations such as gravity. Hence, freedom is

just the absence of limits imposed by other people. Free will would not demand the absence of reason. In fact, our will (as our decisions) is based on (and determined by) beliefs, convictions, available information, experience, emotions, etc. Certainly, we are not fully aware why we make a specific decision as a significant part of the underlying reasons are unconscious or subconscious. Nonetheless, this does not mean that there are no reasons behind and no conflict with human self-perception if our will and judgement is based on who and what we are. An absence of reason would mean totally random and thus arbitrary decisions. This would not be the kind of freedom that partisans of a "free will" have in mind and that they defend against determinism.

The popular saying, "*man can do what he wills but he cannot will what he wills*", cited by Einstein in this formulation in a journal interview (Viereck, 1929, October 26) and in a recorded speech (Einstein, 1932), was actually phrased by Schopenhauer slightly differently, but with the same meaning:

> "*You can do what you will, but in any given moment of your life you can will only one definite thing and absolutely nothing other than that one thing*" (Schopenhauer, 2012 [1839], p. 24)

Hawking & Mlodinow (2010) expressed a similar opinion more simplistically: "*free will is just an illusion*" (2010, p. 32). As well as from quite a philosophical perspective, modern neuroscience supports the view that human will is not free from constraints, reasons and limitations. Popper & Eccles (1984) tried to phrase a common view of philosophy and neuroscience:

> "*That is to say, a range of possibilities is brought about by a probabilistic and quantum mechanically characterised set of proposals, as it were – of possibilities brought forward by the brain. On these there then operates a kind of selective procedure which eliminates those proposals and those possibilities which are not acceptable to the mind*." (Popper & Eccles, 1984, p. 540)

This statement fits very well with Damasio's (1994) theory of somatic markers, described above. The latest findings from neuroscience support the belief that our

brain's mode of operation leaves no space for non-causal interactions that could result in non-causal decisions or could be called manifestations of "free will":

> "*However, modern neuroscience and psychology can demonstrate that our intentions to act and to execute voluntary actions are guided by the interactions of conscious, preconscious, and fully unconscious motives, deriving from cognitive, executive, and emotional-limbic brain centres. During the entire process of preparation and execution of voluntary actions, there is no 'causal gap', in which an immaterial force could become determinative*." (Roth, 2010, p. 231)

To summarize the above, there is a lot of evidence that mankind does not dispose of "free will" in the sense of cognitive abilities that are unswayed by influences outside our control. Prerequisites for reasoning, decision-making and personal views to be called "objective" are just not fulfilled. We therefore need to accept that our knowledge about the world is subjective.

Knowledge creation

How is knowledge created? The starting point of a knowledge creation process is phenomena that feature certain properties. These could be described by data, to use a term as neutral as possible. Only through our perception is this data transformed into information. For example, one of the properties of a glass of water is its thermal energy, our senses can judge whether it is cold or hot, or we can measure the exact temperature and therefore produce information. By reflecting on this information, we can come to conclusions and consequently create knowledge.

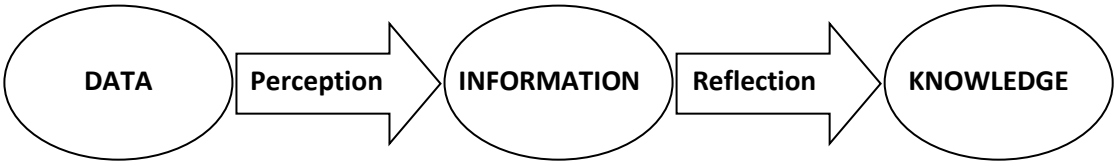

Figure 4: From data to knowledge

Reflections involve decision-making, influenced by experiences and emotions. Our perceptions, as well as our reflections, are subjective and interpretative. The step from information to knowledge requires a creation of meaning. Statistical data or behaviour of others can mean different things, dependent on interpretation. Critical thinking and questioning, i.e. reflecting, is always necessary when creating meaning from information. Consequently, our knowledge is necessarily subjective and interpretative. The process of reflection itself was subject to detailed scholarly work conducted by Schön (1983). He described “reflection-in-action” as a step-by-step approach that follows a kind of decision tree. Different options are considered, whereas the consequences of the different alternatives are compared and weighed, i.e. different possibilities are simulated. Such a simulation can consider a limited number of steps in advance, but then it is necessary to make a decision about one of the alternative paths. One of the options is chosen and the process advances one step further. From this step onwards, mental simulations are performed until a satisfactory answer or solution is found. In the end, this answer is just one of many uncountable possible alternatives and there is no means to judge whether it is the best. Simulations are based on available information, personal experience and the ability to make decisions. The process of reflection involves decision-making on a deep level. As described above, decision-making is always subjective, which is in line with the statement about the subjectivity of knowledge creation in general.

Another influencing factor that is highly subjective is language. Our capabilities to express ourselves towards others are limited by our language, not because specific words are missing (this could be overcome by creating new words), but because language is principally subjective and interpretative. Dewey stated, "*thinking is impossible without language*" (1997 [1910], p. 170). It is important to add that he refers to language in the broadest sense, including gestures, images, and any kind of signs. That means, he does not deny deaf-mute people, babies or even animals of being capable of thinking. Although language is a necessary precondition for thinking, it inherently delimits our epistemological capabilities:

> "*The limits of my language mean the limits of my world*." (Wittgenstein, 2003 [1922], p. 119)

Apart from the more general conclusion that the influence of language is another reason for the subjective nature of knowledge, this has also some very practical consequences for the choice of methods for this research work. It needs to be taken into consideration that even basic terms are not easy to translate into different languages without impacting their meaning. This is especially important in a multi-cultural and multi-lingual environment and academic endeavour.

Knowledge creation through academic work can be seen as "swarm" intelligence; each work is very much limited on its own and is just a collection and reconfiguration of other works. However, all works taken together compose "intelligence", i.e. substantial knowledge and progress, just as a single product is built of many parts and based on numerous precursors. For example, for the production of a car not only the items are produced, but also the machinery for their manufacture and the machinery for the extraction of raw materials and the machines and tools for the production of more complex machines. Ultimately, the sum of all (or almost all) current abilities of mankind is inserted into a complex product. Analogue, the sum of scientific work builds up our current scientific knowledge.

The explanation above reflects the opinion concerning knowledge creation and how scientific progress works for this research. It also shows certain cautiousness in relation to supposed objective "facts", i.e. the importance of verifiable evidence and the awareness that knowledge is subjective. Reality can never be perceived and described exactly; it is always an approximation. In mathematics, there is a line, a point or a cube, but in reality, there are only approximations of lines, points or cubes. Sometimes the approximation is so close we cannot perceive any imperfection. Modern science is able to measure that there are imperfections but measurements are never absolutely exact on principle. This restriction is valid even without limitations of language and culture.

Was Newton right with his law of universal gravitation? Yes, certainly, even if Einstein's general theory of relativity proved it partly wrong in the presence of very strong gravitational fields. Was Einstein right with his theory? Certainly, but somebody may provide an even better explanation for some phenomena. Scientific progress can only provide a constantly improving approximation towards reality.

This standpoint fits very well with a subjectivist epistemology, where all knowledge is based on subjective mental constructs that aim to explain observed (or measured) phenomena. The explanations in this section also substantiate the ontological position of this research as relativist and depict a clear constructivist picture.

In conclusion, it can be said that personal convictions, outlined in the two paragraphs on "objectivity and free will" and "knowledge creation", substantiate this work's relativist ontology and subjectivist epistemology. Both clearly represent a constructivist worldview.

The researcher's philosophical standpoint (pre)determines the methodology applied on a research project, according to some scholars, e.g. Burrell & Morgan (1979) and Guba (1987). However, there does not appear to be an imperative link between positivism and quantitative data analysis or between constructivism and qualitative data analysis. There is a natural fit or tendency to believe, that there are methodological implications of different philosophical positions, but this research follows Easterby-Smith et al. (2012) who argue that mixing paradigms can be justified and even beneficial, dependent on the case (2012). This opinion could also be considered to be constructivist and provides just another argument for the researcher's position.

4.3 Methodology

According to the model of Easterby-Smith et al. (2012), depicted in **Figure 2**, once the ontological ("*what is the nature of reality*?") and epistemological positions ("*what can we know about it*?") are clear, the next step is to select the appropriate methodology to answer the question, "*how can we get knowledge about it*?" The previous section argues that the choice of methodology for a given research endeavour should be based on the researcher's philosophical standpoint, but should also take into consideration the specific requirements of the concerning research questions.

The constructivist worldview, which is shared by this research, enables the application of a diversity of methods as it seeks to gather multiple views of the observed phenomena. A mixture of qualitative and quantitative methods might even be useful, e.g. in order to apply a triangulation (Easterby-Smith et al., 2012).

In general, it is agreed that the more a research question is related to human beings, the more appropriate is qualitative data analysis. However, there are examples where quantitative data analysis is successfully used even though the research subject deals very much with people, e.g. cross-cultural studies carried out by Hofstede (1980), WVS (Inglehart, 2004) and GLOBE (Chhokar, Brodbeck, & House, 2007). Whether quantitative data analysis makes sense in social sciences or not depends on the exact research question.

The question of whether to use quantitative or qualitative data research methods is regarded almost as a question of "scientific faith", as if both were contradictory. Certainly, there are preferences, based on personal philosophy and on the type of research, but in general, quantitative and qualitative scientific work should go hand in hand. Kuhn (1961) states:

> "*large amounts of qualitative work have usually been prerequisite to fruitful quantification …*" (1961, p. 162)

Most research inquiries produce some kind of numerical data or data that can easily be transferred into numbers. Therefore, quantitative data needs to be dealt with in

many qualitative research approaches (Robson, 2011). Quantitative research relates to the empirical investigation of topics using statistical analysis. Its aim is to develop theories and models that explain the rules and phenomena that characterize these topics. Measurements are crucial for quantitative research as they indicate the relationship between observation and theory or a model. Typically, data is collected from a representative sample, statistically analyzed and then used to draw conclusions in general (Given, 2008), whereas inductive, deductive and abductive reasoning are the three main types of logical inference (Balnaves & Caputi, 2001).

Mixed Methods Research

Based on the constructivist position of this research and the conviction that the research questions play a major role in the choice of the conceptual structure; this work uses a combination of quantitative and qualitative research data that has become an established approach in social sciences and is commonly known as *Mixed Methods Research* (MMR).

This methodology fits well into a constructivist worldview (Easterby-Smith et al., 2012) and offers a broad portfolio of methods to choose from. The view that, within a given methodological frame, the research questions determine the research methods is supported by many proponents of MMR, e.g. Bryman (2006) and Tashakkori & Teddlie (2010), but not limited to this group of scholars. Silverman (2015), albeit reserved about MMR, argues that the research questions ultimately determine the most appropriate method to use.

Johnson, Onwuegbuzie & Turner (2007) presented 19 different definitions of MMR whose common denominator is that MMR is a methodology which involves quantitative and qualitative research methods. Creswell (2013), one of the most influential proponents of MMR, provides the following definition:

> "*Mixed methods research is an approach to inquiry involving collecting both quantitative and qualitative data, integrating the two forms of data, and using*

> *distinct designs that may involve philosophical assumptions and theoretical frameworks.*" (Creswell, 2013, p. 4)

Advocates of MMR, such as Creswell (2013), argue that this methodology provides a better understanding of the phenomenon under investigation than a quantitative or qualitative approach alone. One of the guiding principles of MMR is methodological eclecticism, i.e. researchers select the most appropriate qualitative and quantitative research methods from the body of existing techniques (Tashakkori & Teddlie, 2010).

Some scholars take the view of "incommensurability", i.e. that the mixing of methods from different paradigms is impossible: "*one cannot operate in more than one paradigm at any given point in time*" (Burrell & Morgan, 1979, p. 25). Guba (1987) is one of the most cited advocates of the incompatibility of the underlying paradigms of qualitative and quantitative methods, because "*one precludes the other just as surely as belief in a round world precludes belief in a flat one*" (1987, p. 31). Sale et al. (2002) argue that "*the quantitative and qualitative paradigms do not study the same phenomena*" (2002, p. 49) and therefore the combination of both is not a legitimate option, either for triangulation, or for complementarity purposes. Other scholars reject the incommensurability of paradigms and instead support a "compatibility thesis" (Howe, 1988; Tashakkori & Teddlie, 2010).

The long-standing dispute between advocates of qualitative and quantitative research is echoed in the division among scholars about the appropriateness of MMR, which can be considered counterproductive for progress in social sciences (Onwuegbuzie & Leech, 2005). Johnson & Onwuegbuzie (2004) list numerous critique points of MMR that are a subject of academic debate and counter argument. They outline the strengths and weaknesses of qualitative and quantitative research methods and conclude that combining them can "*incorporate the strengths of both*" (2004, p. 23) and propose that MMR can "*bridge the schism between quantitative and qualitative research*" (2004, p. 15). They further argue that both research paradigms are at extreme ends of a continuous scale with MMR in between:

> "*If you visualize a continuum with qualitative research anchored at one pole and quantitative research anchored at the other, mixed methods research covers the large set of points in the middle area.*" (Johnson & Onwuegbuzie, 2004, p. 15)

Today, MMR is supported by a large number of proponents and has become a widely accepted practice. Many scholars recognize its advantages and, like Mason (2002), see a technical challenge for the researcher who needs to develop competencies in very different methodical areas.

The alleged advantages of MMR range from "*reducing bias while adding credibility*" (Muskat, Blackman, & Muskat, 2012, p. 9) through the increased probability "*of unanticipated outcomes*" (Bryman, 2006, p. 11) to the ability to "*provide superior research findings and outcomes*" (Johnson et al., 2007, p. 129). MMR is frequently applied in a sequential mode, a "*phase-model*", where a hypothesis is generated by means of qualitative research methods and subsequently quantitative research methods are used to test the hypothesis (Kelle & Erzberger, 2004). Alternatively, MMR is also used for "*triangulation*", a term defined by Denzin (1973) as "*the combination of methodologies in the study of the same phenomenon*" (1973, p. 297). Denzin (1973) suggested between-method triangulation in order to neutralize potential bias inherent in any single method. Kelle & Erzberger (2004) argue that triangulation provides insight into different angles and thus depicts a more complete picture of the phenomenon of interest.

As a MMR approach has been chosen for this research, it is expected that the combination of methods for quantitative and qualitative data analysis will prove advantageous. Specifically, the research will undertake both methods in a sequential order to address the research questions in the best way. The exact methods and sequence selected are outlined in the following section.

4.4 Choice of Methods

Mixed Methods Research propagates a combination of quantitative and qualitative research methods. How can the research questions defined in section **3.4** benefit from this broad spectrum of methods? This work investigates cultural influence on the concept of patents and subsequently on their economic and ethical valuation. Which method is appropriate to gather data that captures cultural differences, specifically in terms of attitudes towards patents? It seems advisable to examine other research into cultural differences. Influential cross-cultural studies, such as Hofstede (1980), Trompenaars & Hampden-Turner (1997), WVS (Inglehart, 2004) and GLOBE (House et al., 2004), used survey questionnaires as their method of choice. These works related closely to non-quantifiable parameters such as personal judgement and valuation, opinions and beliefs. Gathering large volumes of qualitative data can constitute a particular challenge when it comes to data analysis. Hofstede (1980) overcame this challenge by transferring non-quantifiable parameters, such as personal opinions, into quantitative empirical data using Likert scales retrieved from individual ratings on a number of statements and questions. These scales provided quantitative data that could be statistically processed and analyzed. The survey items were developed beforehand based on existing cross-cultural theory, i.e. through an intense review of available literature, followed by factor analysis of results from first survey rounds (Hofstede, 1980). The initial creation of “survey item candidates” can be considered to be a qualitative method, whereas the factor analysis and the statistical analysis of the final survey results are clearly quantitative methods. Thus, Hofstede’s approach is an early example of applied MMR in cross-cultural studies. Other scholars in this area adopted similar approaches, e.g. the GLOBE project elaborated survey items through literature review, interviews and focus groups. Hence, qualitative methods were used to create the survey items and subsequently the data generated by means of the questionnaire was statistically analyzed (House et al., 1999). As with Hofstede’s approach, the GLOBE project’s approach also constitutes MMR. Both created questionnaire items based on theory (literature review) and expert know-how, gathered through qualitative data collection methods.

The qualitative data provided evidence from practitioners and a stronger academic foundation than a pure theory based approach.

Following a constructivist approach, the aim is to construct knowledge about cultural influence on patent valuation by means of existing scientific knowledge (literature review) in combination with information gathered with the help of an appropriate survey benefitting from the personal experience of the greatest possible number of professionals. **Figure 5** provides an overview of the research design chosen for this work and the applied methods:

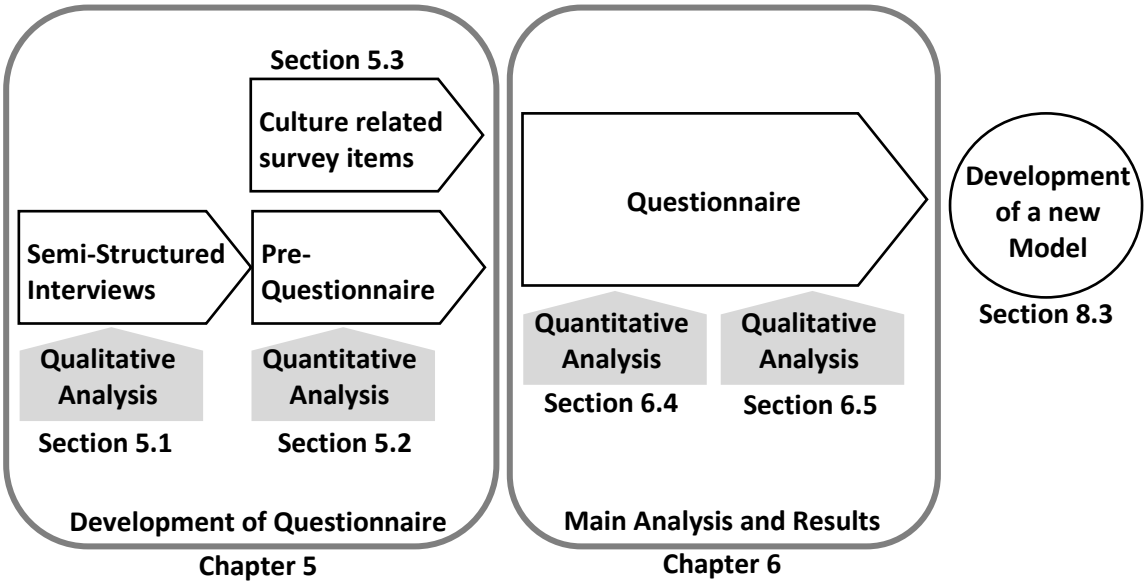

Figure 5: Research design and sequence of applied methods

The research is conducted in two phases. A questionnaire is developed in the first phase (see **Chapter 5**), which is then utilized in the second phase for the main analysis (see **Chapter 6**). The findings from the literature review described in **Chapter 3** provide the starting point for the applied methods. They also led to the research questions and the conceptual model (**Figure 1**) that serve as guidelines for this work. The first data collection method applied is semi-structured interviews. The qualitative data obtained is analyzed and builds the basis for the creation of survey items that are subsequently tested with a pre-questionnaire. The collected quantitative data is analyzed and provides the input for the patent related part of the final questionnaire. The selection of the culture related survey items for the final questionnaire is described in a separate section. A combination of both parts forms the questionnaire

used as a data collection method in the following. The obtained quantitative and qualitative data is analyzed and the results constitute the basis for the discussion in **Chapter 7** and the development of a new model in **Chapter 8**.

The rationale for the choice of the research design depicted in **Figure 5** is based on its theoretical suitability described in section **4.3** and its practical feasibility. It is a customized MMR approach, tailored to the specific requirements arising from the research questions.

"Interviews" was one of the methods applied to create items for the GLOBE survey (Hanges & Dickson, 2004) and is a common method for developing survey content (Onwuegbuzie, Bustamante, & Nelson, 2010). In general, the combination of interviews and questionnaire surveys is frequently used in the area of MMR (Bryman, 2006; Morse, 2010). For this work, it seems advisable to follow the GLOBE project's example and apply "semi-structured interviews" (section **5.1**) as a qualitative data collection method to develop survey items that are subsequently used for a "questionnaire" as a method for quantitative (section **6.4**) and qualitative data collection (section **6.5**). The GLOBE project conducted a pilot survey in order to test the developed survey items before the final questionnaire was created (Hanges & Dickson, 2004). On a smaller scale, this work also conducts a kind of pilot survey in the form of a "pre-questionnaire" (section **5.2**). This is considered an important measure to ensure the quality and appropriateness of the final survey. In contrast to GLOBE, the final questionnaire also collects personal comments so that a qualitative data analysis can provide additional insights and allow triangulation of the results.

The GLOBE project's example has been chosen for several reasons. Firstly, for its strong theoretical foundation – it involved 170 researchers from 62 countries and took into consideration all the relevant work that had been conducted up until then, e.g. studies from Kluckhohn & Strodtbeck, Hofstede, Trompenaars, Triandis, McClelland, Schwartz and others (House et al., 2004). In essence, the GLOBE project investigated cultural impact on leadership, whereas this work investigates cultural impact on patent valuation. There are therefore analogue structures in the research logic, which is why the GLOBE approach fits in principle to the research questions of

this study. Of course, the size and objectives of the GLOBE project are incomparable with those of this work. However, the research approach is highly scalable and judged feasible, although on a much smaller scale. Another main advantage of the GLOBE approach is the possibility of taking over and reusing parts of the GLOBE survey items that are publicly available for researchers (GLOBE, 2006a). This would help to limit the complexity of this work and narrow it down to a feasible size. Also, the survey items created according to the GLOBE approach would fit together seamlessly with the survey items taken over from GLOBE, so that they could be used in one combined questionnaire. In spite of the similarities, the GLOBE approach is not only downsized, but also adapted to the specific needs of this work.

The main methods for data collection and data analysis applied for this study and depicted in **Figure 5** are described in more detail in the following paragraphs.

Semi-structured Interviews

Semi-structured interviews were chosen as a qualitative data collection method, because they provide an advantage that is especially beneficial for this research work: a greater flexibility in design and execution. This allows for the greatest possible adaptations to the specific requirements of the topic, objectives and situation (Horton, Macve, & Struyven, 2004).

The semi-structured interviews followed a clear agenda and target, but left space for the discussion to unfold and develop. The goal was to collect a broad spectrum of individual opinions and experiences. Semi-structured interviews are a widely used means for qualitative data collection with very different applications in a broad spectrum of contexts. They provide interviewees with the freedom to express their opinions and thoughts in their own words and they encourage self-reflection. It is more likely that they will openly express their viewpoints than in a questionnaire or a structured interview (Flick, 2009). Interviewees have a subjective theory about the topic under discussion, which includes explicit and implicit assumptions. Thus, the questions that were asked were designed in such a way that they would help to

reveal this knowledge and reconstruct the interviewee's subjective theory (Flick, 2009).

The actual application of semi-structured interviews in this work aimed to generate survey items for the questionnaire, particularly for the patent related part of the questionnaire, because the culture related part was taken from the GLOBE project (refer to section **5.3**). However, the aim of the interviews was not to create ready-made survey items, but to produce insights concerning the essence of different positions towards patents, how these positions become manifest and how they could be measured. In this way, these findings were utilized to create and phrase the survey item candidates for the pre-questionnaire. There was also sequential learning during the interviews. Each interview added insights that were applied in the subsequent interviews, so that findings could be accumulated. One of the advantages of semi-structured interviews is that they provide enough flexibility to modify the interviews during the process, although the interview guide was left largely unchanged throughout all interviews.

The detailed application of this method and the related analysis are described in section **5.1**.

Questionnaires

There are many types of questionnaires that can be used as a data collection method for both, qualitative and quantitative data, dependent on the questionnaire design. One of this method's advantages is its flexibility. This work's questionnaire includes a **field for personal comments** in order to generate some quantitative data, but first of all it should provide quantitative data that can be statistically processed and analyzed. Therefore, the related questions cannot be open, but need to be closed (Robson, 2011). For a more differentiated statistical analysis, the possible answers are not limited to "yes" or "no", but use **Likert items**. Likert items are relatively easy to analyze and questions can be formulated in an easily understandable manner. Thus, unnecessary sources of error can be avoided in advance.

Hofstede (1980), as well as the GLOBE project (House et al., 2004), used questionnaires consisting of Likert items to gather personal opinions in a quantitative data format. Several Likert items form one Likert scale (more precisely "Likert-type scale"), which then provides the enquired parameter for further considerations (Likert, 1932). Likert items are very commonly used in questionnaires, e.g. the WVS (WVS, 2005) also used them for parts of their survey. The main advantage of a Likert scale is its ability to produce quantitative data that can be statistically analyzed from inputs based on subjective opinions and judgements that otherwise would be difficult to collect and analyze. Its main characteristics can be explained best with an example:

At this university, mixed methods research is considered scientifically sound.						
strongly agree			neither agree nor disagree			strongly disagree
1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐

Figure 6: Sample of a Likert item

Figure 6 shows a 7-point Likert item that asks the respondents to mark one of the 7 points ranging between "strongly agree" and "strongly disagree". This Likert item could be combined with several others to form one Likert scale that is part of a questionnaire used, for example, in a survey among students about their perceived acceptance of different research methodologies. A common characteristic of Likert items is that they consist of 4 to 10 points on a range between two opposite positions. Items with an odd number of points include a mid-point with a neutral position. A neutral position is sometimes avoided to "force" respondents to decide whether they incline more to one or the other position.

Studies have found that results do not differ significantly if the scales have a neutral position or not (Guy & Norvell, 1977) and that the optimum number of points per item depends on several factors, such as the topic and the number of items per scale (Green & Rao, 1970). Dawes (2008) compared 5-point, 7-point and 10-point items and concluded that they all produced very comparable data that could be easily transferred from one format to another and that the number of points per item did not significantly influence statistical characteristics like mean, skewness and kurtosis.

Another study concluded that 7-point Likert items seem to be slightly more reliable than 5-point Likert items (Munshi, 2014). The latter statement is relevant to this work, because Hofstede (2001) used 5-point items, whereas the GLOBE project used 7-point items (GLOBE, 2006b). This supports the decision to follow the GLOBE project's example and use **7-point Likert items**.

The recommended number of items per scale varies. Norman suggests 4 to 8 items per scale (2010), Carifio & Perla propose 6 to 8 items (2007), Hofstede & Minkov (2013) used 4 items per scale and, according to the GLOBE project (GLOBE, 2006c), a reliable Likert scale should be built of at least 3 to 5 items. Hence, the goal for this study was to create **at least 4 Likert items per scale**, whereas in the beginning more "candidate items" were created. These were subsequently reduced during the pilot phase ("pre-questionnaire") in order to ensure quality, effectivity and statistical reliability.

The final questionnaire contains patent related Likert items and culture related Likert items. The patent related items were created beforehand by means of the interviews and tested and improved by the pre-questionnaire whereas the culture related items were taken from the GLOBE project. The use of appropriate cultural dimensions, defined by GLOBE, draws on well-established cultural dimensions and related definitions and scales, which have also been adopted by other scholars (Bertsch, 2012; McCrae, Terracciano, Realo, & Allik, 2008; Radder, 2013). Thus, this work benefits from strong academic foundations. The questionnaire is composed of four parts in order to address the research questions:

- Part 1 concerns ethical valuation of patents. A number of specific statements about patents are rated on a scale from 1 to 7 (representing levels of agreement). The results reflect the participant's notion related to the ethical value of patents, from a "weak patent view" to a "strong patent view".

- Part 2 is about the economic value of patents. A sample of some simple patents will be roughly valuated on a scale from 1 to 7 (representing bandwidths of economic value). Given the difficulty of evaluating how much a patent is "worth",

this part does not try to provide an exact value, but to assess a participant's tendency to assign low or high economic values to patents.

- Part 3 investigates cultural dimensions that are suspected of influencing the notion of intellectual property (refer to section **5.3**). The related 7-point Likert items are reused from the GLOBE project (GLOBE, 2006b).

- Part 4 consists of a field for personal comments. These comments, together with other comments received unformatted by e-mail in the course of the survey, provided the qualitative data collected by means of this questionnaire.

The development of the final questionnaire is described in dedicated sections in **Chapter 5**, the analysis and results of the data collected by means of the questionnaire are the subject of **Chapter 6**.

Quantitative Data Analysis

Statistical analysis as a quantitative data analysis method was applied twice: firstly on the pre-questionnaire and secondly on the final questionnaire.

The pre-questionnaire is used as a pilot to ensure the quality of the survey. Special attention was given to the consistency within the set of items of a scale. Item candidates were tested and the most appropriate ones, concerning their contribution to the scale efficiency and reliability, were selected for the final questionnaire. For this purpose, several statistical functions available in SPSS were used (means, variances, Spearman's rank correlation coefficient rho, Cronbach's alpha).

The results of parts 1 to 3 of the final questionnaire were also statistically analyzed utilizing appropriate software (SPSS). Again, a number of statistical functions were applied (intra-class correlation, analysis of variance, Spearman's rank correlation coefficient rho, linear regression, Cronbach's alpha). The main interest here was whether, and to what extent, the three parts correlate to each other. The aim of this investigation is to find out, not only whether culture has an influence, but also which

cultural dimensions correlate to ethical and economic valuation and how pronounced these relations are.

Qualitative Data Analysis

Qualitative data analysis was applied on the semi-structured interviews and on the qualitative data derived from the questionnaires. The pre-questionnaires also produced a certain amount of qualitative data from participants, such as hints, ideas and suggestions. However, this data was not “analyzed” in a specific way and instead the resulting findings emerged directly through discussion and reflection. Therefore, this paragraph relates only to the qualitative data collected with the semi-structured interviews and the final questionnaires. The principal proceeding was the same for both analyses, although the volume and the structure of the data were very different.

There are numerous methods of retrieving relevant information from text. Tesch (1990) presented a systematic overview of 28 types of qualitative research, organised into 4 groups. However, many of these methods are not clearly defined and sometimes their meaning overlaps or is applied in different ways. One method of special interest for the analysis of semi-structured interviews is the "Gioia Methodology" (Gioia, Corley, & Hamilton, 2013). It is becoming increasingly important in qualitative research (Baker, Powell, & Fultz, 2017) and follows a very systematic and rigid approach. One can say that this inductive method is a further development of "grounded theory" (Glaser & Strauss, 1967). It is specific in the combination of viewpoints from informant and researcher; it applies a “*tandem reporting of both voices*” (Gioia et al., 2013, p. 18) in the form of an informant-centric “1st-order” analysis and a researcher-centric “2nd-order” analysis. However, this method is relatively time- and resource-intensive, so that it is very often carried out by research teams (Gioia et al., 2013). It is best suited for purely qualitative research and for topics relating to areas of organisational research; it is designed to capture “*concepts relevant to the human organizational experience*” (Gioia et al., 2013, p. 16).

Hence, although an interesting approach, it is judged complex without being most suitable for the given objective.

Schmidt (2004) recommends researchers to create their own mode of analysis that best suits the available data and the research objective. For the qualitative data analysis in this work an approach is chosen and adapted to specific needs, based on a method described by Burnard (1991) as “thematic content analysis”, which he used for categorization and codification of qualitative data from semi-structured interviews. Thematic content analysis can be seen as an intermediate approach that combines elements from “thematic analysis” (Guest, MacQueen, & Namey, 2012), which is itself mainly based on the “grounded theory” approach developed by Glaser & Strauss (1967) and “content analysis”, a method that is widely used for analysing textual data of different kinds (Babbie, 2015; Krippendorff, 2012).

Content analysis focusses, as the name suggests, on the content of the body of data. Some researchers, such as Berelson (1952) and Treadwell (2010) use this method mainly for quantitative data analysis, e.g. by counting how often a certain expression is used in texts. Other scholars focus more on the qualitative content of texts, e.g. the underlying personal opinions and intentions, which involves categorization and classification (Flick, 2009).

Thematic analysis is primarily interested in examining specific patterns or themes of texts, which can be judged as an alteration of the focus of qualitative content analysis. In a sense, thematic content analysis is a combination of both content analysis and thematic analysis. The former is used for the groundwork whereas the latter concentrates on themes within the body of data (Burnard, 1991).

As the data collected by means of the final questionnaire was analyzed with quantitative and qualitative data analysis methods, triangulation could be applied to the results as a validation strategy (Flick, von Kardoff, & Steinke, 2004). Further details of this approach are described in section **7.1**.

Limitations

This work only investigates cultural differences within Europe, which are considerable in many aspects, but less pronounced in others. The geographical proximity of European countries and the fact that they share parts of their historical, religious, political and philosophical background, i.e. the main factors that determine culture, result in a relative similarity between cultures. European cultures are relatively close to each other compared to those on a global level, e.g. cultural differences between Japan and Brazil and between Senegal and Iceland are certainly more pronounced than between Italy and Britain, at least that is what common sense and cross-cultural studies suggest (G. Hofstede, G. J. Hofstede, & Minkov, 1991; House et al., 2004). The argument here is that if research shows significant cultural differences between European societies, with respect to a general view on the patent system, then we can assume that these different views on patents are significant when comparing more distant cultures. The reason for this limitation on Europe, more specifically to member countries of the EPO (European Patent Office), is to avoid another parameter that would need consideration in analyses and interpretation. All countries under investigation share the same patent system. Other patent systems, e.g. the USPTO (United States Patent and Trademark Office) and the JPO (Japanese Patent Office) have much in common with the EPO, but there are also many differences. These differences may also impact individual perceptions of the patent system and the individual attitudes towards patents. Hence, an inclusion of countries outside the EPO system would add complexity, but would not help to answer the question of whether culture impacts our notion of patents.

4.5 Ethical Considerations

Ethics of inquiry are subject to all three applied research methods: interviews, pre-questionnaire and questionnaire. The ethical requirements of the applied methods have some commonalities, but also some specifics. The common part is elaborated first, followed by the specific parts.

The fundamental principle in research ethics is to "do no harm". Although this principle provides some guidance and sets some limits, the perception where "harm" begins is highly subjective and leaves quite some room for interpretation (Simons, 1989). The deeper human beings are involved, the more demanding are the related ethical requirements. Thus, less ethical issues are to expect related to a quantitative research approach, whereas a qualitative research approach involves more critical aspects.

The starting point of all ethical considerations is the basic thought - who has an interest in the research in question and who owns the results, i.e. the data? Simons (2009) came up with some concrete guidelines that were judged well-suited and were adapted for usage of this work:

- Communicate clearly and openly the purpose and objectives of this research.
- Obtain consent from all persons who are participants in the research.
- Follow the principle of confidentiality.
- Apply anonymization as far as possible.

These guiding principles were followed throughout this research, together with the concrete procedures defined by the "*University of Gloucestershire's Research Ethics: A Handbook of Principles and Procedures (2008)*".

The interviewees were informed about the research in detail. Precondition of any successful interviews is that consent can be reached for all relevant and potentially critical topics in advance. However, during the preliminary talks no critical issue came up. All personal data was anonymised. The participants were informed that they had

the right to abort the interview at any time and they also could demand even after the interview that the data gathered would not be used and destroyed instead. Such a case did not happen.

Quantitative research relates traditionally more with data than people, however, the data in question derives from people, and therefore ethics is a serious matter as well. The pre-questionnaire and the questionnaire neither relate to sensitive issues, nor do they contain confidential information. Each respondent was informed about the research, and participation was completely voluntarily. The main concerns in case of the (pre-)questionnaire were data access and data integrity. Following standards of good practice, data collected was anonymised before its analysis. The results were obtained through a statistical analysis and do not allow any attribution to a specific person. The (pre-)questionnaires were sent out and received back in digital format. This data, as well as all other data in digital format that emerged during the long way from data collection through data analysis to the final report was stored in a folder on a Hard Disk Drive (HDD) that was password protected, using the Advanced Encryption Standard (AES). This is an encryption standard that is available in Windows 7 (Orchilles, 2010) and is approved in the USA by the Committee on National Security Systems (CNSS) to be “sufficient to protect classified information up to the SECRET level” (CNSS, 2014). Additionally, these data were backed up by a copy on DVD to avoid data loss, as well protected with the same AES password encryption. After secure and confidential storage all data will be safely destroyed after this thesis is approved by the University of Gloucestershire.

4.6 Summary

This chapter describes the chosen methodology and methods for this investigation, whereas the choices were derived from the research objectives and the personal philosophical worldview. Starting from a constructivist position, the mixed methods approach was followed, including a sequence of qualitative and quantitative data collection methods. Semi-structured interviews and questionnaires have been chosen for this research, whereas qualitative data analysis methods are applied to both and a quantitative data analysis method, i.e. statistical analysis is applied for the latter.

The methodological approach and the chosen methods are in line with the framework determined by the conceptual model developed in **Chapter 3**, as well as with the methods of the most relevant cross-cultural studies. This work follows Hofstede's example (Hofstede, 1980) and that of the GLOBE project (House et al., 2004) and therefore moves in theoretically and methodologically safe waters.

This chapter also presents a schematic illustration of the chosen research design and the applied methods (see **Figure 5**). It outlines the boundaries of this research, which are limited to the reach of the European Patent Office member countries. A dedicated section describes the ethical considerations of this work. The following chapters follow the methodological foundations laid above.

CHAPTER 5: DEVELOPMENT OF QUESTIONNAIRE

5.0 Introduction

This chapter presents the development steps towards the final questionnaire. The development of the questionnaire was one of the focal points of this study; therefore, a separate and extensive chapter is dedicated to this part. The reasons for this are, on the one hand, the conviction that only a particularly careful approach can guarantee a reliable basis for a credible interpretation of the results of the study and, on the other hand, that only the greatest possible transparency with regard to the way in which the questionnaire is developed can win the appropriate confidence of other researchers. The questionnaire constitutes the main instrument for answering the research questions formulated in section **3.4** and empirically validating the conceptual model (**Figure 1**) developed in section **3.5**. Furthermore, the questionnaire itself is one of the results of this study, as it will be available to other researchers for future related studies (see section **8.6**). A prerequisite for this is also the transparency provided by a detailed description of the procedure. At this point, it should be recalled once again that, by its nature, this study is limited in its scope and possibilities compared with the cross-cultural studies mentioned in **Chapter 3**. Hence, in order to obtain usable results, the development of a reliable instrument for the investigation is given the utmost importance. The examples of Hofstede and the GLOBE project show that even minor variations in the study setup can have a strong influence on the results (see section **3.2**). The development of the questionnaire therefore receives a similar amount of treatment as the main analysis and results in **Chapter 6**.

The first step, as described in section **5.1**, was semi-structured interviews designed to produce qualitative data reflecting the varied experiences of the interviewees related to methods and content for building survey items. The resulting rich data was analyzed qualitatively to create survey items for a pre-questionnaire. The second step (section **5.2**) consisted of collecting quantitative data by means of this pre-

questionnaire and using statistical analysis to obtain the most suitable survey items for the part of the final questionnaire relating to patent valuation. For the part of the questionnaire relating to culture appropriate survey items were taken from the GLOBE project. The reasons for the choice of items are described in section **5.3**. The sequence of applied methods and the related sections are presented schematically in **Figure 7**:

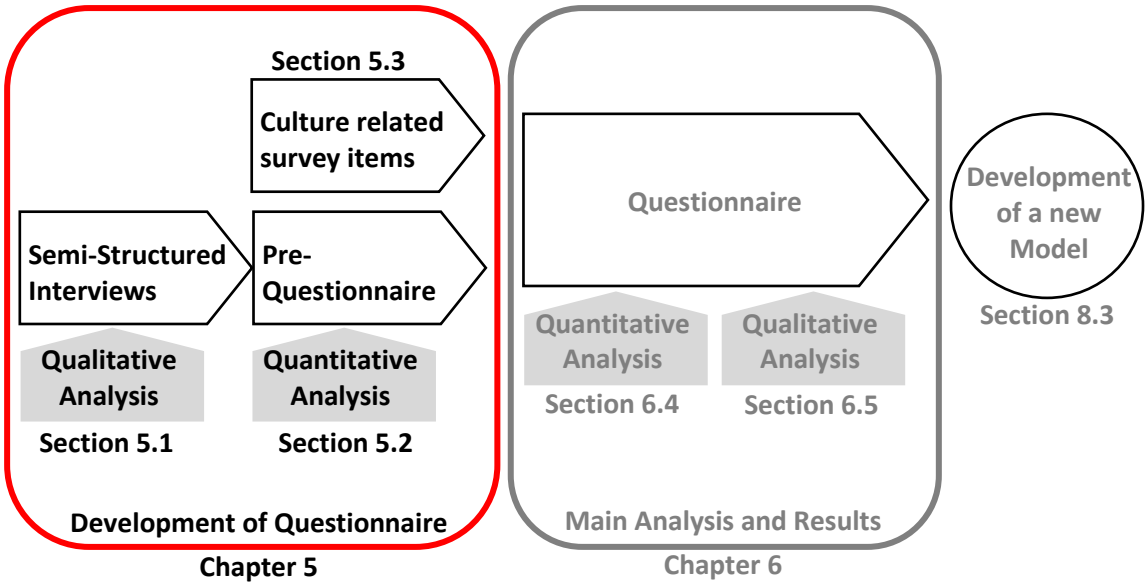

Figure 7: Research design and related sections of Chapter 5 (highlighted)

The schematic illustration of the research approach and the sequence of applied methods in **Figure 7** was previously introduced in section **4.4** (see **Figure 5**). It is repeated for better orientation with the sections highlighted that relate to this chapter. **Chapter 5** concludes with the ready to use questionnaire consisting of patent valuation related survey items and culture related survey items. **Chapter 6** then describes the questionnaire sample and the analysis (quantitative and qualitative) of the data obtained by means of the questionnaire and presents the associated findings.

5.1 Semi-structured Interviews

This section starts with a description of the setup of the semi-structured interviews and is followed by the interview sample. The proceedings and interview guide are then presented and the section closes with a description of the qualitative data analysis and the related results.

5.1.1 Interview Setup and Sample

Before defining the content and proceeding of the interviews it was necessary to address two questions: What are the desired insights and who is the best source of information?

The target of the interviews was a joint creation of data and insights that formulate consistent survey items that could be used to build two Likert-type scales; one that relates to the economic valuation of patents and one that covers the ethical valuation of patents. The aim was not to produce comparable answers that could be discussed quantitatively, e.g. "*two thirds of the interviewees preferred question type A over type B*". Instead, the goal was to gather a broad spectrum of viewpoints and a large number of different opinions and ideas about the subject under investigation, as well as to uncover potential problems related to understanding and wording (misunderstandings, difficulties, required background information, different cultural perspectives). Such a joint creation of survey items allows the researcher to base the research not only on the theoretical foundations from the literature review and on personal experience and opinion, but also on a broader fundament that integrates different experiences and opinions that in extreme cases may even be contradictory. This approach requires diligence in formulating statements and conclusions; it integrates the essence of knowledge from a number of people instead of only one person.

Two-phase approach

Semi-structured interviews may reveal unexpected issues, which can then be treated in the following interviews, i.e. interview questions evolve and can be refined during the process. This work utilized the additional flexibility that a step-by-step refinement of the interview questions offers to address emerging topics. For this purpose, a two-step approach was chosen as a midway between structure and flexibility. The first phase was thought to focus on method competency and on the general approach, i.e. the first interviews should build a sound foundation for the second phase. The interviews in the second phase then acted as a broadening, verification and refinement, aimed to complete the creation of the survey elements. The semi-structured interviews in both phases were conducted sequentially, whereas the interview guide was kept stable and almost unchanged within each phase. The interview guide then underwent a moderate modification before starting phase two; incorporating some relevant learning from the first phase (refer to both versions of the interview guide in **Appendix 1**).

The first phase started with an initial set of questions based on personal pre-understanding after a review of related academic literature, as well as on personal experience, discussions (peer group, colleagues, and friends), reflection and brainstorming. A series of preparatory discussions were conducted with peer researchers so that the initial set of questions for the interviews and proposal for the survey items undertaken had already had a first validity assessment and "sanity check".

Choice of interview sample

The first phase of interviews was conducted with experienced researchers (completed PhD) with a focus on methodological competence. Thus, this work should first benefit from the experience of other researchers regarding the general procedure; the focus in this phase should rather be on questions of principle, such as *"How do you think one could capture the personal viewpoint on patents?"*, *"How would you proceed if*

you intended to create a scale to measure personal opinion on patents?" and *"If you were in charge, if you were responsible, what would you do?".* What must be considered so that questionnaire items are formulated as clearly and comprehensibly as possible? Thus, a sustainable basis should be created for the following second phase, in which the concrete items should then be developed. Since the interviews of both phases were dedicated to the same topic, but with different focal points, it was obvious that the requirements on the sample would also be different in both phases. Nevertheless, the interviews in both, the first and second phases, were aimed at the same goal and the interview guides were only slightly different. Therefore, the two sub-samples can be considered as a single sample with respect to the required sample size. At least if there are no breaks between the first and second phases in the course of the interviews and saturation can be observed after a number of interviews. This was actually the case, so that all interviews could be considered together when evaluating the results.

The interviews in the second phase were conducted with representatives of the target group for the final questionnaire, i.e. individuals who work in the telecommunications sector with tertiary education in STEM fields (for detailed explanations refer to section **6.1**). The idea behind this was to select and formulate the concrete questionnaire items in such a way that they were as well coordinated as possible with the final sample. It cannot be excluded that industry, job type and educational background could have some influence on the understanding and interpretation of the final questionnaire, therefore the samples for the interviews and for the questionnaire should ideally have the same characteristics. This minimizes the risk of ambiguities and misunderstandings. In addition, it is ensured that the two samples do not have significantly different levels of professional competence, so that the answering of the questionnaires is not endangered.

After the decision to use a two-phase approach, the size of the interview sample needed to be specified. Guest, Bunce & Johnson (2006) discovered that data saturation from interviews was reached after only 12 interviews and Breen (2006) stated that theoretical saturation was normally reached with 10 to 12 interviews.

Therefore, the original idea was to conduct 12 interviews and then decide, based on the outcome, whether to add more. The results from the first 12 interviews were judged satisfactory for the creation of the targeted questionnaire items, so no additional interviews were necessary.

Care was taken that the interviewees represent a broad cultural spectrum to avoid an unbalanced cultural bias on the creation of the survey items. Also, a broad variety of aspects and opinions were covered, so the very different cultural backgrounds provided multifaceted feedback and a rich source of information. A purely German culture based interview sample would probably have provided too homogeneous results. A culturally heterogeneous sample was chosen intentionally, because the objective was not to compare results, but to capture variations, multiple standpoints and understandings. This setup ensured the emergence of issues, differing ideas and different, even contrary positions. The first phase particularly focussed on method competency and some experienced researchers from other academic areas were interviewed to foster a broad variety of outcomes. In addition, a number of patent experts (European Patent Office examiners and patent holders) were included in the sample to learn what might be of particular interest or importance in the patent area. In conclusion, a heterogeneous group of participants was chosen for the semi-structured interviews, because this method is designed for qualitative analysis. In contrast, a homogeneous group of respondents was selected for the questionnaires (see section **6.1**), because this method is used in the first place for quantitative analysis (although a qualitative analysis had been conducted as well, to ensure maximum profit from the available data and to increase the explanatory power). Consequently, the questionnaire sample should be as homogeneous as possible so that the only differing parameter is societal culture. The interview sample covers a broader spectrum than the questionnaire sample. In this way, the interviews also include issues and tackle topics that are at the boundaries of this research and may not have emerged if the sample had been more homogeneous. Most interviewees have a STEM educational background as with the sample for the final questionnaire. The interview sample therefore covers method competency, patent experts and the target group for the final questionnaire.

The interviews are primarily focussed on the development of the questionnaire and only contribute indirectly to answering the research questions. This is the first in a series of sequential methods applied that ultimately address the research questions (see **Figure 5** in section **4.4**). However, the interview sample relates to the research questions in so far as the interviewees bring expertise of patents and cover a broad cultural spectrum. This work investigates the influence of cultural dimensions on the concept and the valuation of patents and therefore the interviews constitute a starting point that covers diverse cultural views with regard to patents. The interview sample was chosen accordingly. **Table 5** shows the detailed composition of the interview sample:

No.	Nationality	Profession	Educational Background	Gender	Age Group°	Method Competency	Patent Expert
1	BRA	Psychotherapist	PhD, psychology	f	5X	X	
2	NED	EPO patent examiner	PhD, physics	m	4X	X	X
3	ARG	University Professor	Prof. PhD, education	m	4X	X	
4	POR	Researcher	PhD, chemistry	m	4X	X	X*
modification of interview guide							
5	ROM	Product Manager	MSc, engineering	f	5X		
6	CUB	R&D	MSc, engineering	m	3X		
7	GER	IT Administrator	PhD, biology	m	4X	X	
8	ESP	CTIO	MSc, engineering	m	4X		X*
9	POR	EPO patent examiner	MSc, engineering	m	4X		X
10	GER	Project Manager	MSc, engineering	m	4X		
11	GER	Product Manager	MSc, engineering	m	5X		
12	ESP	Prod. Marketing Mgr.	MSc, engineering	f	4X		

° Age Groups: 30-39 (3X), 40-49 (4X), 50-59 (5X) / * Inventor, holder of at least 2 patents

Table 5: Interview sample

Studies observed that interviewees were more confident with a researcher they knew personally (Harrell & Bradley, 2009). Thus, interviewees were chosen from colleagues

and friends. At this point it should be remembered that the researcher should constantly keep an eye not only on possible bias of the persons involved but also on his own bias during the study. Own bias can never be completely prevented, but every researcher should be aware of this and continuously strive to keep it within acceptable limits with appropriate measures. Similarly, if the sample has characteristics that systematically deviate from a purely random sample, it must also be considered with regard to a possible bias. In this case, the interview sample consists of friends and colleagues of the researcher. However, the group is inhomogeneous in the sense that its members have little contact with each other and have a large spatial distribution (5 different cities in 3 countries), since the acquaintance with the researcher stems from very different life phases. In fact, there is no indication that the interview sample systematically deviates from average values of a purely randomly selected comparison group with the same desired characteristics.

There is still the risk that the interviewees behave differently towards an interviewer they know than towards an unknown interviewer. This risk is minimized by a neutral and distanced approach, whereby the scientific purpose is in the foreground and everything personal is avoided, e.g. a neutral rather than a private environment is chosen. The residual risk is considered low and is more than offset by the benefits of greater openness and trust (see above), which would contribute to a more productive outcome.

Framework conditions

Cross-cultural studies always need to be aware of language issues. Basically, there are two options: either to conduct the surveys in a common language, which is usually English, or to carry out the research in multiple mother tongues. In the first case, the survey may miss some of the content due to the fact that participants feel less confident in the common language or are unable to exactly express their desired meaning. In the latter case, some of the meaning may be lost in translation.

This interview sample (refer to **Table 5**) represents five different mother tongues (Spanish: 4, Portuguese: 3, German: 3, Dutch: 1, Romanian: 1). Fortunately, all participants also speak fluent English and German, so they were asked in advance whether they felt more comfortable to conduct the interview in English or German. Most decided to be interviewed in German, because this is either their mother tongue (3 interviewees) or they have been living in Germany for many years (6 interviewees). The nine interviews that were conducted in German were subsequently translated during the transcription process.

For this research at this stage, no significant language issues were expected, e.g. due to translation. Apart from the favourable situation that all interviewees had sound language skills, contextual and nonverbal metadata could be expected to play a negligible role in the planned interviews, the most important information would be clearly outspoken, i.e. transmitted in the explicit code of the message. Content was expected to be more important than context and context related nuances seemed to be of negligible importance.

Eight interviews took place in an office room (with enough space and convenient working conditions) and four were conducted via Skype, due to large distances between Munich and the interviewee's locations at the time (Hamburg, Berlin and Reykjavík). Care was taken to create a relaxed, casual and comfortable environment. The duration of each interview was roughly one hour.

5.1.2 Proceeding and Interview Guide

Preparations

The execution of successful semi-structured interviews requires thorough preparations and needs to follow some practice-proven guidelines. The interviewer should keep a neutral position to keep their influence on the interviewees to the minimum (Harrell & Bradley, 2009). In particular, the interviewer should not suggest any answer, should not expose their own opinion and should show neither agreement nor disagreement with the interviewee's statements. The interviewer should pay attention to their own cultural bias during the interviews, but also when interpreting the collected data. As the interviews should produce qualitative data, the questions should be "open" to uncover meanings and interpretations (Easterby-Smith et al., 2012), i.e. mostly beginning with "what", "why" or "how". These questions should be defined in advance as part of the interview guide.

Interview guide

The interview guide should ensure that the semi-structured nature of the interviews is maintained, i.e. it should provide a frame with a structure that covers all issues, but should be loose enough to allow reasonable deviations from the sequence (Easterby-Smith et al., 2012). The interview guide contains an outline of topics and it depends on the design and judgement of the researcher how fixed or flexible questions and sequence are (Given, 2008; Kvale, 1996). Although it is the researcher's decision whether to follow the interview guide strictly or to allow flexibility in how the interviews develop (Given, 2008), the interview guide should be created with diligence, because it is a useful and important auxiliary means that offers a fall-back position in case an interview develops in an unexpected direction. The interview guide should be followed as long as other conversational trajectories that are considered worthwhile following do not develop.

The interview guide is not “set in stone” and can be modified between interviews, whenever it is expected to be beneficial, e.g. to test a statement of one interviewee in the consecutive interview(s) in order to learn what others think about a newly emerged idea or aspect. Such a modification is legitimate, because the interviews should not provide data for comparisons, but for a qualitative analysis (Lewis-Beck, Bryman, & Liao, 2004). In the first phase of the interviews, experienced researchers were specifically addressed to benefit from their method competency. For the specific questions of this phase, refer to **Appendix 1**.

The main aim of the interviews was the joint creation of data and insights that allow the creation of two Likert-type scales for the final questionnaire; one that relates to the economic valuation of patents and one that covers the ethical valuation of patents. Therefore, a number of exemplary items were presented during the interviews and the participants were asked for their opinions, not only about the suitability for the purpose, but also regarding item consistency, understandability, clarity and unambiguity. For the ethical patent valuation, the objective was to create a scale that covers a broad range from a "patent critical view" to a "patent friendly view". Patent friendliness may manifest in the preference for a strong patent protection (e.g. 40 years lifetime instead of 20 years), for a cheaper or more expensive application process, for a more or less strict examination, for inventor and/or business friendliness (in contrast to society friendliness, e.g. stimulation of open source), or for strict or generous limits of patentability. Thus, the task of the interviews was to obtain a clearer view of what exactly patent friendliness means and how to capture this position through an appropriate survey scale. The interview guide should provide the frame for a fruitful discussion that provides answers to the formulated task above. Both versions of the interview guide prepared for phase 1 and modified for phase 2, can be found in **Appendix 1**. Some additional item candidates were tested in interviews, but discarded at an early stage. These items can also be found in **Appendix 1**.

The proceedings for both interview guide versions were the same. First, the research was outlined and the goal of the interview was explained in detail to the interviewee,

then a number of questions were asked one by one. Subsequently, some example items for the supposed ethical patent valuation scale were presented and the interviewee was asked for his or her opinion and comments. These items were based on own prior knowledge and on relevant literature concerning the current patent system, e.g. Granstrand (1999), Maskus (2000) and Berman (2002). After that, a specific perspective for economic patent valuation was presented, based on literature about inventor surveys (B. H. Hall, 2009; Harhoff, Narin, Scherer, & Vopel, 1999), and the participant was asked to comment on a number of exemplary patents that were then shown, from the perspective explained before. Finally, a few closing questions were posed and the interviewee was invited to comment and come up with their own ideas and suggestions. As pointed out in section **4.4**, the objective was to create at least 4 Likert items per scale for the final questionnaire, therefore the interviews "tested" more "candidate items", so that a subsequent review and the pre-questionnaire would leave sufficient items for the final questionnaire.

Execution

A commonly used technique to extract data from interviews is to record them via audio or video tape and subsequently transcribe them (Galletta, 2013). Video recording is especially useful to detect implicit meaning in high-context cultures. Facial expressions, gesture, intonation, emphasis, volume and subtle nuances may provide valuable hints for interpretation and may even reveal a completely different meaning than what is explicitly said (Bergmann, 2004). In this research, audio recording was judged to be the appropriate means for these interviews as no such implicit meaning was expected. Recordings were undertaken with a voice-recorder device and by taking notes, during, and shortly after, the sessions. The audio files were transcribed promptly after each interview using the qualitative data analysis software NVivo (Bazeley & Jackson, 2013). This tool was also utilized to support the analysis of the interviews.

5.1.3 Analysis of Interviews

The qualitative data produced by means of the semi-structured interviews was analyzed with a proceeding denominated as "thematic content analysis" (Burnard, 1991). As the name suggests, this combines elements from "thematic analysis" and "content analysis" (refer also to section **4.4**).

This was chosen because a pure content analysis would focus too strongly on the content of the data, in terms of frequency of occurrence of expressions. Whilst this may be beneficial for a quantitative analysis (Berelson, 1952; Treadwell, 2010), it would miss the target in this case. Content analysis may also be used to investigate the qualitative content of texts, which is an interesting application of this method for this work as it focuses on opinions and meanings (Flick, 2009). In addition, this research work is interested in extracting new ideas from the body of data, as well as themes and issues that may not have been explicitly expressed, but are implicitly reflected in the data. Also, opinions and meanings are gained from feedback on ideas presented by the interviewer. During the interviews, some situations and subjects were presented and respondents were asked questions such as, *"What do you think about it?*" Further questions included, "*What are your ideas?*", "*Any other thoughts or ideas on the topic?* and *"Suggestions?*" (refer to the interview guide in **Appendix 1**). These questions were intended to stimulate new ideas from the participants so that the interviews could make full use of the experience and expert know-how embedded in the interviewee's subjective theory (Flick, 2009). Feedback on the ideas presented was considered important to uncover opinions and meanings, but even more important to create new ideas. The interview questions were therefore designed accordingly and the analysis, although dominated by elements from the "content analysis" method, included some elements from the "thematic analysis" method, because the latter set a "*focus on identifying and describing both implicit and explicit ideas within the data*" (Guest, MacQueen, & Namey, 2012, p. 10). In the context of this work, identifying explicit ideas is no big challenge, but implicit ideas about how to capture personal standpoints towards patents are more difficult to

uncover. It is important to use the appropriate method to specifically facilitate this task. The "thematic content analysis" approach described by Burnard (1991) is considered to be the appropriate method for this work as it combines the relevant elements from content analysis and thematic analysis. The former provides the basis and the latter focusses on themes within the data. Burnard (1991) describes fourteen stages of analysis that are adapted to the specific needs of this work. This is supported by Schmidt (2004), who encourages researchers to adapt analysis methods to particular requirements derived from research data and objectives. Some adaptations were made and the steps were streamlined, because the original context and research objectives were very different from those of the present work.

The qualitative data analysis was carried out in 7 steps loosely following Burnard's (1991) approach and described in detail below:

Step 1: Preparations for analysis

Notes that had been taken during, and shortly after, the interviews were added as memos to the transcripts. The complete raw data was reviewed thoroughly and checked for accuracy for quality assurance and corrections were done where necessary.

Step 2: Immersion into the data

The next step of analysis consisted of repeated reading of the transcripts in order to get immersed in the data. In so doing, the researcher may already derive concepts or themes of relevance and is sensitized to patterns in the raw data (Bernauer, Lichtman, Jacobs, & Robertson, 2013). Patterns of relevant content were located within the data and connections and similarities were identified.

Step 3: Open coding

Fillers in the interviews that provide no relevant information for analysis, such as explanations of the research and the goal of the interview that was explained in detail at the beginning of each interview, were considered "dross" and were excluded before coding (Burnard, 1991). The identified ideas or themes can be seen as a "*core level of meaning*" (Galletta, 2013, p. 135), which are the "codes" that were applied all through the text. The process of coding was undertaken through "*waves of interpretation*" (Galletta, 2013, p. 136), i.e. iteratively. Whenever a text segment was identified to carry a specific and relevant meaning, a suitable code was assigned and the whole text was searched for all other text segments with a similar meaning so that the same code should be applied. This open coding is iterative and accumulative, i.e. each round of coding added some headings and sub-headings, or led to modifications, so that after several rounds, a basis was built for the subsequent categorization.

Step 4: Categorization

Categories can be seen as higher level codes, i.e. codes that have certain aspects in common can be assigned to these higher level codes, or categories (Galletta, 2013). The process of categorization is continuous. In this research, several explicit rounds of categorization were necessary and codes with common dimensions were also grouped into categories whenever it seemed appropriate outside these rounds. During this process, several potential categories emerged, of which some were maintained and others were discarded. The resulting categories were consolidated and refined in the following step.

Step 5: Consolidation and refinement

After the whole raw data was coded and all codes were assigned to categories, the next step involved re-reading in order to remove repetitions and to make appropriate adjustments. Categories were consolidated as in some cases higher level categories were built and the levels below were integrated into the final structure. The resulting categories were refined and re-organized. The following **Table 6** lists the final

categories and the number of related text passages that were assigned to each category:

Category	Description	Text Passages
Lack of clarity	further clarification needed	29
Insecurity	interviewee does not feel expert enough to answer	27
Ideas and proposals	ideas and proposals from	80
Opinions and judgements	opinions and personal judgements	239
Inability to answer	question is understood, but interviewee is unable to respond	6
Doubts and disagreement	doubts, disagreement and critique	36
Experience and information	interviewee's experience and "facts"	37
Personal ideas and learning	personal ideas that emerged or became clear during the interviews	47

Table 6: Final categories and number of related text passages

The labelled and sorted transcripts, with the assigned final categories are attached in **Appendix 2**. Arbitrary alphabetic characters were assigned to each interviewee for anonymization. Category “inability to answer” was not considered further as only 6 text passages had been assigned. These were judged irrelevant for the further proceeding.

Step 6: Combining evidence

The categories were further sorted with the objective of combining evidence that is grounded in the categories, e.g. within the category “opinions and judgements” some statements were directly related to the candidate items presented and expressed definite negative or positive opinions regarding their suitability. As one of the objectives of the interviews was to test a number of candidate items, the categories that directly relate to judgement of these items were sorted together in order to prepare the extraction of the findings.

Categories that refer partly or directly to the candidate items presented:

- “lack of clarity” may indicate that a rewording is required

- "insecurity" may indicate that item is too difficult
- "opinions and judgement" may judge the suitability of an item
- "doubts and disagreement" may uncover problems of items

The judgement of whether an item was well suited, may have some issues, or include some aspects that may jeopardize the use of the item, were allocated to all presented candidate items. Furthermore, all the other statements that expressed the same tenor or suggested a same meaning were grouped together.

Step 7: Discussion of findings

Writing up findings and interpretation goes hand in hand and should not be done separately. The seventh step includes the obvious findings, i.e. meaning that emerged clearly from the categorized data through combining evidence and the researcher's pre-understanding (Galletta, 2013), but also the more complex interpretations involving a deeper reflective process with support from relevant academic literature. The process of interpretation itself is iterative, synthesizes thematic patterns and results in a construction of meaning (Galletta, 2013). Meaning is created not only through personal interpretation, but also through considering the interpretations of others obtained through the interviews.

Some of the obvious findings specifically related to candidate items that were presented during the interviews and others were of a more general nature concerning how to capture personal standpoints towards patents or how to create survey items. The clearest findings not needing a higher level of interpretation are listed below:

- It is imperative that survey items are clear, understandable and unambiguous to avoid misunderstandings. Simple wording is important, and avoids unnecessary technical complexity.

- Avoid items that include humanitarian aspects. Medicaments in general, and aspects that are important for developing countries, would be impacted by

potential willingness to provide these patents without patent protection. This would distort the survey results.

- Some patent examples involve a "country bias" due to significantly more or less intense usage and visibility in one country compared to others. A patent related to winter sports would possibly be judged more important (and valuable) in countries where winter sports are very popular (e.g. Finland) than in countries where winter sports play virtually no role (e.g. Greece). Such a "country bias" for specific items would have other dimensions than cultural differences that are the subject of this research. The intention is to measure whether specific cultural dimensions impact patent valuation in general, not whether specific patents are valuated differently in different countries. Thus, items that involve a "country bias" would distort the analysis results and need to be excluded. Items should refer to patents with an underlying technology that should be "country neutral".

- The health care system (but without humanitarian aspects), IT and telecommunications were expected to be "country neutral" areas, at least with regard to the chosen target group for the final questionnaire (tertiary education with STEM background, working in telecommunications). These areas offer a broad spectrum of patents. The most neutral patent items should be the first, because some respondents tend to use the first item as a kind of anchor point and value the following ones relative to the anchor.

- An important learning was that the survey should avoid items that are possibly impacted by religious beliefs. If these items are mixed up with items that try to assess patent-mindedness from an ethical point of view, the results would be affected. If somebody considers protection of intellectual property an important moral right that does not mean that they favour patents on genetically modified plants, because they might reject the idea of meddling in genes altogether for religious reasons.

- Items for economic patent valuation do not need to refer to existing patents and they may refer to imaginary, non-existent patents. This should have no impact on valuation.

- One learning was that people who work with patents are very specialized, e.g. a patent examiner may work with patents in the field of semiconductors or telecommunications, but not with both. This also applies to patent experts in companies that only treat patents in the field where the company is active. The patent experts in this interview sample were from the areas of semiconductors, telecommunications and chemistry.

In the following each question and item of the interviews is discussed individually (refer to interview guide in **Appendix 1**). Quotes are taken from the transcribed interviews (refer to **Appendix 2**).

Question 1: What comes to your mind when you hear "patent value"?

The first thought relating to patent value seems to be of the economic value rather than the ethical value, i.e. the value for society, for innovation, seems to emerge only subsequently. The patent system does not have the best reputation and several respondents were very critical of it ("*a big economic conspiracy, all is driven by money*", "*patenting round corners*"). Although innovation is recognized as an objective of patent protection, the patent system is also seen as a "*protection for big companies*". Apart from the economic and ethical value of a patent, status also emerged as an aspect of value: "*as a researcher it was more for reasons of prestige - patent value is not only economical, but also related to professional realisation, status, career, curriculum*". Humanitarian aspects were also present, e.g. relating to medicaments that "*should be usable by a broad spectrum of the population*" or the medical treatment of people that should not be patentable.

Question 2: How do you think one could capture the personal viewpoint on patents? How would you proceed?

The most important learning from this question is that the final questionnaire needs to define the perspective from which an economic valuation is expected. It makes a

decisive difference whether a patent examiner or a business analyst is asked to value a patent ("*is it a valuation from the point of view of the valuator, the technician, the companies that apply for patents, is it the patent examiners in the patent office that you are referring to?*"). It is also important to define which type of value is meant (e.g. licensing value, selling value or defence value in legal disputes). The need to clarify the cultural dimensions was also raised ("*engineers see these questions differently than sociologists… or linguistic culture, for example German speaking countries*") as well as the meaning of patent friendliness ("*question of property is always connected … related to patent friendliness and patent hostility*").

Question 3: Do you think the following questions could capture the personal viewpoint on patents? Are they understandable? Are they unambiguous? Are they consistent?

The twelve different items **A1** to **A12,** evaluated under question 3, were developed and tested throughout the interview process (e.g. wording). The present analysis is based on the status after the 12th interview. This analysis resulted in further modifications and the final choice for the pre-questionnaire. Some items were expected to be less consistent with personal viewpoints than others; however, they were retained in the pre-questionnaire for testing purposes.

Findings that are directly related to specific candidate items, including some exemplary statements from the interviews that support these findings, are listed below in **Table 7**:

Ethical Item*	Findings	Exemplary Statements
A1 “fairness”	mainly agreement, no single disapproval	*“makes sense and is consistent”, “clearly understandable, classifiable as well”*
A2 "society"	mainly agreement, no single disapproval	*“also for non-experts, I think it's clear”, “also a good question (...) well suited”*
A3 “speed”	not clear enough, requires background information	*“I wonder how people (including engineers) who haven’t gone over the process will respond to this. Their answer will probably be driven by some prejudice which may be all inaccurate”*
A4 "period"	not clear enough, requires some rewording and/or background information	*“if you are not an expert, you don't know”*
A5 “business”	mixed feedback, might be suitable	*“for this you need to know more about economics”*
A6 “government”	small risk of disagreement regarding patent protection and innovation, might be suitable	*“if someone thinks government should promote it, then he probably thinks also that (patent protection) promotes innovation”*
A7 "software"	not clear enough, requires background information	*“patentable means not that code is protected, but some procedures?”*
A8 “SW piracy”	very unclear, not suitable	*“what does "punish more severely" (…) mean, it's the question how I define piracy”*
A9 “juridical support”	no consistency with patent friendliness expected, not suitable	*“there are too many juridical fights, that's exaggerated”*
A10 "plants"	controversial, affected by general beliefs, no consistency with patent friendliness expected, probably not suitable	*“conflict area”, “this is rather a moral question”*
A11 “stem cells”	controversial, affected by general beliefs, no consistency with patent friendliness expected, probably not suitable	*“general positions concerning gene manipulation (...) very controversial”*

A12 “human genes”	even more controversial than “GM plants” and “stem cells”, strongly affected by general beliefs, no consistency with patent friendliness expected, not suitable	*“nobody can patent the genome, nobody has invented it, it's simply nature (...) more in direction to ethical questions”*

* Exact wording of the items can be found below

Table 7: Findings related to candidate items for the ethical patent valuation scale

A1) It is fair that inventors can protect their inventions with patents

This item seems to be very clear and straightforward and no issues with comprehension emerged in the interviews. Even people who criticized the patent system are expected to agree. The main question remaining was whether people vary significantly enough in the extent of their agreement to allow any differentiation concerning their personal stance towards patents. An answer to this question was expected from the pre-questionnaire.

A2) The patent system is overall beneficial for society

The same applies for this item. It seems to be very clear and respondents are expected to largely agree, however, not as unanimously as with the first item. At least some deviation was expected, which would make it well suited for the final questionnaire.

A3) Patent protection should be faster and cheaper than it is today

This statement resulted in some insecurity among the interviewees, because not everyone was aware of the current situation. Those who have enough background information agreed that the patent application process is currently very expensive and time-consuming. This item would probably need some additional explanations to avoid answers that may be not in line with the respondent’s level of patent friendliness. A faster and cheaper patent application process may result in poorer quality and thus lead respondents to disagree with this statement. This item was excluded from further evaluation.

A4) Patent protection run-time should be extended (usually 20 years at present)

The expression "run-time" might be unclear and misleading and thus problematic, at least for non-native English speakers. The 20 years run-time mentioned is also not true for all cases (e.g. medicaments) and counts from the filing date. It was decided to add some information and reword before further evaluations.

A5) A well-functioning patent system is an important business factor

Some respondents did not feel expert enough to judge, but this item was still considered worthwhile to evaluate further.

A6) Government policy should encourage patent protection to promote innovation

There might be different opinions about the relation of innovation and patents (Moser, 2013; Anonymous, 2015, August 8). However, if the item is split into two sub-items, one stating that governments should encourage patent protection and another stating that patents promote innovation, both would most probably be judged consistently. That means, if someone thinks that patents promote innovation, they would probably agree that governments should stimulate patenting.

A7) In principle, software should be patentable as well

This item generated some unexpected reactions, e.g. most interviewees seem to be unaware of the controversial discussion concerning software patents and the software-hardware duality added to this lack of clarity. It was decided to modify this item and to keep it for further evaluation.

A8) Software piracy (e.g. mp3 and Microsoft Office) should be punished more severely

This statement proved very clearly that patent friendliness does not necessarily mean a reprobation of unlicensed copies of mp3, video and other widespread digital content or software. It can be suspected that theoretical standpoints do not coincide with behaviour in practice. Unauthorized copying of digital content is not considered

"software piracy" by many people and thus has the potential to weaken questionnaire results. This item was therefore considered to be unsuitable.

A9) Companies should get stronger juridical support to defend their Intellectual Property Rights

Juridical enforcement of IPR is definitely an important pillar of the patent system and was therefore expected to reflect patent friendliness. However, due to ongoing "patent wars" (Gustin, 2014, May 16; Gibbs, 2015, July 21) that are broadly covered in news media, most respondents are aware of endless and excessively expensive juridical fights between multinational companies about "round corners" of smartphones etc. Thus, it cannot be expected that this item would contribute to capture the stance towards patents. This item was excluded from further considerations.

A10) Genetically modified plants should be patentable under certain conditions

Apart from the insecurity some interviewees revealed about following the controversial debate on genetically modified plants during recent years, there was another, more severe issue. It seems to be very difficult to disentangle personal positions towards genetically modified plants in general from the question of patentability. The former is very much dependent on personal beliefs and even religion, so that even a patent minded person may reject manipulation of genes in general. Thus, results from this item are expected to be inconsistent with those of other items. Adding more background information and examples of use cases (e.g. GM rice that needs less water and helps to combat hunger in the third world) would not eliminate the general problem regarding consistency.

A11) Medical treatments developed from human stem cells should be patentable under certain conditions

This item is similar to item A10, but emphasizes a very humanitarian aspect. Although results from this item probably show the same tendency as item A10, some deviation could be expected. The item was maintained for further testing.

A12) Human genes should be patentable under certain conditions

The same applies for items A10 and A11, but to an even larger extent. It would also require more background information as it may concern "unmodified" or "modified" genes, which might be judged differently, even by the same person. This item is highly controversial and would reveal the respondent's basic beliefs, but not capture their stance towards patents. Results would point in the same direction as items A10 and A11, without adding any insights. Therefore, this item was not used further.

A definition of perspective for valuation was given to all interviewees before presenting concrete exemplary survey items for economic patent valuation. This was so that they would try to judge the items from the same determined perspective. They were then asked for their opinion of this definition (see question 4 below). The wording of this definition of perspective was based on a quote from Harhoff et al. (1999, p. 2), but was substantially modified:

"*Imagine your company possesses the following patent and one of your direct competitors would be interested in buying it from you - what is the smallest amount for which you would be willing to sell it (in €), assuming that the buyer would subsequently exercise its full patent rights*?"

Question 4: Do you think this definition makes sense? Would you formulate it differently?

Although some requests for further clarification emerged during the interviews, the definition of perspective was generally perceived as useful or even necessary. Some shortcomings remain and it seems impossible to get a definition clear enough that every person's understanding is exactly the same. Subjective meaning depends on many aspects such as cultural and educational background, professional experience, context and personality. One participant expressed the main issues: "*This exercise needs to clarify whether my company is making any use of the patent in question or if it is capable to do so in the future. Then, it should give some indication about the company's trust in the patent's strength, is it somewhat easy to provide the same solution without infringing the patent's protection?*" However, this definition was

judged to be useful and the best available. Any more detailed explanation would risk losing attention for the survey and the final questionnaire should be as concise as possible.

Question 5: Which of the following example patents are suitable for the purpose of assessing personal tendency in attributing low or high values to patents? Are they understandable? Are they easy or difficult to estimate?

Some interviewees stated that the task of valuating these patent examples was very difficult, because they were not experts. Special attention must be paid to the simplicity of the example patents with understandable wording and familiar technological areas. Even technical expertise does not help with estimating a value if patent values in general and importance for business were never considered. The idea of providing sample values was rejected and each person should do his or her own calibration. Some respondents may utilize the first valuation as an anchor point and value the subsequent items in relation to the first one. Nonetheless, even such a relative valuation would not jeopardize the general aim of capturing a tendency to assign high or low values to patents. It could be assumed in a case of relative valuation that the anchor points are set according to the individual tendency. The eleven items **B1** to **B11** were evaluated one by one under question 5, whereas the analysis results are based on the status after the interviews. The analysis led to some modifications. Some items were rejected and a set of items were evaluated further with the pre-questionnaire.

Findings that are directly related to specific candidate items, including some exemplary statements from the interviews that support these findings, are listed below in **Table 8**:

Economic Item*	Findings	Exemplary Statements
B1 "damper"	might be difficult to understand and may be subject to a "country bias", not suitable	*"it is very cultural, very German (...) in Spain and Portugal this makes no sense (...) with my cultural background and the country where I live I say this one has absolutely no value"*
B2 "bike helmet"	may be subject to a "country bias", not suitable	*"that's also something valuable", "this one also has no value"*
B3 "liquid lens"	mainly agreement, might be suitable	*"could be very interesting, it has a very versatile application"*
B4 "smart glass"	rewording required, might be suitable	*"relatively short and concise, that's ok"*
B5 "cement"	might be difficult to understand, risk of ecological impact, not suitable	*"from ecological perspective, this is very bad (...) or probably genetically modified bacteria"*
B6 "polymers"	too much text, simplification and rewording required	*"understandable"*
B7 "water"	minor risk of humanitarian influence	*"you could say that is important for the third world that water is cheap. There shouldn't be any patent"*
B8 "QR"	mainly agreement, probably suitable	*"very good (...) understandable"*
B9 "solar cells"	mainly agreement, some insecurity, may need modification, might be suitable	*"the others I can imagine how it works, but this how should it work?"*
B10 "polio"	moral impact, not suitable	*"does not concern industrialised countries"*
B11 "painkiller"	minor risk of humanitarian impact, might be still suitable	*"problematic (…) where people are directly affected they demand a certain protection"*

* Exact wording of the items can be found below

Table 8: Findings related to candidate items for the economic patent valuation scale

B1) Damper system for cabinet hinges that allows the smooth and silent closing of furniture doors.[15]

This item might be difficult to understand for non-native English speakers (the terms "damper" and "drawers" needed some explanation). Most interviewees judged this item to be well suited. Dampers may be more common in some countries than others. One of the Portuguese interviewees stated straight away that this patent had no value at all in his home country. There might be a certain "country bias" and so the decision was taken to remove this item.

B2) Inflatable bike helmet that looks like a scarf and transforms into a head protecting airbag in case of a crash.[16]

As with the previous item, this patent description might be difficult to understand for non-native English speakers. Some terms ("subtle", "scarf" and "collar") needed additional explanation. However, most interviewees rated this item positive. Given the widespread use of bicycles in Germany and the Netherlands and the significantly less widespread use in Portugal and Greece, a certain "country bias" would be expected, therefore this item will not be considered further.

B3) Liquid lens of compact size that uses electrical current to change its focal length.[17]

This candidate item is technically quite complex, but quite clear to understand. Only one interviewee reported problems in understanding. However, this interviewee did not belong to the target group for the final questionnaire (individuals who work in the telecommunications sector with tertiary education in STEM fields), but was participating due to his method competency for the first phase of the interviews. This item was considered to be a promising item for the final questionnaire and was thus maintained for the pre-questionnaire.

[15] European patents EP 1920128 B1 and EP 1199433 B1
[16] European patent EP1947966
[17] European patents EP 1870742 B1 and EP 1662276 B1

B4) Electronically tintable glass that saves energy by controlling the intensity of light that shines into buildings.[18]

Two interviewees struggled to understand this patent example, but in general this item was judged to be well suited. Some rewording seemed to be required.

B5) Self-healing cement that contains limestone-producing bacteria and improves the lifespan of buildings and other constructions made of concrete.[19]

There may be some prejudices relating to the ecological aspects of this item as there is some suspicion that bacteria are genetically modified. This may impact the estimation. Thus, this item was considered unsuitable.

B6) A new class of polymers called "*vitrimers*" that are able to change from a solid to a flexible consistency, controlled by temperature.[20]

The text of this item was modified during the interviews. Originally the explanation was too wordy but even the modified version seemed to have issues. The term "polymers" was unfamiliar to one interviewee. The item is considered to be "free of humanitarian aspects" and "country neutral". A simplification and rewording was expected to be sufficient to create a suitable item.

B7) Energy-efficient water purification based on water-purifying proteins (aquaporins).[21]

At least one of the interviewees thought of water scarcity in the third world, so this patent may be subject to a (minor) humanitarian influence. Overall, this item was considered very clear and suitable.

[18] European patents EP0831360 and EP164690
[19] European patent EP2247551
[20] European patent EP1465930
[21] European patents EP1885477 and EP1937395

B8) The QR code, a two-dimensional bar code can be found virtually everywhere, e.g. product packaging.[22]

This item seemed to be excellent, because it is "free of humanitarian aspects" and "country neutral". The only doubt remaining was whether or not to provide a small picture of a QR code with the question. Without a picture, it might be possible that some people do not recognize it by name, whereas with a picture it stands-out, because it would be the only item with a picture.

B9) Solar cells based on polymers. This new class of photoactive polymers improves efficiency by more than 60% at significantly reduced costs. Moreover, its production is environmentally friendly.[23]

Although one interviewee did not know the term "polymers", this item was judged to be very clear and suitable by the majority of the interviewees. However, it was astonishing to see insecurity about this item among some interviewees. The item was reworded slightly and maintained for the pre-questionnaire.

B10) Medicament that cures poliomyelitis. Despite the existence of an efficient vaccination against poliomyelitis there are still 1,500 new cases every year, especially in India and Nigeria.[24]

This item has a clear humanitarian influence ("*a question of life and death*", "*does not concern industrialized countries*"), which may affect the average result. Therefore, this item was considered to be unsuitable.

B11) Painkiller without side-effects. New pharmaceutical based on a protein produced naturally in the human body.[25]

The term "painkiller" was problematic ("pain reliever" or "analgesic" were not much better), as well as the mentioned, undefined side-effects. However, the majority

[22] European patent EP0672994
[23] imaginary patent, not existing
[24] imaginary patent, not existing
[25] imaginary patent, not existing

judged this item quite positive, so it was still considered for the verification step, by means of the pre-questionnaire.

Question 6: Any other thoughts or ideas on the topic? Suggestions?

Many large companies foster patent production ("*they tried to stimulate all the engineers to file patents and they gave incentives for this*"), not specifically to stimulate innovation, but to help their patent portfolio to be prepared for legal fights. Patent portfolios are used intensively as shields and swords against competitors. It is not the single patent that counts, but the mass of patents. Even small companies file patents with the idea that "*only the number of patents is what counts*".

The main contribution of the interviewees was an understanding of how a standpoint towards patents can be assessed. This is "new knowledge", derived from a qualitative investigation, concatenated know-how from practitioners and representatives of the target group for the final questionnaire (individuals who work in the telecommunications sector with tertiary education in STEM fields).

Further interpretation of the qualitative data gathered through the interviews was also considered in the context of the complete research in **Chapter 7**. In this section, the discussion and interpretation is limited to the concrete task of creating survey items. The selection process by means of a pre-questionnaire, applied on the candidate items, is described in the next section.

5.2 Pre-questionnaire

A pre-questionnaire was used as a pilot survey to ensure the quality of the final questionnaire. For this purpose, the candidate items, that had been elaborated and judged suitable, by means of the semi-structured interviews, were used to prepare a pre-questionnaire. This was then applied with a specific test sample to exclude weak items and extract the clearest and most suitable ones. Consistency within the set of items per scale was especially important. The suitability of the two scales also had to be evaluated, one relating to the ethical patent valuation and the other to the economic patent valuation. How to optimize scaling in order to utilize the full range of the scales and how to investigate how many items should build one scale was also assessed. A series of statistical methods was utilized to analyze the pre-questionnaire results. The methods, pre-questionnaire, test sample and conclusions are described below.

5.2.1 Pre-questionnaire Sample

The developed pre-questionnaire items were tested with a group consisting of 26 individuals. The advantage of a small test group is that each pre-questionnaire can be analyzed in detail and if unexpected patterns appear then the related respondent could be asked for the reasons. A minimum of 20 participants is required to allow for a meaningful statistical analysis (Hofstede & Minkov, 2013; Schlösser et al., 2013), i.e. a sample of 26 participants is small enough to be handled relatively easily and large enough for the application of a number of statistical methods. The sample represented a broad cultural spectrum to cover the maximum variety of differing answers to the pre-questionnaire items. The sample comprised of 12 nationalities with one national group specifically chosen to be larger than the others to allow some intra-group analysis. This was a German sub-sample of 10 participants. The nationalities were not limited to European Patent Office member countries, because

the task of the pre-questionnaire was to use as broad a cultural variety as possible for testing purposes and to optimize the items and scales of the final questionnaire rather than drawing any final conclusions about cultural influence on patent valuation. This task was left for the final questionnaire.

Care was taken that the sample was as homogeneous as possible, with the only differing parameter being societal culture. The pre-questionnaire refines and selects the most appropriate patent related survey items for the final questionnaire. It is the second in a series of sequential methods applied to address the research questions (see **Figure 5** in section **4.4**). Its primary task is related to the development of the questionnaire, rather than a direct contribution to answering the research questions. Nonetheless, the pre-questionnaire sample disposes of the same main characteristics as the final questionnaire sample: it consists of people with a STEM educational background and covers a broad cultural spectrum. In this way, the pre-questionnaire sample also directly relates to the research questions, because the cultural influence on the valuation of patents is investigated among people with comparable professional and educational background as inventors and patent holders (see also section **6.1** that describes the sample of the final questionnaire). **Table 9** shows the detailed composition of the pre-questionnaire sample:

No.	Nationality	Profession	Educational Background	Gender	Age Group*
1	ARG	Project Manager	MSc, engineering	m	5X
2	BRA	IT Manager	MSc, computer science	f	3X
3	COL	CEO	MSc, engineering	m	4X
4	CUB	Project Manager	MSc, engineering	m	3X
5	GER	Project Manager	MSc, engineering	m	4X
6	GER	Product Manager	MSc, engineering	m	4X
7	GER	Project Manager	MSc, engineering	m	4X
8	GER	Project Manager	MSc, engineering	m	4X
9	GER	Project Manager	MSc, engineering	m	5X
10	GER	IT Manager	MSc, computer science	m	4X
11	GER	Product Manager	MSc, engineering	m	5X
12	GER	Project Manager	MSc, computer science	m	4X
13	GER	Product Manager	MSc, engineering	m	4X
14	GER	University Professor	PhD, physics	m	5X
15	EGY	Product Manager	MSc, engineering	m	4X
16	IRL	IT Manager	MSc, computer science	m	4X
17	IRN	Project Manager	MSc, engineering	m	5X
18	ISR	CEO	MSc, engineering	m	5X
19	ISR	COO	MSc, engineering	m	5X
20	ISR	Product Manager	MSc, engineering	m	4X
21	NED	EPO patent examiner	PhD, physics	m	4X
22	POR	Researcher	PhD, chemistry	m	4X
23	POR	Project Manager	MSc, engineering	m	4X
24	ROM	Product Manager	MSc, engineering	f	5X
25	ROM	R&D	MSc, engineering	m	4X
26	ROM	R&D	MSc, engineering	m	4X

* Age Groups: 30-39 (3X), 40-49 (4X), 50-59 (5X)

Table 9: Pre-questionnaire sample

5.2.2 Pre-questionnaire Items

The items that were tested with the pre-questionnaire should be as close to the final questionnaire as possible to avoid unexpected issues emerging later on. Some of the items tested were already preferred, based on the interview's results and others were already in doubt as the pre-questionnaire was meant to prove results from the interviews, rather than start from scratch.

Ethical patent valuation items

Based on the findings from the interview analysis (see section **5.1.3**) nine items for the ethical patent valuation scale were included and three items were reworded (items A3, A4 and A7). The results of the interviews led to the exclusion of three items, A8 ("SW piracy"), A9 ("juridical support") and A12 ("human genes"). The items included in the pre-questionnaire are listed below:

A1) It is fair that inventors can protect their inventions with patents

A2) The patent system is overall beneficial for society

A3) Patent protection should be faster and cheaper than it is today, but without compromising quality

A4) Patent protection period should be extended (nowadays usually 20 years from filing)

A5) A well-functioning patent system is an important business factor

A6) Government policy should encourage patent protection to promote innovation

A7) In principle, software should be patentable as well (which is currently not the case in Europe)

A10) Genetically modified plants should be patentable under certain conditions

A11) Medical treatments developed from human stem cells should be patentable under certain conditions

Economic patent valuation items

Based on the findings from the interview analysis (refer to section **5.1.3**) for the economic patent valuation scale, eleven items were included in the pre-questionnaire. Seven of these (items B3, B4, B6, B7, B8, B9 and B11) were carried over from the interviews, but modified according to the associated findings. Another four items (B12, B13, B14 and B15) were newly created according to the outcomes of the interviews, e.g. they do not touch humanitarian aspects, they contain no contact

point with basic beliefs (e.g. topics that touch religious aspects) and they are free of "country bias". The new items were all related to preferred technological areas, e.g. telecommunications, so that the target group for the final questionnaire (tertiary education with STEM background, working in telecommunications) could be expected to have the necessary background knowledge to understand the items more easily. A few items were excluded from further evaluation as they proved less suitable or problematic during the interviews. These discarded items were B1 ("damper"), B2 ("bike helmet"), B5 ("cement") and B10 ("polio"). The candidate items for the pre-questionnaire that are related to economic patent valuation are shown below:

B3) Liquid lens with a variable focal length that is controlled by electrical current. Its small size makes it suitable for consumer devices such as smartphone cameras.[26]

B4) Smart glass with electronically controllable opacity (level of transparency). This allows for control of light intensity that shines into buildings, which reduces energy consumption for air conditioning.[27]

B6) A new class of plastics (polymers) that is able to change its state from solid to mouldable (shapeable) and back, controlled by changes in temperature.[28]

B7) Energy-efficient water purification. Water is filtered through membranes that comprise of layers with naturally occurring proteins (aquaporins). This low cost method supplies ultrapure water for the semiconductor and photovoltaic industries.[29]

B8) The QR code. Two-dimensional barcode consisting of black-and-white squares that became widely-used thanks to its simplicity, fast readability and error robustness.[30]

B9) Solar cells based on polymers. This new class of photoactive and conductive plastics (polymers) improves efficiency at significantly reduced costs. Moreover, its production is environmentally friendly.[31]

[26] European patents EP 1870742 B1 and EP 1662276 B1
[27] European patents EP0831360 and EP164690
[28] European patent EP1465930
[29] European patents EP1885477 and EP1937395
[30] European patent EP0672994

B11) Painkiller without side-effects. New powerful pharmaceutical that relieves pain by utilizing properties of a specific protein produced naturally in the human body.[32]

B12) Method that reduces power consumption for LTE (4G) signalling for download traffic. Mobile network operators reduce their energy costs and mobile devices save battery power.[33]

B13) Coexistence of LTE (4G) and Wi-Fi in unlicensed spectrum. This method allows the usage of LTE equipment independent from mobile network operators, e.g. in the 5 GHz band.[34]

B14) Lithium bromide battery. Rechargeable battery with a lithium bromide electrolyte that achieves a 20% higher energy density than common lithium batteries.[35]

B15) Novel solid state drive (SSD) flash memory architecture that allows for an increase in reading/writing access speed by 30%.[36]

In addition to the nine items for the ethical patent valuation and the eleven items for the economic patent valuation, the pre-questionnaire also contained some specific questions relating to the instrument itself. The participants were asked to state how long it took to answer the pre-questionnaire and whether it was in general judged to be either "*quite ok*", "*somewhat difficult to answer*" or "*too difficult to answer*". The economic patent valuation related items also included an additional box "*I am not able to estimate*" in order to evaluate how confident the respondents felt to estimate. This supplementary information should help to design the appropriate length and level of the final questionnaire.

The complete pre-questionnaire can be found in **Appendix 3**.

[31] imaginary patent, not existing
[32] imaginary patent, not existing
[33] inspired by European patent EP2193609
[34] World Intellectual Property Organization (WIPO) patent WO2013179095
[35] inspired by WIPO patent WO2015112855
[36] imaginary patent, not existing

5.2.3 Analysis of Pre-questionnaire

The data derived from the pre-questionnaires was statistically analyzed to identify the survey items that were expected to be the most important for answering the research questions. At the same time, the analysis should remove unnecessary items from the questionnaire that would otherwise jeopardize the survey completion rate and response quality.

In general, items that belong to the same scale should ideally lead to low variances within individual's responses. They should also reveal group differences and thus contribute to high variances of means between groups. The pre-questionnaire sample was chosen with a diverse cultural background, so that a high variance of means between individuals was achievable. At the same time, item selection should lead to a low variance within the answers of an individual. However, the data collected with the pre-questionnaire is of limited statistical value due to the sample size. Therefore, apart from the statistical, i.e. quantitative analysis, some qualitative insights were also important: Are there any peculiarities or abnormalities? Are the respondents able to give an answer to each item? Is the scale well chosen? Are there any useful comments from the respondents?

Hofstede & Minkov (2013) used 4 items per cultural dimension scale, whereas the GLOBE project used 3 to 5 items per scale (GLOBE, 2006c). For the ethical patent valuation scale, the pre-questionnaire started with 9 items and for the economic patent valuation scale with 11 items. The most suitable items were selected by quantitative (statistical) analysis, also taking into consideration qualitative input from the respondents. Gradually, the number of candidate items was reduced to a set of items that proved to have the best scale characteristics, whereas the initial goal was to come to 3 to 5 items per scale.

In contrast to the final questionnaire, the economic patent valuation items of the pre-questionnaire had an "*I am not able to estimate*" field to identify items that were particularly difficult to judge and would thus lead to arbitrary values. The ethical

patent valuation items were not expected to be too difficult to judge. Everybody should have an opinion, or at least should be able to indicate some personal preference.

Statistical analysis was undertaken on an individual level as the sample was too small to distinguish between groups, i.e. the test group is too small for any conclusion regarding culture.

The GLOBE methods

The GLOBE project made two pilot studies to test the draft survey items and scales (House et al., 1999) after the initial item creation based on interviews and focus groups (Hanges & Dickson, 2004) and before starting the final survey. The researchers used a number of statistical methods to analyze the data generated including *exploratory factor analysis*, *one-way analysis of variance*, *intra-class correlations* and *reliability analysis* (House et al., 1999). A large multi-year endeavour such as GLOBE invested much more time in item creation and testing to ensure a reliable and strong fundament for the subsequent survey than a much smaller study such as this. However, the following discusses which of the methods used in the GLOBE project were considered to be appropriate to analyze the data provided by the pre-questionnaire.

Exploratory factor analysis

Exploratory factor analysis is especially useful for reducing a set of variables to a smaller number of latent variables, or factors. In the GLOBE project, it was utilized to identify the basic cultural and leadership dimensions that were to be tested. This was useful in the GLOBE project, but is not meaningful for the pre-questionnaire of this work. The pre-questionnaire consists of only two patent related dimensions or factors that need investigation (“ethical patent valuation” and “economic patent valuation”) and there is no indication that both can be reduced to just one dimension. However, both may relate to each other, this is one of the questions under investigation. In any

case, a minimum sample size of 60 would be required for useful results[37] (Klopp, 2013). Exploratory factor analysis was therefore not applied for the pre-questionnaire.

One-way analysis of variance

Analysis of variance (ANOVA), developed by Fisher (1921), is used to investigate two or more groups. This is to see whether there are one or more independent variables, with respect to the variance of the mean values of a dependent variable that have equal or significantly different behaviour. This is used to verify an appropriately formulated difference hypothesis. In the case of an independent variable it is called a single factor (one-way); in the case of multiple independent variables it is called a multifactorial (two-way, 3-way…) analysis of variance. The pre-questionnaire used a relatively small sample with a high cultural diversity (26 respondents from 12 countries). The sample is therefore not suitable for a statistical analysis of multiple groups.

Intra-class correlation

Several statistical methods can be used to assess inter-rater reliability, which indicates the degree of concordance among respondents. Intra-class correlation (ICC), as proposed by Shrout & Fleiss (1979), can be considered a suitable estimation for inter-rater reliability (Landers, 2015). It can be used to determine whether the scales and items show a reasonable agreement within a group of respondents. Due to the comparison of groups, ICC is also not applicable for the pre-questionnaire sample.

Reliability analysis

Cronbach (1951) developed a statistical means to estimate scale consistency and thus reliability of test scores. “Cronbach’s alpha” is one of the most widely used indicators

[37] The sample size of 60 is considered the absolute minimum where an application of exploratory factor analysis is meaningful, under the precondition that other statistical criteria are met, e.g. that variables share common variances (communalities) to a certain extent (> 0.60). Therefore, large sample sizes are recommended for a reliable Exploratory Factor Analysis, preferably 500 participants or more (Comrey & Lee, 2013).

of the degree to which a set of scale items measures a common phenomenon (Streiner, 2003). Although caution is advised regarding which values for α indicate a good enough reliability, scale item reliability is mostly considered acceptable if $\alpha > 0.7$ (Cortina, 1993; Schmitt, 1996). This is indeed a statistical method that proved to be useful for the analysis of the pre-questionnaire data.

Other statistical methods

Apart from the statistical methods used by the GLOBE project, there are other instruments that were considered applicable for this analysis and delivered results that helped to identify the most appropriate survey items for the final questionnaire.

Correlation analysis

Siniscalco & Auriat (2005) recommend a less comprehensive approach for smaller scale projects. The authors suggest performing a *correlation analysis* to identify the items that correlate most closely with the total score. This identifies the items that contribute most to the discrimination power of the test scale. The most commonly used for ordinal scale data is probably the rank correlation coefficient ρ (rho) of Spearman (1904). In general, the value of the correlation coefficient is a measure of the shared variance between two variables.

Means and variances

Even if an item shows a high discrimination power, it may be discarded if it does not show sufficient variation between respondents (Siniscalco & Auriat, 2005). For this purpose, the *inter-rater variance* is measured, i.e. variance within mean item scores over all respondents. This value should be as high as possible, so that the utilized items add to differentiation between individual respondents. A high individual differentiation can be considered a pre-condition for differentiation between (cultural) groups. In contrast, the *intra-rater variance* should be low, i.e. the variances within item scores for each respondent. This value can be considered an indication of scale consistency. Additionally, the average *mean item scores* over all respondents

should ideally be in the middle of the scale (4.00) to allow for a broad bandwidth of responses and the possibility of a high differentiation between respondents.

Analysis results

Comments from respondents provided some qualitative feedback. It showed the need for a hint for respondents to tick only one box per item to prevent them ticking two boxes to indicate an intermediate value. Also, a field for comments at the end of the questionnaire was proposed. Both suggestions were put into effect in the final questionnaire. Another respondent commented that a patent value of more than €500 million is completely unrealistic. Actually, this was a comment from a patent expert and is probably true for the individual business value of a single patent. However, it was not the aim to come to correct economic patent values (whatever "correct" means in this context), but to investigate whether there are culturally founded differences in the willingness to assign high values to patents. Subjective values do not need to be realistic. The same respondent suggested a more detailed scale of between €5 million and €500 million. This was considered in the final questionnaire, because the scale proved to be too asymmetric and without enough discrimination power in the mid-range (see further the end of this section). In the following, the evaluation of the candidate items is described step by step, first for the ethical patent valuation scale (3 steps) and then for the economic patent valuation scale (4 steps).

Evaluation of ethical patent valuation items – Step 1

Item A11 "Stem Cells": This item shows a negative contribution to intra-rater item consistency. As expected (due to learning from interviews), some respondents who replied very positively to some items responded very negatively to this item (3 of the 26 respondents responded above average on items 1 to 7, but only judged "1" on item 9). Interestingly, this item shows a high correlation with the mean score (ρ = 0.773). The influence of religious or other beliefs on this specific item may only apply to a minority, but this item was discarded in order to minimize the risk of distortion.

Item A10 "Plants": There is only a moderate contribution to intra-rater item consistency and 15 of 26 respondents rated this item on average lower than items 1 to 7. This item correlates significantly only with "Stem Cells" (ρ = 0.625) and with the mean score (ρ = 0.559). It does not correlate significantly with any other item. The same applies to a lesser extent for "Stem Cells". However, this item was discarded for the same reasons.

After exclusion of the two items "Stem Cells" and "Plants", Cronbach's alpha decreases from α = 0.784 to α = 0.758.

Evaluation of ethical patent valuation items – Step 2

Item A4 "Period": High negative contribution to intra-rater item consistency. It showed the lowest correlation with the mean score (ρ = 0.431), it was the only item that did not correlate significantly at the 0.01 level. The average intra-rater variance decreased from 2.60 to 1.98 and Cronbach's alpha increased from α = 0.758 to α = 0.785 if the item was deleted. Therefore this item was also excluded.

Evaluation of ethical patent valuation items – Step 3

The remaining 6 items were systematically analyzed with regard to their contribution to *mean item score*, *inter-rater variance*, *intra-rater variance* and *Cronbach's alpha*, as well as to their *correlation with the mean score*. The results are shown in **Table 10** and **Table 11**:

	Correlation with mean (ρ)
Fairness	0,751
Society	0,753
Business	0,512
Government	0,836
Speed	0,616
Software	0,829

Table 10: Correlation with mean score for the remaining six items

Fairness	X		X	X	X	X	X
Society	X	X		X	X	X	X
Business	X	X	X		X	X	X
Government	X	X	X	X		X	X
Speed	X	X	X	X	X		X
Software	X	X	X	X	X	X	
Mean item scores	5,833	**5,677**	5,877	5,746	5,800	5,869	6,031
Inter-rater variance	0,658	0,775	0,631	**0,811**	0,643	0,761	0,495
Intra-rater variance	1,192	1,227	1,262	1,242	1,388	1,208	**0,827**
Cronbach's alpha	0,785	0,748	0,735	0,788	0,701	**0,796**	0,728

Table 11: Combinations of 5 or 6 items and the corresponding statistical results.

Item A1 "Fairness": This was identified as an item for further reduction in the next step. Its exclusion would decrease the mean item score the most and increase the inter-rater variance. It shows a medium correlation with the mean score.

Item A2 "Society": This item was maintained as its exclusion would impair all observed parameters. This item shows a medium correlation with the mean score.

Item A5 "Business": This item was also judged to be appropriate for further reduction in the next step. Its exclusion would increase inter-rater variance the most, the mean item score would decrease and Cronbach's alpha would slightly increase. It shows the lowest correlation with the mean score.

Item A6 "Government": This item was kept as its exclusion would impair all observed parameters, except the mean item score (almost no change). It shows the highest correlation with the mean score.

Item A3 "Speed": This item is a third item for further reduction. Its exclusion would increase Cronbach's alpha the most and increase inter-rater variance, whereas other parameters are only slightly changed. Its correlation with the mean score is quite low.

Item A7 "Software": This item was maintained, although its exclusion would decrease intra-rater variance the most. However, all other observed parameters would be impaired and it shows a high correlation with the mean score.

From the results above alone, it is difficult to decide which of the three items to discard. Therefore, three scenarios are analyzed that each excludes two of the three items. The results are shown in **Table 12**:

Fairness	X		
Society	X	X	X
Business			X
Government	X	X	X
Speed		X	
Software	X	X	X
Mean item scores	5,769	**5,529**	5,683
Inter-rater variance	1,020	**1,032**	0,943
Intra-rater variance	1,237	1,189	1,260
Cronbach's alpha	**0,824**	0,760	0,758

Table 12: Three scenarios with 3 items and the corresponding statistical results.

Unexpectedly, two scenarios provide even better results than the exclusion of only one item. The exclusion of either "Business" and "Speed", or "Business" and "Fairness" show significant improvements. The first optimizes Cronbach's alpha and correlation with mean scores, whereas the latter optimizes the mean item score and the inter-rater variance. The third scenario also shows good values, but not as good as the first two scenarios. The second scenario (exclusion of "Business" and "Fairness") was chosen, because a reduced mean item score is considered more important than an optimized Cronbach's alpha. Even so, the mean item score remains quite high, which limits the possibility of a high differentiation between respondents and consequently, between groups. Cronbach's alpha remains high enough to be consistent in the reliability of the scale. In conclusion, the selected items for the ethical patent valuation scale in the final questionnaire are A2 ("Society"), A3 ("Speed"), A6 ("Government") and A7 ("Software"), refer also to **Appendix 4**.

Evaluation of economic patent valuation items – Step 1

Item B9 "Solar Cells": This item was excluded, because it turned out to be too complicated. Only 17 of 26 respondents rated a value and the other 9 respondents ticked the box "*I am not able to estimate*". It also showed a high mean score (above average) and a low inter-rater variance (below average).

Item B11 "Painkiller": This item was also excluded as it shows the lowest inter-rater variance of all the items and by far the highest mean score.

Item B6 "Polymers": Item 3 was also discarded, because only 18 of 26 respondents were able (or willing) to give an estimate.

The reduction from 11 to 8 items leads to the following statistics: The 8-item scale shows a Cronbach's alpha of 0.873, a mean item score of 4.964, an inter-rater variance of 0.900 and an intra-rater variance of 0.880. These are already quite good values, in comparison with the ethical patent valuation scale.

Evaluation of economic patent valuation items – Step 2

Item B8 "QR": The correlation analysis showed that all items correlate significantly at the 0.001 level with the mean score (between 0.693 and 0.928), except item B8, which shows no significant correlation with the mean score. Without this item the intra-rater variance would decrease from 0.880 to 0.650 and Cronbach's alpha would increase from 0.873 to 0.912. All relevant parameters would therefore improve and so it was an easy decision to discard this item.

Evaluation of economic patent valuation items – Step 3

The remaining 7 items underwent a statistical analysis regarding their contribution to *mean item score*, *inter-rater variance*, *intra-rater variance*, *Cronbach's alpha* and their *correlation with the mean score*. The results of this analysis are presented in **Table 13** and **Table 14**:

	Correlation with mean (ρ)
Smart Glass	0,763
Liquid Lens	0,763
Water	0,795
LTE Power	**0,938**
LTE & Wi-Fi	0,865
Lithium	0,757
SSD	0,828

Table 13: Correlation with mean score for the remaining seven items

Smart Glass	X		X	X	X	X	X	X
Liquid Lens	X	X		X	X	X	X	X
Water	X	X	X		X	X	X	X
LTE Power	X	X	X	X		X	X	X
LTE & Wi-Fi	X	X	X	X	X		X	X
Lithium	X	X	X	X	X	X		X
SSD	X	X	X	X	X	X	X	
Mean item scores	4,990	4,988	4,988	5,012	**4,952**	**4,952**	5,000	5,036
Inter-rater variance	1,082	1,134	**1,147**	1,062	1,023	1,040	1,137	1,138
Intra-rater variance	0,650	0,664	0,621	0,631	0,714	0,638	**0,619**	0,660
Cronbach's alpha	**0,912**	0,901	0,909	0,899	0,880	0,895	0,908	0,899

Table 14: Combinations of 6 or 7 items and the corresponding statistical results

Item B4 "Smart Glass": The exclusion of this item would bring quite mixed results and so it was kept for the next analysis step.

Item B3 "Liquid Lens": This item was excluded, which leads to the best inter-rater variance and the highest Cronbach's alpha (among 6-item scenarios). The mean item scores and intra-rater variance improve slightly and the correlation with the mean score is among the three lowest.

Item B7 "Water": The exclusion of item B7 would slightly improve the intra-rater variance but all other parameters would be slightly impaired. It shows a medium

correlation with the mean score. Therefore, it was decided to maintain this item for the time being.

Item B12 “LTE Power”: This item showed by far the highest correlation with the mean score. Its exclusion would impair all parameters, except the mean item score. It was kept for the next analysis step.

Item B13 “LTE & Wi-Fi”: This item was difficult to evaluate (8 of 26 respondents stated that it is too difficult to estimate). However, a much better response rate is expected for the final questionnaire as the final sample has a telecommunications background, in contrast to the test sample for the pre-questionnaire. This item showed one of the highest mean scores, the intra-rater variance would be slightly better if the item was excluded and the inter-rater variance and Cronbach's alpha would be slightly impaired. This item was checked again in the next analysis step.

Item B14 “Lithium”: The exclusion of this would optimize the intra-rater variance and increase the inter-rater variance. It would slightly impair the mean item score and Cronbach's alpha. This item shows the lowest correlation with the mean score. Item B14 was discarded.

Item B15 “SSD”: Excluding this item would increase the inter-rater variance, but all other parameters would be impaired. It shows a high correlation with the mean score. Therefore, this item was kept for the next step.

Evaluation of economic patent valuation items – Step 4

The remaining 5 items were statistically analyzed again, in order to check whether further reduction provides any improvement or not. Results are shown in **Table 15** and **Table 16**:

	Correlation with mean (ρ)
Smart Glass	0.815
Water	0.850
LTE Power	**0.919**
LTE & Wi-Fi	0.873
SSD	0.804

Table 15: Correlation with mean score for the remaining five items

Smart Glass	X		X	X	X	X
Water	X	X		X	X	X
LTE Power	X	X	X		X	X
LTE & Wi-Fi	X	X	X	X		X
SSD	X	X	X	X	X	
Mean item scores	5,000	5,000	5,036	**4,946**	**4,946**	5,071
Inter-rater variance	1,212	**1,308**	1,191	1,165	1,184	1,260
Intra-rater variance	0,593	0,619	0,571	0,673	0,554	**0,548**
Cronbach's alpha	**0,903**	0,886	0,884	0,855	0,885	0,898

Table 16: Combinations of 4 or 5 items and the corresponding statistical results

A further exclusion of items would only negligibly improve the one or the other observed parameter, but at the cost of downgrading at least another parameter. Therefore, all remaining 5 items are kept, i.e. the economic patent valuation scale of the final questionnaire consists of the items B4 ("Smart Glass"), B7 ("Water"), B12 ("LTE Power"), B13 ("LTE & Wi-Fi") and B15 ("SSD"), refer also to **Appendix 4**.

Adjustment of the economic patent valuation measuring range

The appropriateness of the economic patent valuation scale was also analyzed in terms of symmetry and score balancing. Values "1" and "7" include extremes "no value" and "infinite value", which are not measured appropriately with this scale, thus scoring should be moved from the extremes towards the mean value "4". The five items chosen show a non-balanced scoring, as shown in **Figure 8**:

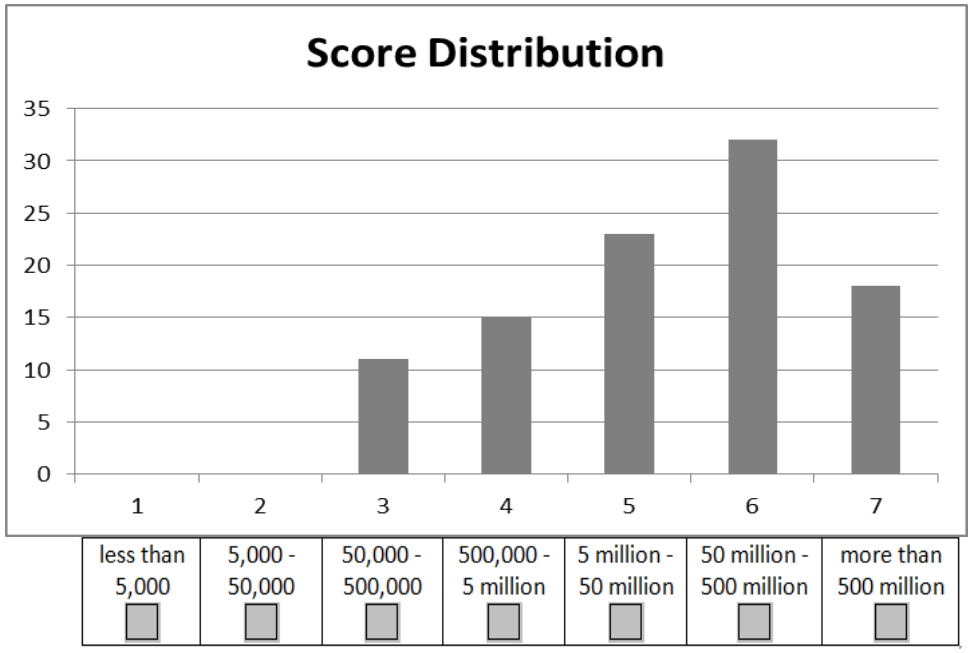

Figure 8: Score distribution of economic patent valuation scale

There was no rating below €50,000 and the range of €50 to €500 million was the most utilized valuation. Consequently, the measuring range should be stretched in this area between €50,000 and €500 million and should be shifted more towards high values to provide a higher possibility of differentiation. The following measuring range fulfils both requirements and was utilized in the final questionnaire:

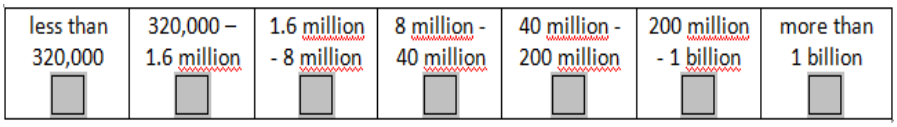

Figure 9: Adjusted economic patent valuation measuring range

The new measuring range is still a logarithmic scale, but with base-5 instead of base-10. The results of the statistical analysis of the data, gathered by means of the pre-questionnaire, were implemented in the final questionnaire, which can be found in **Appendix 4**.

5.3 Culture Related Survey Items

The final questionnaire contains culture related items as well as the patent related items created before. These culture related survey items are taken from the GLOBE project. This section describes which items were selected and the reasons why.

Which Cultural Dimensions are relevant for this work?

The literature review in **Chapter 3** discussed cross-cultural studies (section **3.2.2**) and the concept of cultural dimensions (section **3.2.3**), which provides a means to measure and compare societal cultures. The conceptual model (**Figure 1**) in section **3.5** postulates the influence of cultural dimensions on the valuation of patents. The literature review evaluated different sets of cultural dimensions that were developed by different scholars. Several studies conclude that the three cultural dimensions "Uncertainty Avoidance", "Individualism" and "Power Distance" are related to intellectual property piracy and innovativeness, whereas the former can be seen as a proxy for the notion of IPR and innovativeness for its part relates to patent statistics. Consequently, these three cultural dimensions seem to be rather obvious choices for further consideration in this research. The literature review also concludes that neither the reported results, nor the different argumentations support predictions about a potential influence of the cultural dimension "Masculinity vs. Femininity" on patent valuation, therefore it is not included in further considerations.

Another cultural aspect that was considered interesting as potentially influencing patent valuation is how a societal culture is oriented towards the past, present and future. The corresponding cultural dimension "Future Orientation" defined by the GLOBE project (House et al., 2004) was judged in the literature review to be better suited than "Long-term Orientation" introduced by Hofstede (Hofstede et al., 1991). It seems to be relevant, because every investment in patents (time, effort, money) is an investment that hopefully pays out in the future, but the required resources (R&D efforts, money) compete against other possible investments and spending in the

present. A society that is more oriented towards the future than others would more likely invest in patents, which could impact the valuation of patents.

In summary, the most interesting cultural dimensions with regard to this study are "Uncertainty Avoidance", "Individualism" (split in the GLOBE project into "Institutional Collectivism" and "In-Group Collectivism"), "Power Distance" and "Long Term Orientation", or in this case, the corresponding GLOBE dimension "Future Orientation".

Apart from the indications through the studies related to IP piracy and innovativeness, there are some other strong rationales for this choice:

> **Individualism** – patents are rights of individuals (or small groups, organisations) against the collective, i.e. society
>
> **Power Distance** – hierarchical thinking and unequally shared power are suspected to play a major role in innovativeness and thus may impact our stance towards patents
>
> **Uncertainty Avoidance** – patents are a type of insurance against future uncertainties
>
> **Future Orientation** – patents also represent a sort of investment in the future, given the costs involved and the fact that its potential profitability is several years in the future

Why GLOBE?

There are innumerable cross-cultural studies that developed cultural models, such as Hofstede, Schwartz, Trompenaars, WVS, the GLOBE project and others. Some of them provide ready to use questionnaires for further utilization by researchers. Only well-established cultural dimensions with well-proven items and scales are considered, because the creation of new cultural dimensions alone would go far beyond the scope of this work. Among those, the most widely used and most highly developed models are the ones from Hofstede and GLOBE. Apart from the publicly available

survey items, there were two other main reasons for choosing the GLOBE project: Strong theoretical foundations and the fact that the GLOBE project followed a research logic that features structures that are analogous to this work. Thus, it could be expected that the developed patent related survey items of this work fit seamlessly to the culture related survey items taken from the GLOBE project.

The GLOBE research framework was created from a joint undertaking of 170 researchers from 62 countries (Chhokar, Brodbeck, & House, 2007). Using appropriate cultural dimensions defined by GLOBE draws on well-established cultural dimensions and related definitions and scales, as adopted by other scholars (House et al., 2004). Thus, this work benefits from strong academic foundations. It is more modern in comparison with Hofstede's model, (partly based on Hofstede) and it introduced some improvements, especially the distinction between societal cultural values ("should be") and societal cultural practices ("as is"). In fact, more studies and quotes are related to Hofstede than to GLOBE and Hofstede remains better known in academia (Northouse, 2013; Tung & Verbeke, 2010). Hofstede's work "*Culture's Consequences*" (Hofstede, 1980) was published 24 years before the GLOBE project's results "*Culture, leadership, and organizations: The GLOBE study of 62 societies*" (House et al., 2004). Nonetheless, the GLOBE project provides the stronger academic foundation and an excellent questionnaire that is permitted for re-use by other researchers (GLOBE, 2006a).

Item Selection

The most natural approach would be to completely reuse the part of the GLOBE survey related to cultural dimensions. This would result in 78 items for the cultural part alone. The online survey platform, SurveyMonkey conducted an analysis of approximately 100,000 surveys and found that respondents spend more time per item on shorter surveys than on longer surveys (Chudoba, 2011), which threatens response quality. In his study, Krosnick (2000) confirms that respondents tend to adapt their response speed to the survey length and recommends using short surveys to ensure proper response quality. This work's goal is to maximize the survey

completion, return rate and response quality and to create a lean and efficient questionnaire. This means not overloading the questionnaire with unnecessary items and only focussing on those items that are important to answer the research questions. As mentioned above, the GLOBE project distinguishes between societal cultural values ("should be") and practices ("as is"), so that half of the survey items belong to each of the two categories. The reason for this distinction is that people may respond differently to questions, dependent on whether they respond to practices or beliefs. For example, it makes a difference if one is asked to comment on "people in this society live for the present" or "people in this society should live for the present". A statement concerning "as is" sometimes results in opposite responses than the same statement concerning "should be". The disparities between practices and values can be explained with the "deprivation hypothesis" (Chhokar, Brodbeck & House, 2007), i.e. people seem to perceive their own societal practices differently from what they think they should be and they sympathize with values that are higher or lower than the respective practice levels. The "deprivation hypothesis" is described in more detail in section **7.2**. In fact, the distinction between practices and values results in a significantly negative correlation for seven out of nine cultural dimensions when compared with each other (Chhokar et al., 2007). They therefore measure very different aspects and require clear differentiation.

The patent related items created refer to an evaluative assessment (e.g. "*Government policy should encourage patent protection to promote innovation*") rather than to a perceived practice. They refer to a moral view of the concept of patents. A higher ethical valuation of patents does not necessarily relate to higher numbers of patent applications, but does refer to a moral assessment. This work is concerned with societal cultural values, i.e. culturally influenced evaluative assessments, and therefore fits more to the "should be" items from the GLOBE project. An investigation concerning societal cultural practices would require a different research design. Likert (1932) had already recommended using the term "should" for the survey items, because he considered it important that the answers expressed "*desired behaviour and not statements of fact*" (Likert, 1932, p. 44).

Thus, considering only the "should be" items from the GLOBE project reduces the number of potential items to 39. A further reduction can be achieved by focussing on the most relevant and most suitable of the 9 cultural dimensions investigated by the GLOBE project (House et al., 2004).

Although the studies mentioned above use Hofstede's cultural dimensions, it seems a fair approach to investigate the corresponding GLOBE cultural dimensions instead, due to the advantages stated above.

In total, 22 survey items related to the five most relevant cultural dimensions (see justification above) are taken from the GLOBE project for utilization in the final questionnaire. This is to limit the questionnaire to the most relevant items, keep it concise, maximize completion rate and guarantee response quality. The respective culture related survey items can be found in the final questionnaire in **Appendix 4**. The five cultural dimensions are calculated as the means of the following items (reverse coded items are underlined):

Uncertainty Avoidance (**UnAv**) = 10 + 19 + 20 + 22 + 23

Future Orientation (**FutO**) = 11 + 12 + 15 + 26

Power Distance (**PowD**) = 13 + 18 + 24 + 27 + 29

Institutional Collectivism (**Col1**) = 14 + 17 + 30 + 31

In-Group Collectivism (**Col2**) = 16 + 21 + 25 + 28

5.4 Summary

This chapter describes the development of the final questionnaire consisting of a patent valuation and a culture related part. The survey items for the patent valuation related part were created in two steps. A number of candidate survey items emerged from the data gathered by means of semi-structured interviews (see section **5.1**). These candidate items were tested and analyzed with the help of a pre-questionnaire, described in section **5.2**. This two-step process produced a set of survey items that covered the patent valuation related part of the final questionnaire. The culture related survey items for the questionnaire were taken from the GLOBE project; section **5.3** describes the concerned items and the rational for the selection. A combination of both sets of survey items forms the final questionnaire that is the subject of the next chapter.

CHAPTER 6: MAIN ANALYSIS AND RESULTS

6.0 Introduction

The conceptual model (**Figure 1**) developed in **Chapter 3** assumes an influence of cultural dimensions on patent valuation. **Chapter 4** elaborates the methodology and methods for an empirical validation of this model. A first step in this direction was the development of the questionnaire described in **Chapter 5**, which is now utilized as a quantitative and qualitative data collection method in this chapter.

The questionnaire consists of 31 survey items (9 related to patent valuation and 22 related to culture), as well as some additional questions concerning personal information for statistical purposes and a field for comments. The patent related part was developed with the help of semi-structured interviews and a pre-questionnaire (refer to sections **5.1** and **5.2**), whereas the culture related part was taken from the GLOBE project (refer to section **5.3**). The data gathered by means of the questionnaire is analysed and provides the basis for answering the research questions and for validating empirically the conceptual model of cultural influence on patent valuation.

This chapter starts with a description of the questionnaire sample and the choice of countries in section **6.1**, followed by a presentation of the questionnaire items (section **6.2**) and the data gathered by the questionnaire, aggregated on a country (societal) level (section **6.3**). The subsequent section **6.4** explains the statistical analysis of the quantitative data and presents the associated findings. A field for comments was included to provide qualitative data. Section **6.5** presents the qualitative analysis of this data and the related results.

The schematic illustration of the research approach and the sequence of applied methods are presented in section **4.4** (see **Figure 5**). In the following it is repeated in **Figure 10**, whereas the sections related to this chapter are highlighted:

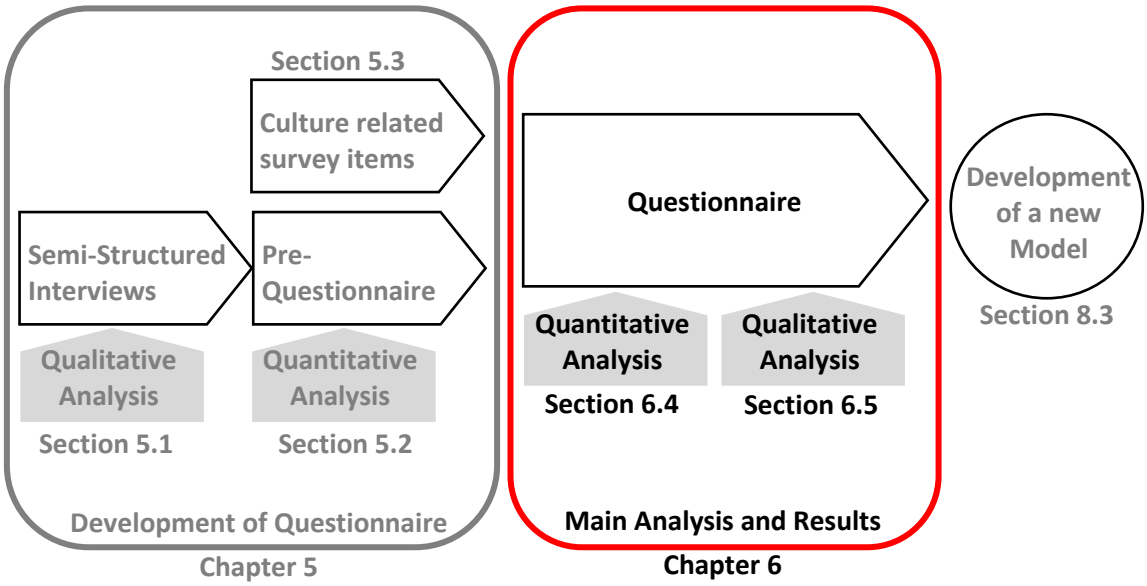

Figure 10: Research design and related sections of Chapter 6 (highlighted)

The findings of the analyses carried out in sections **6.4** and **6.5** are discussed in detail in **Chapter 7**.

6.1 Questionnaire Sample

This research aims to investigate cultural influence on the valuation of patents. Culture is neither measurable, nor has specific consequences. Therefore, a number of determined cultural dimensions have been identified whose influences on patent valuation are evaluated by means of a questionnaire. Given that specific cultural aspects are tested, the related questionnaire sample should represent a broad variety concerning these aspects, but exhibit the greatest possible homogeneity concerning all other parameters. Otherwise, observed differences in patent valuation could not be assigned unambiguously to the cultural parameters under investigation. Personal position towards patents may also be affected by the local ruling patent regime. In order to eliminate this potential additional parameter, this work is limited to European Patent Office member countries; refer also to section **4.4**. The cultural variety among these member countries is sufficiently large so this limitation is not

expected to have any negative consequences for the analysis of results. The questionnaire sample is determined by the selection of the countries considered for this investigation and by the profile of the participants. First, the selection of countries is described and the sample size and profile is then explained.

Country selection

Ideally, the questionnaire would include all 38 EPO member states (EPO, 2016b); however, this would go beyond the scope of this work. Therefore, a reasonable number of countries needed to be defined and then an appropriate sample of countries selected. According to Franke & Richey (2010), an investigation needs to involve at least 7 to 10 countries in order to allow credible generalizations. Some preparative explorations showed it was possible, albeit challenging, to access a reasonable number of people per country for up to 10 countries, determined by the researcher's working environment and personal contacts. These countries were Finland, France, Germany, Great Britain, Greece, Italy, Netherlands, Poland, Portugal and Spain. This number of countries would fulfil the requirements mentioned above and would also represent a broad cultural spectrum. These 10 countries represent all 5 European cultural clusters,[38] identified by the GLOBE project (Gupta & Hanges, 2004). They stretch over a large area of Europe and span a distance of 5,000 km from southwest Portugal to northeast Finland (refer to **Figure 11**).

[38] The GLOBE project defined 10 cultural clusters: Anglo Cultures, Latin Europe, Nordic Europe, Germanic Europe, Eastern Europe, Latin America, Sub-Sahara Africa, Arab Cultures, Southern Asia and Confucian Asia

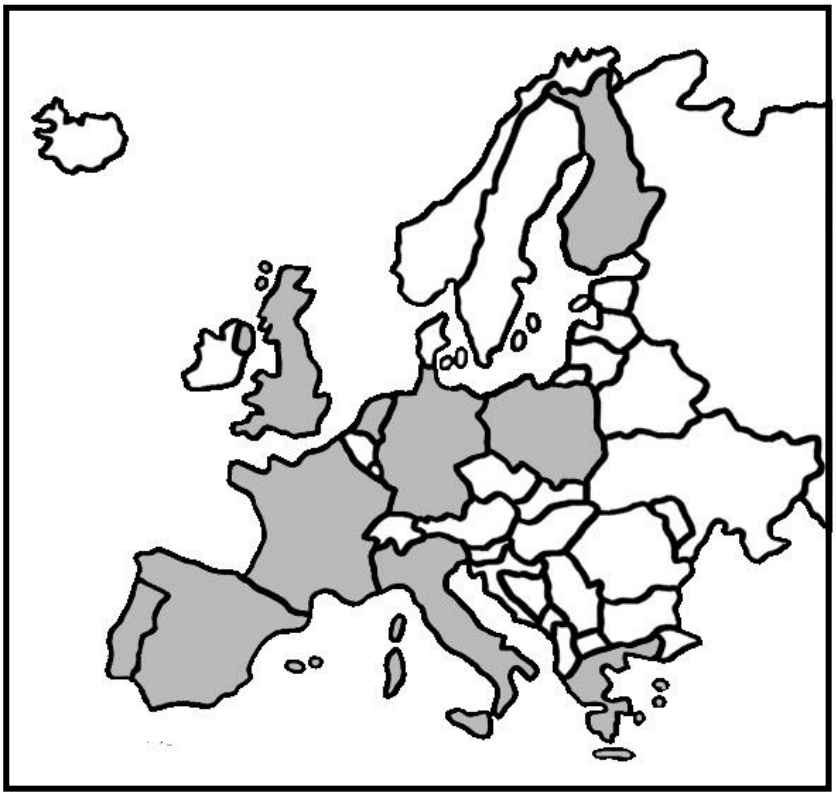

Figure 11: Map of Europe with the ten sample countries marked in grey

Geographical distance does not necessarily mean cultural distance, but it is an indication of separate historic-cultural developments within a common frame of mutual influence, and for different climate zones. This is a relevant factor for cultural development (Landes, 1999). The 10 country populations speak 10 different languages belonging to 5 different language families: Germanic, Hellenic, Finno-Ugric, Romance and Slavic (Baldi, 1983; Ramat & Ramat, 1998). Language is an important carrier of culture, it is "*bound up with culture in multiple and complex ways*" (Kramsch, 1998, p. 3). Linguistic diversity is another indication of cultural variety.

Consequently, if cultural diversity among the 10 selected countries is significant, then these differences should have been manifested in the GLOBE project results. The cultural dimensions' scores for the country sample did indeed exhibit a broad variety, as shown in **Table 17**:

	Position among 61 countries / Country Score									
	UnAv		FutO		PowD		Col1		Col2	
Finland	53	3.85	51	5.07	60	2.19	55	4.11	47	5.42
France	45	4.26	55	4.96	27	2.76	26	4.86	46	5.42
Germany*	59	3.32	57	4.85	44	2.54	28	4.82	55	5.18
Great Britain**	47	4.11	53	5.06	24	2.80	47	4.31	37	5.55
Greece	17	5.09	48	5.19	52	2.39	5	5.40	42	5.46
Italy	40	4.47	9	5.91	46	2.47	18	5.13	30	5.72
Netherlands	60	3.24	52	5.07	47	2.45	38	4.55	56	5.17
Poland	30	4.71	44	5.20	10	3.12	50	4.22	28	5.74
Portugal	41	4.43	35	5.43	53	2.38	9	5.30	15	5.94
Spain	27	4.76	28	5.63	59	2.26	12	5.20	21	5.79

* West Germany (former FRG) / ** England

Table 17: GLOBE societal values ("should be") and position among 61 countries (House et al., 2004)

In the five cultural dimensions under investigation, the 10 selected countries cover a broad spectrum of the 61 countries the GLOBE project investigated. **Table 18** shows the lowest and highest position among the 10 selected countries and the calculated differences of the respective country scores. These "score differences" among the sample countries range between 42% and 71% of the "total score differences" among the 61 investigated countries:

	lowest position*	highest position*	position range*	score difference**	total score difference***	range coverage
UnAv	17	59	43	1.77	3.45	51%
FutO	9	57	49	1.06	1.87	57%
PowD	10	60	51	0.93	1.61	58%
Col1	5	55	51	1.29	1.82	71%
Col2	15	56	42	0.67	1.58	42%

* lowest and highest position among the 10 selected countries and the range between both
** difference between highest and lowest score among 10 selected countries
*** difference between highest and lowest score among 61 investigated countries

Table 18: GLOBE societal values ("should be") differences among country sample in comparison to differences among all 61 investigated countries (House et al., 2004)

In summary, it can be said that the country sample complies with the preconditions to allow generalizations. The sample size of 10 countries and the broad spectrum of

societal cultures cover the five cultural dimensions under investigation between 42% and 71% of the total spectrum investigated by the GLOBE project (House et al., 2004).

Sample size and profile

The differences between countries under investigation will be of a statistical nature. Therefore, the sample size per country needs to be large enough to produce statistically reliable results. This work will follow Hofstede & Minkov (2013), who recommend a sample size of at least 20 participants per country. The sample should be homogeneous concerning all parameters other than societal culture. This investigation is ultimately targeted at inventors and patent owners, because they ultimately decide whether an invention is worth being patented (this is costly in terms of time, money and resources and each patent application binds resources and thus involves opportunity costs) and subsequently worth the annual maintenance fee being paid. One of the economic patent valuation methods is based exactly on the decision of whether to renew the annual maintenance fee payment for a patent. This "renewal data based method" is described in detail in section **3.3.2**. Thus, the final questionnaire should ideally be aimed at inventors and patent holders. However, it is impossible to access enough individuals from ten different countries who comply with the condition of being an inventor and/or patent owner. The alternative is to address individuals with a similar professional and educational background as this group can be considered a good approximation. Roughly 96% of all patent applications at the EPO are in a STEM (science, technology, engineering, and mathematics) related technology sector[39] (EPO, 2016b) and patenting can be considered "*frequently an engineering activity*" (Giuri et al., 2007, p. 1111). There are few statistics available concerning the percentage of inventors with a STEM educational background, because patent documents contain names of inventors, but no information about their education. Walsh & Nagaoka (2009) found that 98.5% of Japanese and 94.5% of US American inventors have a STEM educational background. Jung & Ejermo (2014) came to a similar conclusion, stating that about 90% of Swedish inventors had a

[39] electrical engineering, instruments, chemistry, mechanical engineering and civil engineering

tertiary level of education in STAM (science, technology, agriculture, and medicine) subjects. Patent owners are typically large companies[40]. These are represented by managers of different levels, who take business decisions about patent applications and patent renewals. However, when assessing the (potential) value of patents, they are most likely to rely on engineering specialists or other experts with a STEM educational background. Thus, for this work a questionnaire sample was chosen whose members are all working in the telecommunications industry and who all have a tertiary education in STEM fields (science, technology, engineering, and mathematics).

More than 500 questionnaires have been sent out and a total of 224 respondents returned filled in questionnaires, of which 215 were complete and usable for statistical analysis. All respondents are nationals of 10 different EPO (European Patent Office) member countries:

ESP Spain - 22 respondents
FIN Finland - 21 respondents
FRA France - 22 respondents
GBR Great Britain - 23 respondents
GER Germany - 24 respondents
GRE Greece - 20 respondents
ITA Italy - 21 respondents
NED Netherlands - 20 respondents
POL Poland - 21 respondents
POR Portugal - 21 respondents

The questionnaire sample consists of 215 respondents in total from 10 countries, all with STEM educational background working in telecommunications. In this way, a sufficiently broad cultural spectrum is covered with a sample that is homogeneous concerning all relevant parameters other than cultural dimensions.

[40] large enterprises were responsible for 69% of European patent applications in 2015, SME (small and medium-sized enterprises) and individual inventors accounted for 26% and universities and public research for 5% (EPO, 2016b)

6.2 Questionnaire Items

As the questionnaire should provide quantitative data that can be further processed, the questions need to be closed questions (Robson, 2011). For a more differentiated statistical analysis, the possible answers are not limited to “yes” or “no”, but a seven-point Likert scale from 1 to 7. Likert scales are relatively easy to analyze and clear questions can be formulated. Thus, unnecessary sources of error could be avoided in advance. These scales provided quantitative data that could be statistically processed and analyzed, utilizing appropriate software (SPSS). The rationale behind the choice of the Likert-type scales and a related description is referred to in section **4.4**.

The questionnaire (**Appendix 4**), developed in **Chapter 5**, included **31 items** that are related to **7 scales**. These 7 scales measure the following dimensions:

Pat1	4 items	Ethical valuation of patents
Pat2	5 items	Economic valuation of patents
UnAv	5 items	Cultural dimension “Uncertainty Avoidance”
FutO	4 items	Cultural dimension “Future Orientation”
PowD	5 items	Cultural dimension “Power Distance”
Col1	4 items	Cultural dimension “Collectivism I: Institutional collectivism”
Col2	4 items	Cultural dimension “Collectivism II: In-group collectivism”

The questionnaire also included a number of questions to provide some personal information for statistical purposes. These are:

- years of professional experience
- years in telecommunications
- age group (in blocks of five-years, e.g. 30-34)
- gender
- nationality
- educational background

6.3 Questionnaire Data

The data obtained from the 215 questionnaires was first used to calculate the scale value per respondent and then aggregated on a societal level. The results are shown in **Table 19**.

	Pat1	Pat2	UnAv	FutO	PowD	Col1	Col2
ESP	5,75	4,15	4,43	4,68	2,44	5,01	5,20
FIN	5,48	4,41	3,83	4,62	2,70	4,19	4,58
FRA	5,93	4,04	4,23	4,93	2,67	5,02	5,24
GBR	5,05	4,53	3,60	4,60	2,57	4,42	5,21
GER	5,61	4,24	3,87	4,61	2,55	4,29	4,75
GRE	5,50	4,50	4,68	5,08	2,74	4,83	5,09
ITA	5,62	3,91	4,34	4,92	2,74	4,99	4,54
NED	5,28	3,75	3,63	4,46	2,59	4,13	4,76
POL	5,13	3,90	4,13	5,02	2,75	4,11	4,76
POR	5,35	3,77	4,14	4,90	2,63	4,81	5,35

Table 19: Aggregated questionnaire data

Table 19 represents the raw quantitative data obtained from the final questionnaire. This data is statistically analyzed in the following section.

6.4 Statistical Analysis

The quantitative data produced by the questionnaire was statistically analyzed with appropriate software (SPSS). This section first presents the applied statistical methods and then expounds the main analysis of the quantitative data gathered by means of the final questionnaire.

6.4.1 Statistical Methods

A final suitability check was performed in order to ensure scale reliability and data quality before the statistical data analysis. The selection of the most appropriate methods to determine the relationship between different variables is also presented.

Scale reliability and data quality

The appropriate level of analysis needs to be taken into consideration when assessing scale reliability and consistency. The main objective of this work is to investigate cultural differences concerning patent valuation and therefore the scales of the questionnaire are designed for a societal level of analysis. Scale quality and consistency is assessed on a societal level of analysis. The GLOBE project also used this method; the researchers aggregated the items that comprised each scale to the societal level and computed Cronbach's alpha (Hanges & Dickson, 2004). The GLOBE results for those cultural scales that were utilized in this work (*UnAv*, *PowD*, *FutO*, *Col1*, *Col2*) are shown in **Table 20**. They represent the cultural values ("should be") on a societal level with a sample size of n = 61 countries.

	UnAv	FutO	PowD	Col1	Col2
Cronbach's α	0.85	0.76	0.74	0.77	0.66

Table 20: Cronbach's α for GLOBE scales ("should be") on societal level (n = 61) (Hanges & Dickson, 2004, p. 134)

All values for Cronbach's alpha in **Table 20** lie above 0.7, which is the threshold that is most commonly considered a reasonable limit for acceptable scale consistency (Cortina, 1993; Hofstede & Minkov, 2013; Schmitt, 1996). The only exception is *Col2*, where alpha is slightly below 0.7, but still at a level that does not question the validity of this GLOBE scale. The GLOBE project executed extensive and academically sound statistical analysis of the construct validity of the culture scales, of which Cronbach's alpha was only one statistical method among many:

> "*we performed a variety of statistical analyses to assess the psychometric properties (e.g., rwg, ICCs, multilevel confirmatory factor analyses, reliability analysis) of our scales. (…) Scales were reliable at the organizational and/or societal level.*" (GLOBE, 2006a, p.2)

The reliability and consistency of the cultural scales from the GLOBE project have been confirmed by numerous researchers and studies (Bertsch, 2012; Gabrenya Jr & Smith, 2015; Kabasakal et al., 2012; Krishnan & AlSudiary, 2016; Waldman et al., 2006). Therefore, it can be safely assumed that the GLOBE scales are an appropriate means to investigate differences of the concerned cultural dimensions on a societal level.

The last thing to assess is the appropriateness of the two additional scales that were developed by this work in **Chapter 5** and that relate to patent valuation, i.e. the scales *Pat1* (ethical patent valuation) and *Pat2* (economic patent valuation). As mentioned above, the calculation of Cronbach's alpha provides different results for the individual and the societal level. The societal level of analysis is relevant for this work because it investigates cultural differences. The patent related scales *Pat1* and *Pat2* were developed and tested based on the pre-questionnaire sample, but the final questionnaire has a much larger sample which allows for a much higher informational value. In addition to Cronbach's alpha the two-way random intra-class correlation coefficient ICC(2,1) is calculated as another indicator for scale consistency. Both statistical methods are briefly presented in section **5.2.3**. A high value of ICC indicates that the scales measure a phenomenon consistently. Scale reliability can be regarded as poor for ICC below 0.40, fair for ICC from 0.40 to 0.59 and good for ICC above 0.60

(Cicchetti & Sparrow, 1981). The respective results for the two scales *Pat1* and *Pat2* are presented in **Table 21**:

	Pat1	**Pat2**
Cronbach's α	0.845	0.750
ICC(2,1)	0.577	0.405

Table 21: Cronbach's α and ICC(2,1) for *Pat1* and *Pat2* on societal level (n = 10)

All values in **Table 21** indicate an acceptable scale consistency; Cronbach's alpha > 0.7 for *Pat1* and *Pat2* and ICC(2,1) > 0.4. The calculation is based on a much smaller sample size (n = 10 countries) than for the cultural scales from the GLOBE project shown in **Table 20**, but is considered sufficient for the purpose of this study.

Additionally, the one-way analysis of variance (ANOVA) was calculated for the patent valuation related scales *Pat1* and *Pat2*. ANOVA is a measure of differences between groups. The probability (p-value) is calculated that the means of the groups are equal, i.e. to investigate whether the 10 societal groups differ significantly concerning a scale. The results show that some of the groups' scores have a significant overlap on scales *Pat1* and *Pat2*, i.e. although means and variances differ, these differences are not pronounced enough to indicate that groups are different related to the scales on a significant statistical level. Detailed results can be found in **Appendix 5**. The ANOVA result is not related to scale consistency, but to the differentiability of the scales. Whether the differentiability of the scales *Pat1* and *Pat2* is sufficient remains to be seen in the further course of the statistical analysis, i.e. the next sections will prove whether the correlation and linear regression calculations can provide meaningful results for the used scales.

Correlation and Linear Regression

The main aim of this statistical analysis is to determine the relationship between the different patent and culture related scales. Correlation calculation and linear regression were the methods judged most appropriate for this purpose.

The first thing to mention is the correlation calculation that determines the extent of correlation between different variables. This method was also used in section **5.2.3**, but for a different purpose, i.e. to identify the items that correlate most closely with the total score. Here the use case is different; the aim is to determine the dependence of two variables. It is more common to use either the rank correlation coefficients τ (tau) of Kendall and ρ (rho) of Spearman, or the product-moment correlation coefficient r of Pearson. The first two coefficients, τ and ρ, give a measure of the relationship among ordinal scale data, whereas the product-moment correlation coefficient is used to measure the correlation of interval scaled data. A very common classification of scales of measure was introduced by Stevens (1946). He distinguished between *nominal* (data based on names or other qualitative classification, e.g. nationality or language), *ordinal* (this type of scale allows for rank order and the mathematical operators < and > are applicable, e.g. school grades from 1 to 6, whereas no information about distances between grades is implied), *interval* (metric scale where differences in rank and distance between values can be measured, e.g. the Celsius temperature scale) and *ratio* (metric scale with a zero value, which allows for division and multiplication, e.g. mass or duration) scales. Only ordinal and interval scale data are relevant in this work. Likert-type scales are ordinal in nature, although the points on them are assumed to be equidistant and are therefore sometimes treated as if they were interval scales (Norman, 2010). Consequently, the statistical method of choice is Spearman's rank correlation. For example, this is used by Kabasakal et al. (2012) to test correlation between cultural values and leadership attributes from the GLOBE study. In general, the value of the correlation coefficient is a measure of the shared variance between two variables. A higher value does not necessarily mean that a variable is the cause of the other. For example, both variables can have a common cause. The question of causality is not answered by the correlation alone.

A certain probability of error is accepted and therefore a meaningful significance level is defined. The error probability corresponds to the α-error. This is defined as the probability that the sample mistakenly confirms or rejects a hypothesis. A commonly used significance level is 0.05 for "significant" correlations or differences and 0.01 for

"very significant" correlations and differences. This allows error probabilities of 5% ("significant") or 1% ("very significant"). The reliability of this method increases with the sample size and this research uses a relatively small sample size of n = 10 (this study uses culture as the level of analysis; therefore n is the number of societal cultures).

In addition to the Spearman's rank correlation, linear regression (McDonald, 2009) is also used to examine how and whether the variables are related. The linear regression should provide a linear equation that best represents the relationship between the independent and the dependent variable. In this case, cultural dimensions are the independent variable and patent valuation is the dependent variable. The main interest is whether, and to what extent, the data derived from the three different types of items interrelate (relating to cultural dimensions, ethical patent valuation and economic patent valuation). Linear regression is not only another method to analyze whether and to what extent variables are related to each other, but also a method that enables a graphical and easy-to-understand representation of the results. Such a graphical representation is shown in **Figures 12** to **16**.

The statistical data analysis showed whether and how strong determined cultural dimensions interrelate with a willingness to attribute high economic value to patents (average high scores at the related Likert-type scale). It also uncovered whether and how strong determined cultural dimensions interrelate with different ethical standpoints towards patents. With these insights the first research question can be answered. The extent of these interrelations addresses the “how” of the second research question. The data analysis also provides insights to address the “why” of the second research question, through the potential interrelation between the willingness to attribute high economic value to patents and the different ethical standpoints towards patents. This last part of the second research question is also theoretically elaborated in **Chapter 7,** with the help of the theory of culture. Answering the two research questions enables the elaboration of a new model in **Chapter 8** that helps analysts and M&A professionals to consider a cultural impact

among other factors (e.g. industrial sector, average remaining run-time, license revenue) for estimating the economic value of a patent portfolio.

6.4.2 Cultural impact on ethical patent valuation

Research Question 1 (What cultural dimensions influence the concept of patents?) can be answered with the statistical analysis of the data obtained from the questionnaire (refer to **Table 19**). A calculation of Spearman's rank correlation coefficient rho results in ρ = 0.685* for the relation between *Pat1* and *UnAv* and ρ = 0.782** for the relation between *Pat1* and *Col1* (* correlation is significant at the 0.05 level / ** correlation is significant at the 0.01 level). The other cultural dimensions *FutO*, *PowD* and *Col2* do not correlate with *Pat1* on a significant level. The detailed results for n = 10 are provided in **Table 22**.

		Pat1	Pat2	UnAv	FutO	PowD	Col1	Col2
Pat1	Spearman's **ρ**	1,000	,042	,685*	,321	-,128	,782**	-,049
	Sig. (2-tailed)		,907	,029	,365	,725	,008	,894
Pat2	Spearman's **ρ**	,042	1,000	-,006	-,018	-,146	,188	-,030
	Sig. (2-tailed)	,907		,987	,960	,688	,603	,934

* Correlation is significant at the 0.05 level (2-tailed)
** Correlation is significant at the 0.01 level (2-tailed)

Table 22: Correlation between patent valuation and cultural dimensions (n = 10)

The calculation of Spearman's rank correlation coefficient showed that there is indeed a distinct relation between both dimensions Pat1 and UnAv. This relation is represented graphically in **Figure 12**, where a pair of numbers (Pat1|UnAv) is depicted for each country examined. A first look at this scatter plot suggests a general tendency, but it would be very useful to quantify this tendency. This can be done by means of a linear regression. This approach requires interval scaled data. In principle, Likert items are ordinal in character, but a thorough design that ensures symmetry and an approximate equidistance between values allows Likert scales, being sums of Likert items to be treated statistically as if they were interval scales (Carifio & Perla, 2008; Norman, 2010). Hence, linear regression is considered a useful means for an

approximation of a quantified linear relation. A linear regression analysis performed with SPSS provides the following equation: *Pat1* = 3.806 + 0.407 x *UnAv***.** The line through points Pat1(3.50) = 5.23 and Pat1(4.80) = 5.76 is also shown in **Figure 12**.

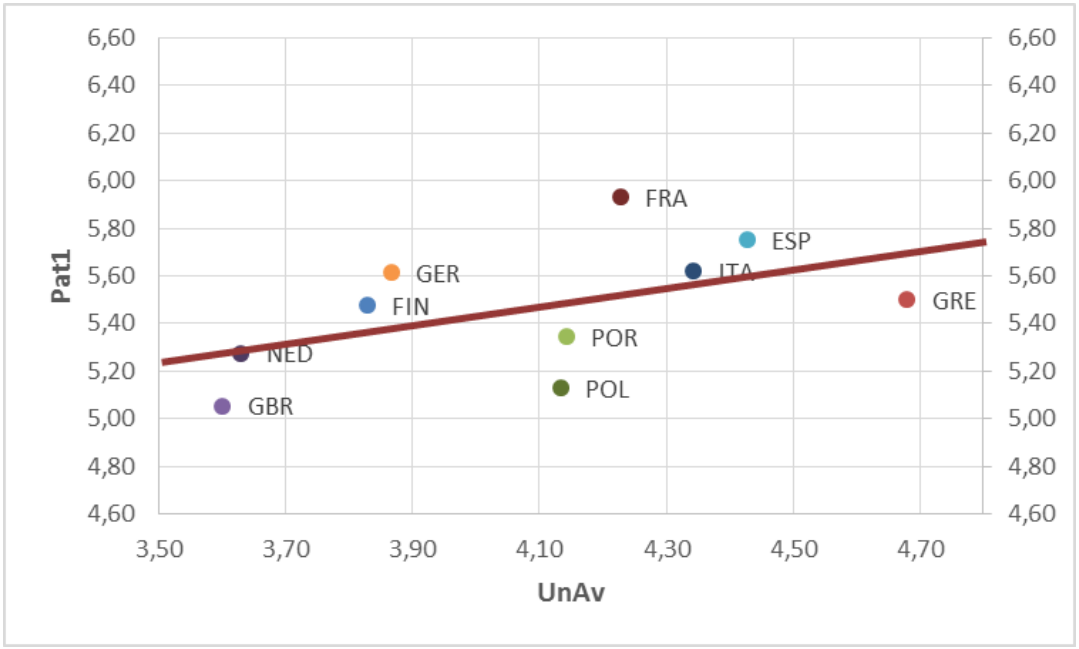

Figure 12: Relation between dimensions *Pat1* and *UnAv*

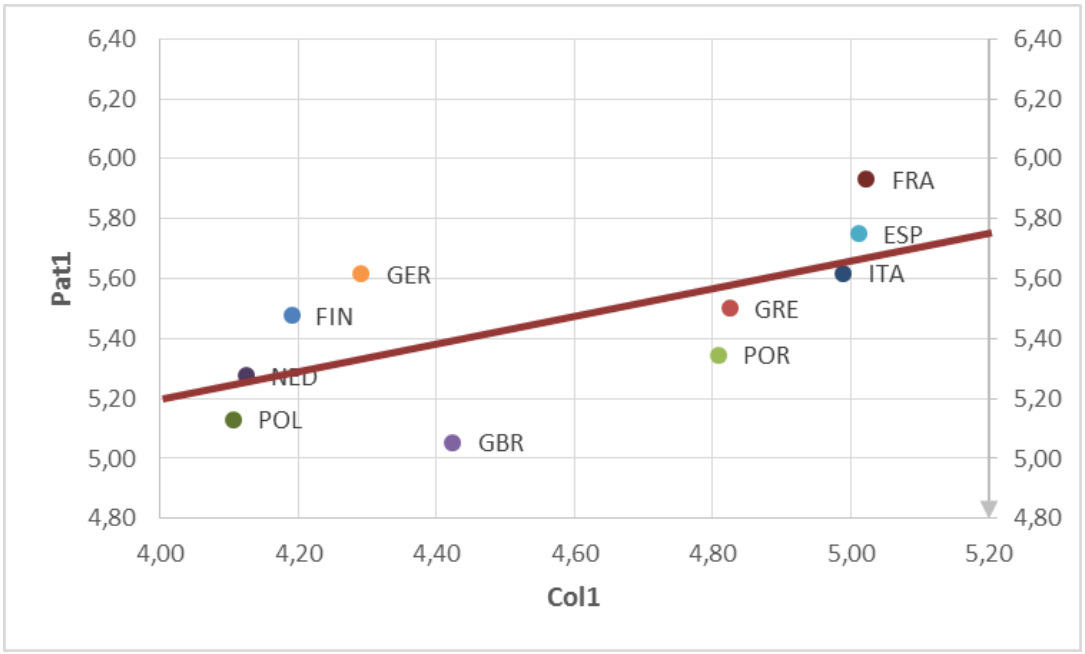

Figure 13: Relation between dimensions *Pat1* and *Col1*

The relation between the dimensions *Pat1* and *Col1* can be seen in **Figure 13**, whereas the linear regression equation *Pat1* = 3.321 + 0.469 x *Col1* is shown as the line through the two points Pat1(4.00) = 5.20 and Pat1(5.20) = 5.76.

6.4.3 Cultural impact on economic patent valuation

The investigation of cultural impact on economic patent valuation addresses the economic aspect of Research Question 2 (How, and why, do these cultural dimensions impact the economic and ethical valuation of patents?). A calculation of Spearman's rank correlation coefficient rho does not result in any significant correlation between dimension *Pat2* and the five cultural dimensions or between dimensions *Pat1* and *Pat2* (refer to **Table 22**). However, analyzing the relation of *Pat2* with cultural dimensions on item level, it turned out that *Pat2* correlates with one of the four items that build the cultural dimension *FutO*. The items of *FutO* are as follows (refer also to the complete questionnaire in **Appendix 4**)[41]:

> *Item11* - I believe that people who are successful should: plan ahead / take life events as they occur
>
> *Item12* - I believe that the accepted norm in this society should be to: plan for the future / accept the status quo
>
> *Item15* - I believe that social gatherings should be: planned well in advance (2 or more weeks in advance) / spontaneous (planned less than an hour in advance)
>
> *Item26* - I believe that people should: live for the present / live for the future

A calculation of Spearman's rank correlation coefficient rho results in ρ = -0.644* for the dependence between *Pat2* and *Item26* (* correlation is significant at the 0.05

[41] Items 11, 12 and 15 are reverse coded

level), for items 11, 12 and 15 rho is far from close to the significance level (*Item26* scores can be found in **Appendix 5**).

The question *why Pat2* correlates only with one item of the Future Orientation scale is further discussed in **Chapter 7**.

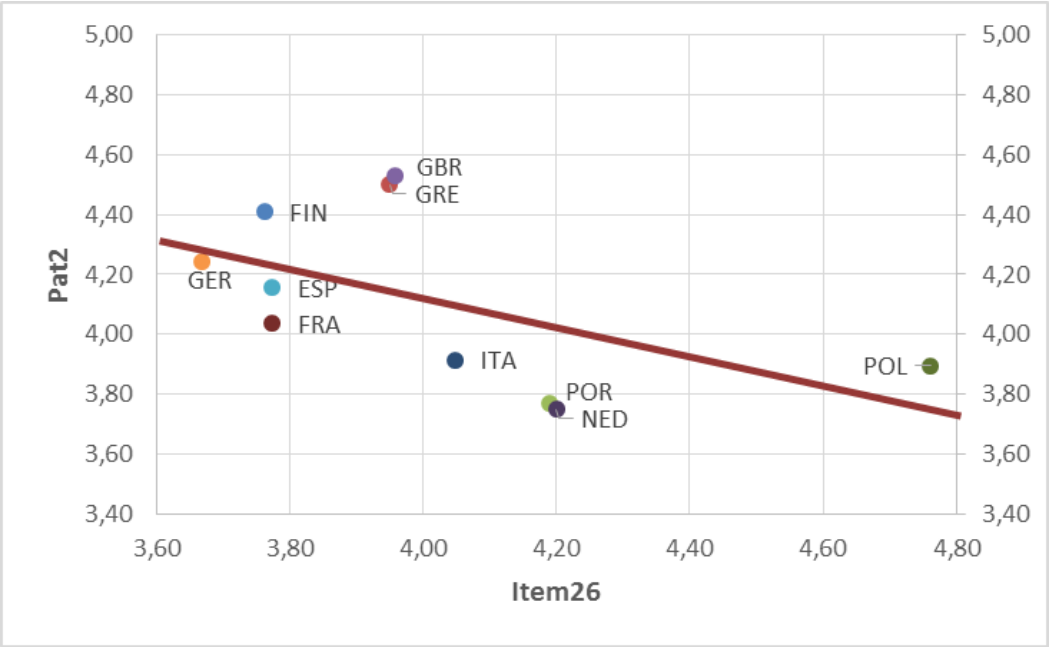

Figure 14: Relation between dimension *Pat2* and *Item26*

Figure 14 shows the relationship between *Pat2* and *Item26*, whereas the linear regression equation *Pat2* = 6.061 - 0.484 x *Item26* is depicted as a line through the two points Pat2(3.60) = 4.32 and Pat2(4.80) = 3.74.

6.4.4 Relation between different cultural dimensions

The relation between the different cultural dimensions has also been analyzed. The results of Spearman's rank correlation rho on country level can be found in **Table 23**:

		UnAv	FutO	PowD	Col1	Col2
UnAv	Spearman's **ρ**	1,000	,770**	,261	,697*	,109
	Sig. (2-tailed)		,009	,466	,025	,763
FutO	Spearman's **ρ**	,770**	1,000	,717*	,358	,116
	Sig. (2-tailed)	,009		,020	,310	,751
PowD	Spearman's **ρ**	,261	,717*	1,000	-,170	-,305
	Sig. (2-tailed)	,466	,020		,638	,392
Col1	Spearman's **ρ**	,697*	,358	-,170	1,000	,389
	Sig. (2-tailed)	,025	,310	,638		,266
Col2	Spearman's **ρ**	,109	,116	-,305	,389	1,000
	Sig. (2-tailed)	,763	,751	,392	,266	

* Correlation is significant at the 0.05 level (2-tailed)

** Correlation is significant at the 0.01 level (2-tailed)

Table 23: Correlation between cultural dimensions (n = 10)

Although it is unsurprising that some cultural dimensions correlate on a significant level with each other, e.g. *UnAv* with *FutO*, it is worth mentioning that most cultural dimensions do not correlate significantly with others and hence provide independent information about the cultures under investigation (House et al., 1999). As these cultural dimensions have been taken from the GLOBE project, it is also interesting to see how far the results of this survey coincide or differ from the GLOBE results. The GLOBE results for the selected countries and the corresponding cultural dimensions "should be" are shown in **Table 24** (GLOBE, 2004):

	GLOBE ("should be")				
	UnAv	**FutO**	**PowD**	**Col1**	**Col2**
ESP	4,76	5,63	2,26	5,20	5,79
FIN	3,85	5,07	2,19	4,11	5,42
FRA	4,26	4,96	2,76	4,86	5,42
GBR[42]	4,11	5,06	2,80	4,31	5,55
GER[43]	3,32	4,85	2,54	4,82	5,18
GRE	5,09	5,19	2,39	5,40	5,46
ITA	4,47	5,91	2,47	5,13	5,72
NED	3,24	5,07	2,45	4,55	5,17
POL	4,71	5,20	3,12	4,22	5,74
POR	4,43	5,43	2,38	5,30	5,94

Table 24: Results from the GLOBE project for selected societal cultural dimensions "should be" (GLOBE, 2004)

These results can be compared with the corresponding values from the survey in **Table 19**. For a meaningful comparison, the Spearman's rank correlation rho between the aggregated questionnaire data from this survey for the 5 cultural dimensions and the 10 countries under investigation (**Table 19**) and the corresponding data from the GLOBE project (**Table 24**) is calculated and presented in **Table 25**:[44]

			GLOBE ("should be")				
			UnAv	**FutO**	**PowD**	**Col1**	**Col2**
This survey	**UnAv**	Spearman's **ρ**	,830**	,547	-,273	,794**	,432
		Sig. (2-tailed)	,003	,102	,446	,006	,213
	FutO	Spearman's **ρ**	,806**	,377	,115	,430	,419
		Sig. (2-tailed)	,005	,283	,751	,214	,228
	PowD	Spearman's **ρ**	,389	,305	,188	-,085	,122
		Sig. (2-tailed)	,266	,392	,602	,815	,737
	Col1	Spearman's **ρ**	,455	,207	-,176	,697*	,280
		Sig. (2-tailed)	,187	,567	,627	,025	,434
	Col2	Spearman's **ρ**	,207	-,095	,073	,395	,372
		Sig. (2-tailed)	,567	,795	,841	,258	,290

* Correlation is significant at the 0.05 level (2-tailed)

** Correlation is significant at the 0.01 level (2-tailed)

Table 25: Correlation between results of this survey and corresponding data from the GLOBE project (n = 10)

[42] England

[43] West Germany (former FRG)

[44] GLOBE refers to West Germany (former FRG) and England, whereas this work refers to Germany and Great Britain

UnAv and *Col1* correlate with the respective values from the GLOBE project (GLOBE, 2004), but *FutO*, *PowD* and *Col2* do not.

The GLOBE project undertook its survey in the late 1990s among middle managers of three different industries: food processing, financial services and telecommunication services (Chhokar et al., 2007). Differences between the three industries were observed in relation to leadership preferences, but also to societal cultural values (Chhokar et al., 2007, pp. 537, 616). This observation is in line with Hofstede's guidance that results from one survey are only comparable with those from another survey if both samples of respondents match all criteria such as age, profession, industry, gender and point in time (Hofstede & Minkov, 2013). As this is virtually impossible, results from different surveys may always differ. This point of view is supported by Maznevski et al. (2002), who emphasize the influence of the survey context and subcultures (e.g. industry and educational background) and also by the GLOBE project that in some cases experienced more difference in mean scores for societal cultural values between industry sectors within countries, than between countries (Chhokar et al., 2007). Therefore, although there are further studies that used the same or similar cultural dimensions for cross-cultural research, their results are not expected to correlate more closely with the results of this work than those of the GLOBE project.

The sample of this survey is more homogeneous than the GLOBE sample as all respondents are from one industry sector (telecommunications), with a similar educational background (STEM fields). Furthermore, most of the respondents (177 = 83%) are currently working for the same company (Nokia). However, just as with GLOBE, country samples vary in their composition regarding age, gender and job role.

Although Nokia is a company rooted in Finland, it has become a truly global company. This means that the corporate culture developed from a Finnish foundation, but with strong influences from many other countries. This means that many of the respondents in this survey have lived abroad for some time and are influenced by other cultures than their country of origin.

The most that could be expected from the results of this survey are similarities to those of the GLOBE survey. This is the case with the cultural dimensions *UnAv* and *Col1* that closely correlate with the corresponding dimensions from the GLOBE survey. The other three cultural dimensions utilized in this survey do not show similarities, due to the differences of the country samples, as explained above.

6.4.5 Impact of age, gender, educational background and job role

As stated above, this survey's sample is more homogeneous than the GLOBE sample, but there are still some variations in age, gender and job role that may influence the comparability of the results. The questionnaire provided some information about age group, years of professional experience and gender. Additional information about current job roles was collected in parallel, either through personal contacts or publicly accessible sources like LinkedIn and XING.

Age / Professional Experience

The different country samples exhibit considerable differences in their age structure, due to varying company strategies for the concerned countries over the last 15 years. For example, the Finnish and German workforce has undergone several staff adjustment measures, whereas a significant number of Polish and Greek employees have been hired during the same time frame. In the Finnish sample, the average years of professional experience is 28 and the mean age group is between 50 and 54. The Greek sample has an average professional experience of 11 years and is in the age group between 35 and 39.

The respondents were asked to choose their age range in the questionnaire. They were not asked to give their exact age in order not to discourage potential respondents. During the preparations for the questionnaire, there was some feedback that questions about age could be perceived as intrusive or indiscreet, even though the other questions could also be perceived as very personal (indeed in one

case a respondent rejected the questionnaire, because he did not want to disclose his opinion). When the questionnaire was created, age was regarded as of secondary interest and a respondent's willingness to respond should not be endangered just because of this parameter. Therefore, age ranges have been chosen. For the statistical analysis these age ranges were mapped to age groups 1 to 7, analogue to the patent valuation and cultural dimensions scales that also range from 1 to 7. The mapping is presented in **Table 26**:

Age	-34	35-39	40-44	45-49	50-54	55-59	60-
AgeGr	1	2	3	4	5	6	7

Table 26: Mapping of age ranges to age groups

The differences regarding age groups and average years of professional experiences in the country samples are presented in **Table 27**:

	ProfEx	**AgeGr**
GRE	10,65	1,95
FIN	28,29	5,14
POR	15,95	2,86
GBR	27,96	4,26
ESP	18,68	3,23
GER	26,00	5,13
ITA	23,33	4,43
FRA	19,73	3,55
POL	15,57	2,52
NED	22,60	3,90

Table 27: Age groups and professional experience in country samples

The different age groups do not show significantly different means and variances (one-way ANOVA) regarding the dimensions *Pat1* and *Pat2*. Professional experience is highly connected to the age of the respondent and therefore provides very similar results for one-way ANOVA as age groups.

A calculation of Spearman's ρ for age groups and professional experience shows no statistically significant correlation between either age groups (*AgeGr*) or professional experience (*ProfEx*) with *Pat1* and *Pat2*. As expected, *AgeGr* correlates strongly with

ProfEx (correlation is significant at the 0.01 level). The fact that the different age structure of the country samples does not show significant correlation with *Pat1* and *Pat2* confirms, together with the results from one-way ANOVA, that the sample does not need to be controlled for the parameter age to investigate patent valuation.

Gender

The GLOBE sample consisted of 74% males and 26% females with some variation in the distribution over country samples, e.g. the female share of the German sample was 14% (Brodbeck & Frese, 2007). In fact, the GLOBE project analyzed the potential impact of gender and detected no differences in societal cultural values, except "Gender Egalitarianism" and "Humane Orientation" (House et al., 2004, p. 385/386). Neither cultural dimension is considered relevant for this work. Trompenaars identified small cultural differences between male and female samples, but did not judge these differences significant enough to question the generalizability of the overall results of his study (A. Trompenaars, F. Trompenaars, & Hampden-Turner, 2012, p. 311). Hofstede used mixed male and female samples but he analyzed them separately (Hofstede, 1980). He found no significant difference in "Power Distance", in "Uncertainty Avoidance" and in "Individualism". The only cultural dimension where he found some significant gender differences was "Masculinity", a dimension that is irrelevant for this work.

Based on the evidence described in the literature above, this study did not expect any impact of gender and thus did not control the gender distribution in the different country samples (see **Table 28**).

	Total	Female	Female [%]
ESP	22	7	31,8%
FIN	21	0	0,0%
FRA	22	2	9,1%
GBR	23	2	8,7%
GRE	20	4	20,0%
GER	24	1	4,2%
ITA	21	2	9,5%
NED	20	0	0,0%
POL	21	2	9,5%
POR	21	3	14,3%
	215	**23**	**10,7%**

Table 28: Gender composition of country samples

An analysis was done with one-way ANOVA and the 23 female and 192 male respondents showed no significantly different means and variances concerning *Pat1* and *Pat2*. Hence it can be assumed that females and males do not form statistically significant distinguishable sub-groups on country level regarding patent valuation. The female country samples are too small to allow for a meaningful correlation calculation, but even so there is no significant impact of gender expected in the results of this work.

Educational Background

Other studies have already shown that some parameters, such as related industries and educational background, have considerable impact on the results of cultural studies (Chhokar et al., 2007; Hofstede & Minkov, 2013). Therefore, this work is limited to only one dedicated industry (telecommunications) and respondents with a tertiary STEM (science, technology, engineering, or mathematics) educational background. This provides a relatively homogeneous sample that only exhibits significant variation related to nationality. Nonetheless, the questionnaire also asked for some more details about the related STEM field. **Table 29** shows the educational background of all respondents in detail.

	Respondents	**Pat1**	**Pat2**
Electrical Engineering	120	5,49	4,18
Computer Science	30	5,58	3,97
Telecommunications	16	5,53	4,16
Physics	12	5,44	4,17
Industrial Engineering	5	6,05	4,84
Mechanical Engineering	5	5,95	3,00
Civil Engineering	3	4,75	4,60
Chemistry	2	3,38	3,50
Mathematics	2	5,75	4,50
Others	20	5,19	4,04
Total	215		

Table 29: Educational background of respondents

Only the 4 largest groups (electrical engineering, computer science, telecommunications and physics) were tested for exhibiting significantly different ratings related to patent valuation. All other educational groups were too small to be statistically meaningful. One-way ANOVA confirmed the null hypothesis, i.e. the means and variances of educational groups are equal for *Pat1* and *Pat2*. This indicates no significant impact on patent valuation of variations within the STEM educational background.

Job Role

169 of 215 respondents can be classified into one of 6 main job groups that have been identified. These are R&D (Research & Development), ProdM (Product Management), SSM (Solution Sales Management), BPM (Business Development and Business Project Management), Care (Care Program Management and Services Management) and Sales (Sales and Account Management). Other job roles such as Pricing Management, Operations Management, Systems Integration, IPR Specialist, Business Strategy, Marketing, Standardization, Network Planning, Quality Management etc. could not be further considered, because there were not enough respondents in these job roles to allow for meaningful statistical analysis. Also, differences of job role compositions among the ten country samples could not be analyzed statistically because the samples are too small for analyses on a job level within national groups. However, the available data about job role compositions is taken up and further discussed in **Chapter 7**. **Table 30** shows the main job roles of the respondents:

Job Role	Respondents
R&D	21
ProdM	36
SSM	26
BPM	31
Care	31
Sales	24
Other	46
Total	**215**

Table 30: Main job roles of respondents

Surprisingly, one-way ANOVA revealed significant job role differences related to *Pat1*: $F(5,163)=3.200$, $p=.009$

This result indicates a significant impact of the job role on the ethical patent valuation. Although there are differences in the country sample compositions of job roles, there is no obvious, systematic difference. The relationship between job role and *Pat1* cannot be analyzed with a correlation calculation, because there is no

natural order of job roles on a scale and any forced mapping to scale values would be misleading. Hence, the influence of current job roles on the ethical patent valuation could be identified, but cannot be explained or quantified with the data currently available. One-way ANOVA did not show significant job group differences regarding *Pat2*.

6.4.6 Relation of economic indicators and patent valuation

In addition and complementary to the statistical analysis of the questionnaire data, the patent valuation scales have also been compared with country specific parameters. Although the comparison is questionable, due to the fact that the sample values differ from the country mean values (Hofstede & Minkov, 2013), it is still considered a useful and interesting exercise, because it may still reveal a tendency or serve as a verification check providing additional evidence for conjectures. Some generally available country data, such as data related to how much patents a country produces and the extent to which a country profits from patents, seems to be relevant. The first related to the number of patent filings published by the European Patent Office (2014) and the latter is reflected in statistics about charges for the use of IP published by the World Bank (2016). This huge and publicly accessible databank also contains other data that could be of interest: “GDP per capita (US$)”, “Charges for the use of intellectual property, payments/receipts (US$)”, “High-technology exports (US$)” and “Research and development expenditure (% of GDP)”. Several indicators that were taken from the World Bank (2016) database for further analysis are presented in **Table 31**:

	Population [m]	GDP per capita [US$]	IP payments [bn US$]	IP receipts [bn US$]	High-Tech exports [bn US$]	R&D expenditure [% of GDP]
GRE	11,03	22690	0,32	0,06	0,85	1,92
FIN	5,44	48820	1,83	3,72	3,72	8,91
POR	10,46	21270	0,52	0,05	1,94	3,10
GBR	64,11	41680	10,53	17,10	24,22	44,08
ESP	46,62	29940	2,10	0,97	16,35	16,98
GER	80,65	47250	8,42	13,11	193,09	106,87
ITA	60,23	35620	5,38	3,71	29,75	26,78
FRA	65,93	43520	10,15	11,56	113,00	62,62
POL	38,04	13240	2,69	0,31	12,05	4,55
NED	16,80	51060	38,15	30,82	69,04	17,13

Table 31: World development indicators 2013 (World Bank, 2016)

Data from **Table 31** is then standardized on a "per capita" basis with the help of the population data from the same table. This allows comparison between the countries under investigation and is a precondition for further statistical analysis.

	IP payments per capita [US$]	IP receipts per capita [US$]	IP balance per capita [US$]	High-Tech exports per capita [US$]	R&D expenditure per capita [US$]	Patent applications per m inhabitants
GRE	29,23	4,99	-24,24	78	174	6,13
FIN	337,17	683,11	345,95	685	1638	359,85
POR	49,76	4,32	-45,44	186	296	8,70
GBR	164,24	266,80	102,55	378	688	72,04
ESP	44,97	20,77	-24,20	351	364	31,75
GER	104,46	162,61	58,15	2394	1325	328,35
ITA	89,34	61,54	-27,80	494	445	60,24
FRA	153,96	175,29	21,32	1714	950	147,90
POL	70,79	8,18	-62,62	317	120	9,67
NED	2270,37	1833,83	-436,54	4108	1019	346,68

Table 32: Standardized world development indicators 2013 (World Bank, 2016) on "per capita" basis / Patent applications 2013 (EPO, 2014)

The standardized data is shown in **Table 32**, together with information about the number of patent applications per million inhabitants of each country (EPO, 2014), highlighted with grey background. Although most of the data is available for 2014 and

some even for 2015, all data in **Table 31** and **Table 32** is related to 2013 to guarantee comparability.

Given the fact that *Pat1* and *Pat2* are ordinal scaled and the examined indicators are all interval scaled, both correlation calculations are conducted, Spearman's rho and Pearson's r. It turned out that only *Pat2* and *IPnet* (IP balance per capita) correlate on a statistically significant level: ρ = 0.830** and r = 0.662* (**correlation is significant at the 0.01 level / * correlation is significant at the 0.05 level). Detailed results can be found in **Appendix 5**. The result means that economic patent valuation is related to the extent to which a country profits from business with intellectual property. The more positive a country's balance related to IP payments, the more its citizens are willing to attribute high monetary values to patents. A graphical representation of this relationship is shown in **Figure 15**, whereas the scatter plot is complemented by a linear regression equation *Pat2* = 4.130 + 0.001 x *IPnet* that is depicted as a line through the two points Pat2(-500) = 3.63 and Pat2(400) = 4.53 (see section **6.4.1**).

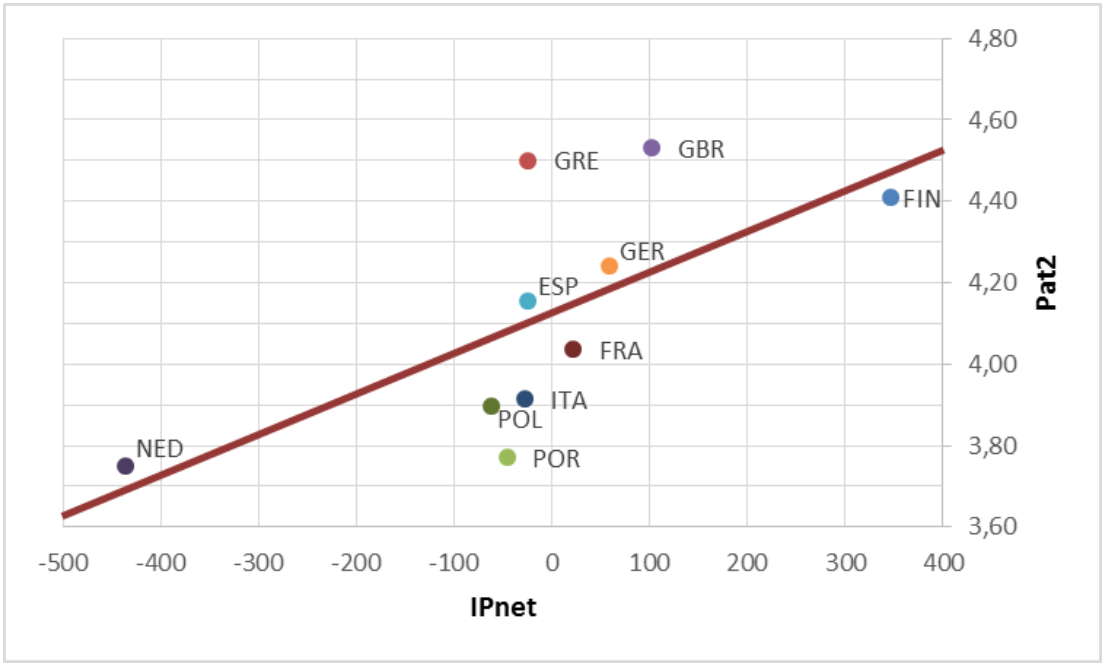

Figure 15: Relationship between *Pat2* and *IPnet* (balance of charges for the use of IP)

The two notable outliners in **Figure 15** are the data points for Finland and the Netherlands. They seem to dominate the slope of the line and raise the question of whether there would be still a significant correlation between *Pat2* and *IPnet* without

these two countries. To be on the safe side, a correlation analysis and a linear regression calculation have been performed without either country, i.e. with a sample size of n = 8. The results confirm the former findings: *Pat2* and *IPnet* correlate on a statistically significant level: ρ = 0.810* (* correlation is significant at the 0.05 level). The linear regression equation *Pat2* = 4.131 + 0.003 x *IPnet* is represented as line through the two points Pat2(-100) = 3.83 and Pat2(150) = 4.58.

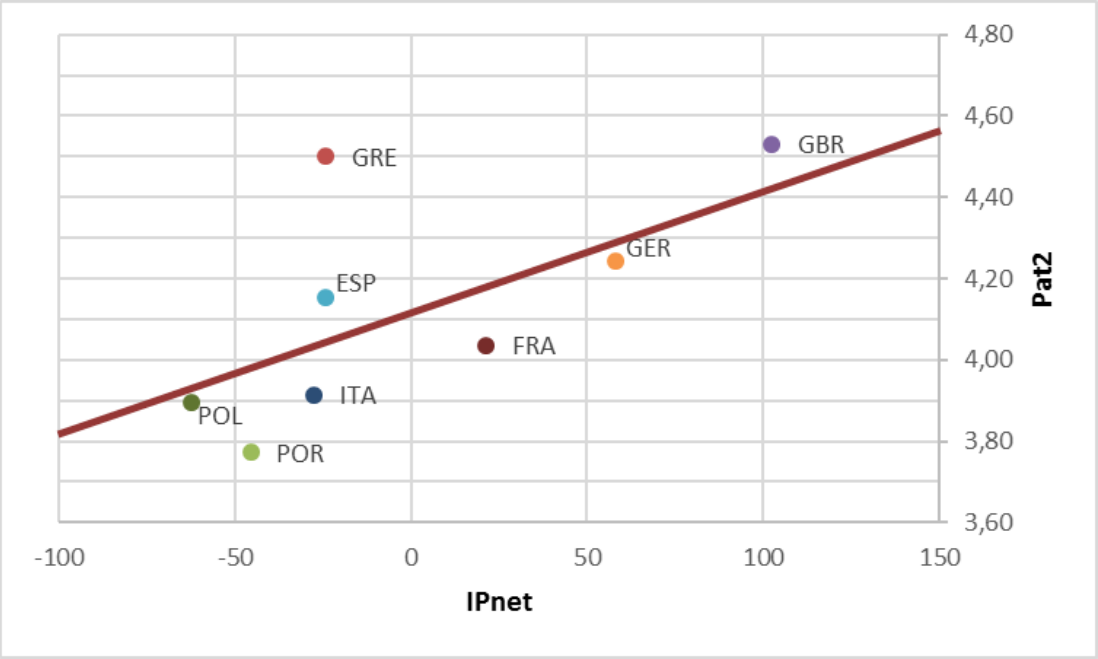

Figure 16: Relationship between *Pat2* and *IPnet* for a reduced country sample

Further details can be found in **Appendix 5**. In conclusion, although Finland and the Netherlands show extreme values among the investigated country sample, they do not distort the general tendency of a statistically significant relationship between a country's mean scores on the economic patent valuation scale and a country's balance of charges for the use of Intellectual Property.

6.4.7 Conclusions

The most important result of section **6.4** "Statistical Analysis" is the confirmation that there is indeed an impact of determined cultural aspects on the ethical valuation of patents. The cultural dimensions "Uncertainty Avoidance" and "Collectivism I: Institutional Collectivism" correlate positively on a statistically significant level with an ethical standpoint towards patents. The higher a society scores on the two cultural dimensions mentioned above, the more positive its citizen's opinion of patents.

Regarding the economic valuation of patents, the influence of cultural aspects is much less pronounced and could only be demonstrated for a singular, albeit important item that forms part of one specific cultural dimension. Responses to Item 26 ("I believe that people should: live for the present / live for the future") correlate negatively on a statistically significant level with the readiness to attribute high economic values to patents. This means, the more a society declares to "live for the present", the higher its members economic patent valuation.

Another major finding was that the economic valuation of patents correlates with the economic importance of intellectual property in one's country.

Contrary to expectation, there seems to be no direct relationship between ethical and economic patent valuation.

Relating to other potentially influential factors, it turned out that the job role (within the telecommunications industry) is a parameter that influences ethical patent valuation. Such an influence could not be observed for different educational backgrounds (within tertiary education in STEM fields). The results show no relationship between age and patent valuation and no impact of gender on patent valuation.

The findings of the quantitative (statistical) analysis, together with the results of the qualitative analysis described in the next section, will be discussed more in detail in **Chapter 7**.

6.5 Qualitative Analysis

The primary goal of the data gathering through the questionnaire was to obtain suitable data for a quantitative, i.e. statistical analysis. However, the questionnaire also provided a field for additional comments to gather some qualitative data. Furthermore, many respondents communicated via e-mail to give comments. These comments contained some rich data that allowed for a qualitative analysis. Results from this analysis complement the statistical analysis of the quantitative data obtained from the questionnaires, as a kind of methodological triangulation (Denzin, 1973) and thus increase the validity of the findings. The aim of this qualitative analysis was to uncover indications that country samples have different opinions of the patent system. This would support the outcomes of the quantitative analysis that culture impacts the ethical valuation of patents, i.e. the stance towards patents. Indications about cultural impact on the economic valuation of patents were not expected, because the comments did not include opinions about concrete economic patent values. Some 556 questionnaires in total were sent out and 215 completed and usable forms were returned. Feedback in the comments section of the questionnaire and the associated communication via e-mail both provided numerous comments. Overall, 98 of the respondents provided some comments. The distribution among country samples can be seen in **Table 33**:

	addressees	respondents	comments	response rate	comment rate
ESP	56	22	6	39%	11%
FIN	44	21	9	48%	20%
FRA	89	22	20	25%	22%
GBR	101	23	11	23%	11%
GER	30	24	10	80%	33%
GRE	30	20	4	67%	13%
ITA	50	21	8	42%	16%
NED	52	20	12	38%	23%
POL	64	21	10	33%	16%
POR	40	21	8	53%	20%
	556	**215**	**98**	**39%**	**18%**

Table 33: Comments per country sample

As can be seen in **Table 33**, the questionnaire response rates and the rate of additional comments per addressee, vary from country to country. These variations may indeed indicate cultural differences, such as low-context and high-context culture styles, according to Hall (1976), but it might also be owing to the differing levels of professional familiarity between the addressees and the researcher. For example, most of the German addressees were known personally for many years, which probably explains the higher-than-average response rate. In contrast, most British and French addressees were not personally known, which is probably the reason why the response rates are much lower. As the extent of professional familiarity cannot be quantified, this work will not try to relate different response rates to cultural differences, although they may have an impact. However, there is no indication that differing levels of professional familiarity should have any impact on the questionnaire data, because the researcher's position towards the items is as neutral as possible and not disclosed to the addressees.

Apart from different levels of familiarity, other systematic differences may have impacted the response rates as well, e.g. the level of work pressure or stress does not need to be the same across the company. The more pressure an employee is under, the less he is able or willing to spend time and effort on unnecessary tasks such as questionnaires. The amount of work pressure can vary over time, depending on the business area, job role or country. Such an influence of work pressure can ultimately not only affect the response rate, the comment rate (i.e. the rate of additional comments per addressee), but also the response quality. However, there is no indication of a systematic difference in work pressure or systematic variations in response quality. Therefore, the same applies to differences in work pressure as to the degree of familiarity - influence on the response rate, the comment rate and even the response quality in terms of completeness or thoroughness are judged as unsystematic. A possible explanation for the observed differences in response rate and comment rate are therefore still cultural differences, such as the above mentioned low-context and high-context cultural styles according to Hall (1976). In order to evaluate these, however, an individual investigation would be necessary, which lies outside the scope of this work. However, there is no indication that such an

influence on the response rate and comment rate would affect or distort the results of the present work. Thus, the observed differences in response rate and comment rate per country (refer to **Table 33**) are considered negligible regarding the results of the analysis.

Although the task of this qualitative data analysis was different to the analyzing of the interviews in section **5.1.3**, the approach was similar, with some small variations due to the different type of data. For this qualitative analysis again a "thematic content analysis" (Burnard, 1991) approach adapted to the specific needs of the task was chosen. A more detailed description of this approach can be found in section **5.1.3**. This analysis loosely follows the steps described by Burnard (1991), however it is adapted and streamlined and carried out in the following six steps:

Step 1: Preparations for analysis

In the first step, data was compiled into one single document and irrelevant "dross", such as salutations and complimentary closes, was excluded.

Step 2: Immersion into the data

A thorough and repeated reading followed in order to get immersed in the data. It is important to state that the qualitative data volume produced by the questionnaire was much smaller than that from the transcripts of the interviews making it much faster and easier to get familiar with the raw data. Relevant themes and patterns of relevant content were identified.

Step 3: Open coding

The coding was conducted iteratively in several "*waves of interpretation*" (Galletta, 2013, p. 136). Relevant text segments were assigned to suitable codes, which led to headings and sub-headings. These became the basis of a continuing categorization.

Step 4: Categorization

Categories are a sort of higher level code with categorization seen as a consolidation of codes (Galletta, 2013). The process of categorization is iterative and accumulative.

During the analysis of the data various possible categories emerged, of which some were then discarded. The resulting categories were consolidated further and repetitions were removed.

At the end of the iterative process the following categories were judged to be useful and expedient:

1.	**interesting topic**	respondent explicitly expresses interest in the topic
2.	**positive opinion**	respondent states positive opinion on patents
3.	**negative opinion**	respondent states negative opinion on patents
4.	**no expert, no response**	respondent declares himself/herself not able to respond to patent questions, because he/she is no patent expert
5.	**no expert, but response**	same as 4., but could be convinced to answer
6.	**not typical**	respondent states that he/she is not typical of his/her country
7.	**patent items difficult**	patent valuation difficult, e.g. because information missing
8.	**relative patent values**	explicitly relative patent valuation
9.	**culture items difficult**	culture related questions difficult to answer
10.	**ideas and suggestions**	ideas and suggestions/opinions how to valuate patents
11.	**moral and philosophy**	philosophic standpoints, worldview, moral view
12.	**miscellaneous**	other noteworthy remarks

Whereas “dross” has been excluded, the coded data with its assigned categories is attached in **Appendix 6**. It is sorted by category and country. Each respondent was only denominated with his/her abbreviated nationality for reasons of anonymization.

Step 5: Consolidation and refinement

Following the coding of the complete raw data and an assignment to the categories listed above, a further consolidation was conducted. In a preliminary interpretation, some categories were merged together, based on the judgement that they involve

similar meanings and can be discussed together. These final higher level categories are listed below:

A.	**behaviour**	notable variances in behaviour among groups; comprising lower level categories 1, 4 and 5
B.	**opinions about patents**	respondent explicitly states opinion on patents; comprising lower level categories 2 and 3
C.	**feedback on questionnaire**	feedback from respondents about the questionnaire; comprising lower level categories 7, 8 and 9
D.	**other findings**	ideas, suggestions, miscellaneous; comprising lower level categories 6, 10, 11 and 12

Step 6: Discussion of findings

A separate step of "combining evidence", as shown in section **5.1.3**, was not necessary due to the much smaller data volume. The related activity was integrated into the last step instead. This step consisted of a discussion of the organized, condensed and categorized data. This is just a preliminary discussion as the final interpretation, in the context of the complete research work, will follow in **Chapter 7**. Not all the categories above provide new insights. Some just confirm trivia, but others do contribute to an understanding of cultural influence on how the patent system is seen from an ethical point of view.

A. Behaviour

This category comprises data that was judged to relate to variations in behaviour among country groups. The sample is relatively small, so that room for interpretation is limited and generalizations are inappropriate. However, some of the behaviour patterns that are expressed in personal comments strengthen the findings of the quantitative analysis from the previous section.

One observation of interest was that most Greeks who provided comments (three out of four) explicitly judged the topic to be interesting. Other nationals expressed less interest on average and strikingly, no German or Finn did. The point here is not

whether the addressees liked or disliked the topic. The observed difference does not mean that there is actually a significant difference between countries regarding whether the topic is interesting or not but demonstrates the societal required polite form. In Greece, it is customary and socially accepted or expected that interest is expressed in what the other person you are talking to is doing. This is a matter of politeness. Personal experience suggests that in Germany one would only explicitly say that a topic is interesting if it is judged especially interesting. If the topic is only slightly interesting, one would rather not say anything. Politeness is one of countless aspects of intercultural communications (Spencer-Oatey, 2000) and there are many related studies that specifically concern intercultural politeness theory (Kádár & Haugh, 2013). However, politeness is not the subject of this work as there is no indication that it bears any relation to patent valuation. This work concludes from this observation that notable differences between country groups are visible even in small samples. It therefore endorses the chosen method and sample size.

Another observation was that a number of addressees revealed that they did not feel expert enough to answer the questionnaire and these addressees were very unequally distributed among the country groups. Nine out of twenty-nine addressees who claimed not to be expert enough were French, which was by far the highest number among the country groups. At the other extreme were the British and the Finns, which were the only two country groups that did not appear in categories 4 and 5 (see step 4: categorization). Comparing these three country groups it is noticeable that French and British response rates were very similar (25% and 23%, refer to **Table 33**) and no country sample contained significantly more “patent experts” than others. Only 5 among the 215 respondents worked directly in the area of patents or IPR. They constituted a negligible minority, so that virtually no respondents were experts. So why did the French apologize for not answering the questionnaire, whereas the British just did not respond? This contrast points to a difference in socially accepted behaviour. It might be an aspect of politeness, similar to the observation related to the Greek sample mentioned above. It could also be interpreted as a type of warning to the researcher that one’s participation could possibly distort the results of the research. This would indicate a certain feeling of

responsibility for the other, which could be understood as a pointer towards collectivist behaviour. It might also be a simple excuse, if a respondent is not willing to expend effort on the survey, but wants to avoid leaving a negative impression. Even this possibility might point into the direction of collectivism. Collectivist societies tend to focus more on personal relationships, because their members are more dependent on each other than those of individualist societies (House et al., 2004). This interpretation fits quite well with the findings of the quantitative analysis (refer to section **6.4**) that shows the highest score on the *Col1* (Institutional Collectivism) scale for the French sample, whereas Finns and British are more individualistic and score quite low values (refer to **Table 19**).

B. Opinions about patents

There was little positive feedback about the patent system. However, it is significant that among the seven respondents who expressed a positive opinion about patents, three were French. This was more than from any other country. It is striking that France was the country with the highest mean value of *Pat1*, i.e. the French sample expressed the highest ethical valuation of patents on average. Although three responses are no basis for statistical evidence, it is an additional indication of the validity of the results of the statistical analysis. Similarly, it was striking that two out of five respondents who explicitly gave negative feedback about the patent system were Poles. Poland was the country with the second lowest mean score of *Pat1* after Great Britain. This is not conclusive evidence, but it supports the results of the statistical analysis.

The main argument in favour of the patent system is that patents foster innovation. Five out of twelve respondents expressed this opinion. This causal relation is controversial, and contradicted by some respondents. Two argue that the patent system hampers innovation. There are multiple reasons why people think negatively about the patent system: excessive patent litigation costs (“very high amount of money which looks to me completely unreasonable”), abuse of the patent system (“patenting can lead to abusing and manipulation”) or the question of fairness (“is it fair for competitors?”). One opinion is considered especially noteworthy: “patents

provide competitive advantages for companies". This statement from a German respondent implies a whole set of discussible consequences. Does the current patent system favour (big) companies at the expense of independent inventors? Are patents being used as unfair weapons between companies (e.g. "patent trolls") and between countries (keyword: protectionism)? The discussion in **Chapter 7** will return to this point.

C. Feedback on questionnaire

This category does not contribute to answering the research questions, but provides some feedback on the questionnaire that could be useful for other research. Therefore, the findings from this feedback are also mentioned here.

Sixteen addressees stated that they judged patent related items to be difficult, which was within expectations. The pre-questionnaire explicitly disposed of the possibility to tick a box "I am not able to estimate" in order to address the problem of economic patent valuation related items that were too difficult (refer to section **5.2.2**). Some candidate items were excluded, because they were perceived as too difficult. Nonetheless, this work is fully aware that the economic patent valuation items are challenging. Only four of the sixteen individuals who reported difficulties did not provide estimations and needed to be excluded from the statistical analysis. The other twelve respondents gave their estimation. This means the level of difficulty seems to have been appropriate, i.e. on an acceptable level and able to provide sufficient data for a meaningful analysis. This can be considered to be confirmation of the usefulness of the pre-questionnaire.

It was quite surprising that some respondents judged the cultural questions to be difficult. The culture related items were taken from the GLOBE project (House et al., 2004), a comprehensive multiyear endeavour that involved 170 researchers and gathered data from 17,000 respondents in 62 countries. Each item was based on solid theoretical fundaments and thoroughly tested before; according to academic state-of-the-art standards (see also section **5.2.3**). However, no questionnaire is unambiguous and understandable to all potential addressees. This shows how

complex cross-cultural studies are in general and puts the patent related survey items created by the present work into perspective. The comparison with the GLOBE survey items endorses the patent related part of the questionnaire in terms of quality and appropriateness.

Although only mentioned explicitly by five participants, it can be assumed that many respondents followed the same approach, i.e. to assign relative values for the items that relate to economic patent valuation. This approach to take the first item as a kind of anchor point and estimate the following items relative to the first one was also mentioned by participants of the interviews and was discussed in the analysis of the interviews in section **5.1.3**. The comments in this section confirm the findings of the interviews. This work does not attempt to judge the "correctness" of economic patent valuations; therefore a relative valuation is in line with expectations. The decision of where to set the anchor or fixed point is most probably taken at the first related item, so that the following items are judged either more, less or equally valuable. The meaningfulness of the economic patent valuation scale is nonetheless the same as if the estimations were "absolute" valuations. The aim is to test whether there is a cultural factor that influences the willingness to assign high economic values to patents, regardless of whether the scale is built from the sum of absolute values or the sum of relative values.

Two German respondents stated that they tend to mark the middle box in questionnaires. Some researchers use Likert scales with an explicitly even-point scale to prevent respondents from choosing the neutral mid-point too easily and freely (Holmes & Mergen, 2014). Such an even-point scale is sometimes called a "forced choice" method. However, several studies have shown that results are not significantly different for even-point or uneven-point scales (Armstrong, 1987). So the feedback of the two respondents indicates that there might indeed be an issue with the neutral point of a Likert scale, but related literature suggests that the effect might be negligible.

D. Other findings

Some respondents complained that it was very difficult to economically valuate patents without additional background information and some provided ideas on what parameters a valuation should be based on. Four respondents referred to quite a simple cost based valuation, four respondents mentioned a value based approach and others proposed more detailed parameters, such as number of alternatives, innovativeness or licensing. One respondent dived much deeper into the complexity of the topic, mentioning broadness of claims, difficulty to develop a similar solution, standardization topics (e.g. FRAND terms) and lifetime of the invention. This feedback shows the importance of a proper definition from which perspective the economic patent value should be estimated. Although this point had been considered for this questionnaire it seems that the definition could be improved for future research.

Respondents from five countries used the opportunity to reflect on more generic topics like society, globalization and the future of humanity. Several respondents expressed their concern about severe topics such as capitalism, greed for profit, (economic) crisis, (terrorist) attacks and climate change. Three out of nine were French. Both British respondents included views on leadership but no respondent from any other country did. One (British) respondent gave an ethical and philosophical assessment of patent rights and even proposed a solution for the moral challenges and ambivalence of the current patent system. These comments do not allow any conclusions on a country level, but they indicate that many people are concerned about global issues and that they are viewing the world with certain idealism. In this sense, people may see topics like the patent system from an ethical and moral point of view. Somebody who is very critical of capitalism, globalization and environmental degradation may tend to reject the ideas of patents altogether, whether or not these topics are directly or indirectly related to the patent system. The comments in this category suggest that patents are often seen as linked to ethical questions and hence endorse the conjecture of this work that the ethical view on patents, which for its part may be culturally influenced, could impact their economic valuation.

Three of the respondents question whether to sell patents in general and would prefer to keep and licence them instead. There is a widespread opinion that intellectual property is an integral part of the inventor (or the inventor's company), not separable from his identity. Selling it would therefore be almost immoral; an excess of capitalism. An inventor would probably consider a patent as his brainchild and his judgement would be highly influential when it comes to selling his patent and setting a price level. This position touches on the discussion about the cultural and philosophical background of how we see property and especially intellectual property. According to this line of argument, an inventor is not just doing a job, but is also motivated by curiosity, work ethic and professional self-fulfilment. Therefore, pure economic profit is not the only or most important aspect from the inventor's perspective. From an altruistic position, an invention can be seen as a personal contribution to the collective well-being, in the form of innovation and progress. As outlined in section **3.3.2**, inventors are an important determining factor concerning economic patent valuation, especially when applying renewal data based or survey based methods. Following this argument would indicate that patent valuation would also be influenced by psychological aspects such as self-conception, interwoven with culture and personality. This discussion thread will be followed in **Chapter 7**, where this question is considered further in the light of the results from the statistical results from section **6.4**.

Several respondents (two Finns, one Frenchman and one Pole) considered themselves "untypical" of their country. People seem to think that living outside their home country for a longer period of time makes them less "Finn" or "French", i.e. in a cultural sense they feel less typical. It may be noteworthy that in an international business environment, such as Nokia, the national culture may become less pronounced for two reasons. First of all, many employees spend some time abroad, be it for a temporary delegation or for frequent business trips. Secondly, national cultures are in some way overlaid by corporate culture. The majority of all telephone conferences and meetings are held in English, which can be considered the "lingua franca", because most of the time at least one participant comes from another country. E-mails are also usually written in English, even e-mails addressed to German

colleagues, to facilitate further re-use or forwarding to colleagues from other countries. The country's national language is predominantly only used for more informal communication or in face-to-face meetings. Multinational corporations experience "globalization on a small scale". However, even in an advanced international business environment there are still distinct cultural differences. They are just less obvious than in a more localized environment and less pronounced than 20 years ago. Culture is not set in stone, it undergoes changes over time (Hofstede, 1980), even "*people's basic values and beliefs are changing*" (Inglehart & Welzel, 2005, p. i). Cultural change and cultural variances in different (professional) environments have to be taken into consideration in all cross-cultural research endeavours, not only in the design phase, but also when interpreting the results. This indication will be taken into account in **Chapter 7**.

Conclusions

Ideally the findings of the qualitative analysis would support the results of the quantitative (statistical) analysis. They do this satisfactorily, although to a limited extent. First of all, they confirm the common perception that culture influences virtually all aspects of life, from number and type of comments to standpoints and opinions. Secondly, the explicitly positive or negative comments about the patent system fit neatly to the results of the statistical analysis (refer to section **6.4**). These showed quite significant differences concerning the ethical valuation of patents between some of the country samples, notably France and Poland. Other findings of the statistical analysis could not be confirmed, mainly due to the limited scope of this qualitative analysis method chosen. However, there was no result that indicates any contradiction between quantitative and qualitative analysis results.

Furthermore, the category "behaviour" indicated that responses from participants underlie culturally coined differences like politeness and traits that pointed towards the cultural dimension *Col1* (Institutional Collectivism). The category "opinions about patents" provided comments that are in line with the results from the statistical analysis, because the group with the highest score (French) on the ethical patent

valuation scale *Pat1* gave the most positive opinions about the patent system, whereas the group with the second lowest score (Polish) on *Pat1* showed the most negative opinions. The findings of the third category "feedback on questionnaire" endorsed the suitability and reliability of the chosen research methods. It also included some findings for further research in this area, from which some recommendations can be derived (e.g. to utilize a pre-questionnaire). "Other findings" provided some useful hints about the importance of a proper definition of the perspective for economic patent valuation, which feeds into recommendations for future research in the last chapter. This category also supported the conjecture of this work that culture impacts the ethical standpoint towards patents and it supplied some hints for the interpretation in **Chapter 7**. For example, a section in that chapter will discuss the interdependencies of culture and personality, and its implications for patent valuation. Another subject for further elaboration in the next chapter is cultural change, its implications for cross-cultural studies in general and for this work in particular.

A more detailed discussion and interpretation, together with the results from the quantitative analysis (see section **6.4**), and in the light of related theory, follows in the next chapter.

6.6 Summary

This chapter presented the questionnaire sample and the choice of countries in section **6.1**, followed by a presentation of the final questionnaire items (section **6.2**) and the data obtained from the questionnaire aggregated on a societal level (section **6.3**). The subsequent sections describe the analyses of the quantitative (section **6.4**) and qualitative (section **6.5**) data collected by the questionnaire. The results from both analyses were presented, discussed and prepared for the final discussion and interpretation provided in the following chapter.

CHAPTER 7: DISCUSSION OF RESULTS

7.0 Introduction

In this chapter, the results of the previous chapter are discussed and interpreted. The first section outlines how the results from the qualitative and quantitative analyses are integrated by means of triangulation. The major part of this chapter relates to the interpretation of the analysis results, whereas three main findings, influence of Uncertainty Avoidance, of Institutional Collectivism and of specific aspects of Future Orientation are treated subsequently. The following sections examine the influence of personality, cultural change and various findings, such as the relation between ethical and economic patent valuation, the influence of job roles, economic indicators and patent reputation. The discussion in this chapter takes place in the light of the research questions formulated in section **3.4** and the conceptual model (**Figure 1**) of cultural influence on patent valuation developed in section **3.5**.

7.1 Triangulation of Results

The previous chapter presented the results of the quantitative (statistical) and qualitative analyses of the data gathered by means of the questionnaire developed for this purpose. **Chapter 6** also provides a preliminary discussion of these results, albeit limited to rather obvious findings. **Chapter 7** examines the analyses of results in the context of the complete research. This more detailed discussion and interpretation, in the light of the related theory, uses a methodological triangulation as a validation strategy (Denzin, 1973; Flick, von Kardoff & Steinke, 2004), according to the model depicted in **Figure 17**:

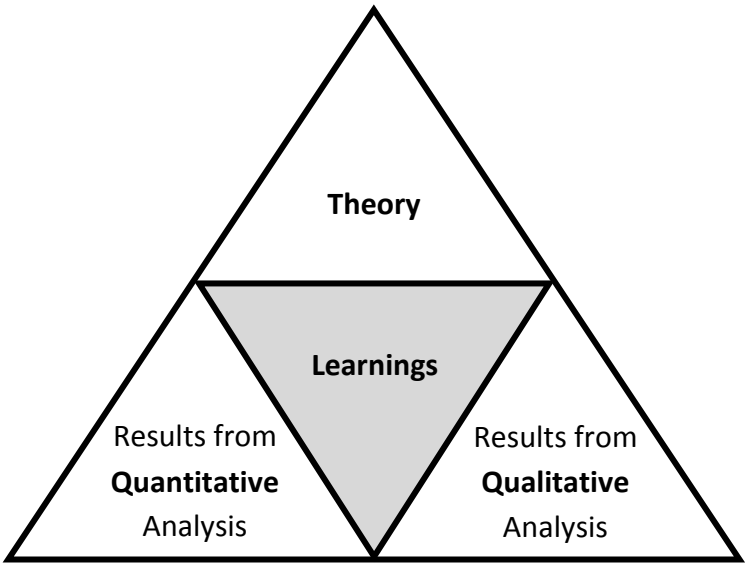

Figure 17: Methodological triangulation

The learning derived from the between-method triangulation of the results, as shown in **Figure 17**, represents new knowledge based on a combination of insights about the phenomenon under investigation. Triangulation is one of the main advantages of mixed methods research and contributes to the neutralization of potential bias that is inherent in any of the applied methods (Denzin, 1973). In the following sections, the findings of the analyses described in **Chapter 6** are discussed jointly, with special attention to supportive or critical evidence from the respective alternative method, and then interpreted in the light of the related theory.

7.2 Influence of Uncertainty Avoidance on ethical patent valuation

The results of the quantitative analysis of the data derived from the questionnaire show a statistically significant correlation between the cultural dimension "Uncertainty Avoidance" and the ethical patent valuation at a societal level (refer to Section **6.4.2**). The supposition that Uncertainty Avoidance could influence the ethical-moral position towards patents was based on the assumption that patents could be seen as a type of insurance policy against potential business threats in the future, thus helping to avoid business uncertainty. A number of research works have found a relation between this cultural dimension and either the level of SW piracy (Moores, 2008) or innovativeness (Shane, 1993; Kaasa & Vadi, 2010; Vecchi & Brennan, 2009; Halkos & Tzeremes 2011; Efrat, 2014).

Moores' (2008) investigation showed that a high *UAI* (uncertainty avoidance index according to Hofstede) of a country correlates with a high decline in SW piracy. This result suggests that high Uncertainty Avoidance relates to high respect for intellectual property rights. The Uncertainty Avoidance cultural dimensions of Hofstede and the GLOBE project (that were utilized in this work) differ significantly, in particular because the latter distinguishes between societal practices ("as is") and societal values ("should be"). Also, SW piracy cannot be directly related to ethical valuation of patents. Therefore, the reported relation between *UAI* and SW piracy can only be interpreted as a hint of the direction in which to investigate. It may suggest an expected tendency, but it is not considered appropriate to draw direct conclusions for this work.

The relation between Uncertainty Avoidance and innovativeness has been investigated by a number of studies. Uncertainty Avoidance shows a statistically significant negative correlation with the number of patent applications per capita (Kaasa & Vadi, 2010) and with the number of trademarks per capita (Shane, 1993), whereas both measures were used as approximation for innovativeness. The first of the mentioned studies used cultural dimensions derived from the European Social Survey (Jowell, 2003) and the second referred to the Hofstede dimension.

Consequently, even though they point in the same direction, neither studies are directly comparable. Furthermore, this tendency was reported in three further works that used the Hofstede cultural dimensions: Vecchi & Brennan (2009) came to the conclusion that low Uncertainty Avoidance relates to higher innovation indicators such as R&D investment, training and education, but not by using patent statistics. The authors conclude that countries that display high-risk tolerance tend to invest more in innovation. Halkos & Tzeremes (2011) investigated innovation efficiency using the *European Innovation Scoreboard* database (EIS, 2008) and found a negative relationship to *UAI*. Efrat's (2014) study examined a number of innovation indicators (patents, journal articles, high-technology exports) that also correlated negatively with *UAI*. Although innovation and innovativeness are measured in different ways, there is a lot of evidence that the cultural dimension Uncertainty Avoidance is negatively related to aspects of innovativeness. One rather obvious interpretation is that a precondition for innovation goes alongside risk tolerance and a willingness to change instead of holding on to an established situation. Returning to the original idea that the cultural dimension Uncertainty Avoidance could be seen as a type of insurance, it seems to influence the tendency to file patents in two opposing ways, either as an insurance aspect or a risk involving investment. Patent applications require investment of time and money. Although such an investment could be motivated by the desire for insurance (e.g. against competitors or to protect investment in the underlying technology), it still involves the risk of losing money. This risk perception seems to be the most important factor. Therefore, Uncertainty Avoidance correlates negatively with the number of patent applications (see also **Table 34** below) and it relates to a certain cautiousness concerning investments of any type.

Some authors have investigated the relationship between Uncertainty Avoidance and aspects other than innovativeness, e.g. corruption, corporate capital structures, relationship development strategies and job satisfaction (Rapp, Bernardi & Bosco, 2010). However, most of these aspects are not related to the research questions of this work and are not pursued further. Two studies (Chang & Noorbakhsh, 2009; Ramírez & Tadesse, 2009) independently came to the conclusion that Uncertainty

Avoidance impacts the cash holding of companies. The first concludes that corporations in countries with a high level in the Hofstede dimension *UAI* tend to hold larger amounts of cash than those in countries with lower *UAI* scores. The latter came to the same conclusion, using the *UnAv* "should be" GLOBE cultural value scale. These results are in line with intuitive expectations. Uncertainty Avoidance also relates to security-mindedness in business. Other research provides evidence of the suspected influence of this cultural dimension on international business. For example, Frijns et al. (2013) found that Uncertainty Avoidance impacts M&A decisions and managerial risk tolerance in the way that the management of companies in countries with higher *UAI* scores require higher premiums in order to risk a takeover. Venaik & Brewer (2010) suggest that companies in high Uncertainty Avoidance countries tend to avoid ambiguity and risks involved in international business transactions and focus more on domestic business transactions.

Overall, it can be said that the above-mentioned research works provided strong evidence for the influence of the cultural dimension Uncertainty Avoidance on business related aspects: it is negatively related to SW piracy, innovativeness and risk tolerance in business.

How can these consequences of Uncertainty Avoidance then be interpreted, with respect to the observed relation with ethical patent valuation?

The GLOBE project defines Uncertainty Avoidance as "*the extent to which members of collectives seek orderliness, consistency, structure, formalized procedures and laws to cover situations in their daily lives*" (Sully de Luque & Javidan, 2004, p. 603). The scale that measures Uncertainty Avoidance consists of five items that aim to capture this cultural dimension (items 10, 19, 20, 22 and 23[45]; refer to **Appendix 4**). One of these items explicitly concerns the preference for orderliness and consistency at the expense of experimentation and innovation (item 10) and one item asks for a positioning respective of a structured life with few unexpected events (item 19). The other three items are related to the preference for instructions from society (item

[45] all reverse coded

20), rules and laws (item 22) and detailed plans from leaders of how to achieve goals (item 23). The scale thus measures conformity and the extent to which people positively judge obedience to authorities, to rules and laws. Conformity and obedience may have a number of causes, e.g. a repressive regime, accommodativeness, ignorance, fatalism, religious beliefs etc. As the countries under investigation are all liberal democracies with a Western cultural background, these reasons can be disregarded in the context of this research. Instead, it seems to be more credible to consider conformity and obedience as an expression of trust in societal structures. This means people in principle trust in the state and its executive, legislative and judicial bodies, as well as in state administration and its representatives. There are many countries worldwide where this basic trust is not evident. However, functioning institutions are a precondition for a working patent system, which can only reveal its value in such an environment (Donges, Meier & Silva, 2016; Tebaldi & Elmslie, 2013). Following this line of argument, it could be expected that societies that exhibit high scores of Uncertainty Avoidance also have a higher level of trust in societal structures. Comparing this supposition with the results of the questionnaire, it is at first surprising to see Greece, Spain and Italy exhibiting the highest values for *UnAv*, whereas Great Britain, the Netherlands and Finland show the lowest values. Intuition would suggest the opposite. However, on a second look, the results are consistent. The contrast between the “as is” and “should be” set of items of Uncertainty Avoidance that lead to completely opposing scores are key to the understanding of this apparent contradiction. **Chapter 5.3** already mentioned that the GLOBE project distinguishes between societal cultural practices (“as is”) and values (“should be”). Interestingly, both categories show a significant negative correlation for most of the cultural dimensions (seven out of nine), i.e. contrary to Hofstede, the GLOBE project measured different aspects of the same phenomena (Chhokar, Brodbeck & House, 2007). Uncertainty Avoidance is one of the cultural dimensions that shows negative correlation on a statistically significant level between practices (“as is”) and values (“should be”) counterparts (Chhokar et al., 2007), as well

as between the GLOBE practices and the Hofstede UAI dimension, as can be seen in **Table 34**:[46]

		Pat1	UnAv	UnAvGV	UnAvGP	UAI	PatA
Pat1	Spearman's **ρ**	1,000	,685*	0,248	-0,018	0,280	0,030
	Sig. (2-tailed)		0,029	0,489	0,960	0,434	0,934
UnAv	Spearman's **ρ**	,685*	1,000	,830**	-,697*	,796**	-,661*
	Sig. (2-tailed)	0,029		0,003	0,025	0,006	0,038
UnAvGV	Spearman's **ρ**	0,248	,830**	1,000	-,891**	,784**	-,867**
	Sig. (2-tailed)	0,489	0,003		0,001	0,007	0,001
UnAvGP	Spearman's **ρ**	-0,018	-,697*	-,891**	1,000	-,778**	,891**
	Sig. (2-tailed)	0,960	0,025	0,001		0,008	0,001
UAI	Spearman's **ρ**	0,280	,796**	,784**	-,778**	1,000	-,827**
	Sig. (2-tailed)	0,434	0,006	0,007	0,008		0,003
PatA	Spearman's **ρ**	0,030	-,661*	-,867**	,891**	-,827**	1,000
	Sig. (2-tailed)	0,934	0,038	0,001	0,001	0,003	

* Correlation is significant at the 0.05 level (2-tailed)

** Correlation is significant at the 0.01 level (2-tailed)

Table 34: Correlation between Uncertainty Avoidance related scales (n = 10)

The table above shows the correlation calculation between GLOBE values *UnAvGV*, GLOBE practices *UnAvGP* (House et al., 2004), Hofstede's *UAI* (Hofstede, 2016), this research work's scales *Pat1* and *UnAv* (refer to **Table 19**) and patent applications statistics *PatA* (refer to **Table 32**). The disparities between practices and values, and between GLOBE and Hofstede, prompted an academic debate that did not reach reconciliation, but divided cross-cultural research into two camps (Minkov & Blagoev, 2012; Hofstede, 2010; McCrae et al., 2008; Javidan et al., 2006). Nonetheless, the GLOBE project provided a fairly satisfactory explanation in the form of a "deprivation hypothesis" (Chhokar, Brodbeck & House, 2007). This hypothesis is based on the "cognitive dissonance theory" (Festlinger, 1957), which deals with inconsistencies between actions and beliefs and the resulting dissonance. When such a dissonance occurs, people try to resolve it either by changing their actions, changing their beliefs (very unlikely when it concerns more profound convictions), or by changing the perception of the actions (Festlinger, 1957). Applied to cultural dimensions, the disparity between practices and values can be considered as "cognitive dissonance"

[46] GLOBE refers to West Germany (former FRG) and England, whereas Hofstede, this work and patent statistics *PatA* refer to Germany and Great Britain

that results in either changes of practices (thus behaviour) or, if changing is considered useless due to the prevalent social practices, it may even result in exaggerated negative perceptions about the current situation. Both mechanisms contribute to the discrepancy between practices and values (Chhokar et al. 2007). A negative correlation between practices and values of the same cultural dimension may indicate the prevalence of exaggerations regarding negative perceptions of practices and positive perceptions of values. The GLOBE project calls this “practical scepticism” and “value idealism”, two factors that play an important role in the “deprivation hypothesis” (Chhokar et al. 2007).

According to this hypothesis, people seem to perceive their own societal practices differently from what they think they should be, i.e. they sympathize with values that are higher or lower than the respective practice levels. This explanation aligns with everyday experience; the grass is always greener on the other side of the fence. This means that if certain practices in a country are perceived as inappropriate, the reported values (as things should be) may be emphasized even more than in countries where these values are part of normality.

Table 34 shows that the Spearman's rank correlation coefficient rho results in ρ = 0.830** for the relationship between *UnAv* of this survey and the respective “should be” dimension from the GLOBE project and ρ = 0.796** for the relation with Hofstede’s *UAI* (** correlations are significant at the 0.01 level). This strong correlation supports the reliability of this work’s questionnaire sample and the supposition that the results of the statistical analysis (refer to section **6.4**) are in line with the numerous academic works mentioned above. **Figure 18** graphically represents the relationships between the scales of **Table 34** in the form of a signpost:

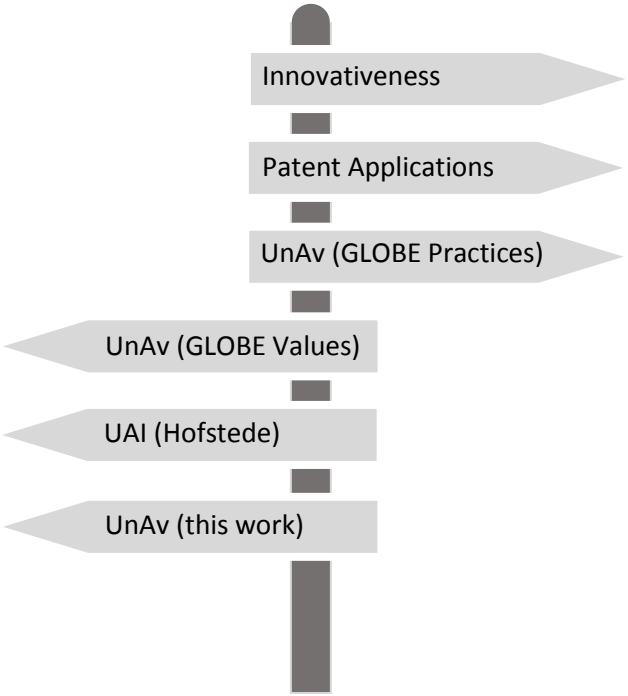

Figure 18: Signpost "Uncertainty Avoidance"

The figure clearly shows that "innovativeness", as discussed above, points in the same direction as patent application statistics, as well as the societal "Uncertainty Avoidance" practices according to the GLOBE project. The corresponding GLOBE societal values, the "Uncertainty Avoidance Index" according to Hofstede and the results of this work (utilizing the GLOBE values scale) are negatively correlated, i.e. pointing in the opposite direction. The signpost does not contain the *Pat1* scale - the ethical patent valuation correlates significantly to *UnAv*, but not with any other of the depicted scales. "Uncertainty Avoidance" stands for low risk tolerance and, as patents can be seen as a kind of insurance, it is plausible that *UnAv* correlates with *Pat1*. "Uncertainty Avoidance" relates to a higher ethical valuation of patents, because the patent system is similarly perceived as other rules and laws; something that provides a secure footing, certainty, reassurance, something to rely on. However, *Pat1* shows no significant correlation with *PatA* (refer to **Appendix 5**). It was expected that a high score in the ethical patent valuation scale would relate to high regard for the patent system and result in a high number of patent applications. This is not the case, as the statistical analysis shows. How can this discrepancy be explained? The answer seems to reflect the discrepancy between practices and values. In fact, people who tend to judge patents positively do this on a theoretical level. The questionnaire items that

make up the corresponding scale refer to more abstract ideas about patents, e.g. whether they are beneficial for society (refer to **Appendix 4**).

It may be said that the *Pat1* scale captures "societal values" such as the assessment the GLOBE project termed "should be". The items do not refer to any practical usage, nor do they ask the respondent to imagine any concrete patent, i.e. the answers refer to a moral view of the concept of patents. A higher ethical valuation of patents does not relate to higher numbers of patent applications, because the latter reflects actual practice ("as is"), which represents a different level than the theoretical assessment ("should be") of the former. Also, other factors may influence the number of patent applications, e.g. the economic structure and situation in a country. In practice, reasons to file patents may not be in line with a more general stance towards patents.

The qualitative analysis of the semi-structured interviews and the questionnaire comments does not provide further findings that would allow for a meaningful triangulation with the results from the statistical analysis. It does not, therefore, contribute to the overall understanding. However, one specific quote from a British respondent of the questionnaire is noteworthy even though as an individual opinion it does not allow for generalizations: "*British philosophy of law, which (…) holds that there is a common understanding of what is right, and it is the job of the system of law to discover and represent that - and that it is a fluid thing which can change. So I am strongly in favour of a strong system of law, but strongly against writing it all down in advance*". This opinion is fully in line with Great Britain's low score of Uncertainty Avoidance (lowest of the 10 sample countries). It would have been much more surprising, for example, to have such a statement from a Greek participant.

7.3 Influence of Institutional Collectivism on ethical patent valuation

The statistical analysis in section **6.4.2** revealed a significant correlation between the cultural dimension "Collectivism I: Institutional Collectivism" defined by the GLOBE project (House et al., 2004) and ethical patent valuation. The higher a society scores on the *Col1* scale, the more positive are its member's opinions about patents. The motivation to include this dimension in the questionnaire was mainly because property rights, and thus patents, can be seen as individual rights against the collective, i.e. the society grants its members rights to inventions, literature work or trademarks, which they may use against any other member of the society. It cannot be considered natural that a society grants such individual rights. As the history of patents shows it took a long time until the concept of patents was established in Western cultures, not to mention elsewhere. Intellectual property rights are a deal between the individual and society. The former gets protection and exclusivity, and the latter hopes to benefit from innovations and economic stimulation. Intellectual property rights clearly separate the individual and society. An investigation into the influence of Individualism-Collectivism on attitudes towards patents is therefore valuable.

There is further motivation for the investigation of this cultural dimension in academic literature. Numerous research works provide evidence of the influence of Individualism-Collectivism on SW piracy and on innovativeness; two aspects that suggest a relation with ethical patent valuation. A number of studies conclude that Hofstede's cultural dimension *IDV* ("Individualism vs. Collectivism") correlates negatively with rates of SW piracy (Yang, 2008; Moores, 2008; Yang & Somnez, 2007; Husted, 2000). The researchers present different explanations for this relationship. Yang & Somnez (2007) identify a higher regard for individual property rights in individualist societies. They conducted a multiple regression analysis and found out that *IDV* and GNI per capita together explain 73% of the variations in SW piracy (Yang & Somnez, 2007). The study does not achieve its aim of quantifying the impact of *IDV* alone, because *IDV* is strongly related to GNI per capita, but the qualitative impact is clearly visible. Moores (2008) proposes a more indirect influence of *IDV*:

"*Individualism promotes wealth, wealth increases individualism, and this overall effect reduces software piracy*" (Moores, 2008, p. 46). Husted (2000) views the relationship from the other side. He argues that members of collectivist societies put more emphasis on sharing things within their group, i.e. copying SW can be seen as a kind of sharing. It can be concluded that basic beliefs and values shape attitudes towards private property versus collective property.

Other scholars studied the impact of Individualism-Collectivism on innovativeness. Shane concluded that *IDV* correlates positively with the number of patent applications (1992) as well as with the number of trademarks (1993). Kaasa's (2013) research points in the same direction, stating that *IDV* is positively correlated with innovation performance. The measurements are based on innovation indicators such as R&D Expenditures, Global Innovation Index (INSEAD, 2011) and patenting. The authors struggle to provide a satisfactory explanation for the proposed relationship, but recognize that individualism seems to be an important factor due to its emphasis on individual freedom and autonomy. Gorodnichenko & Roland (2011) go one step further and suggest that *IDV* is the main cultural dimension to positively affect economic growth in the long run.

Considering all the academic literature mentioned above, it can be concluded that the cultural dimension Individualism-Collectivism significantly influences aspects that are related to intellectual property rights (SW piracy and patent statistics). This validates the decision to include this cultural dimension in the investigation of cultural impact on ethical patent valuation. However, before the results of the statistical and qualitative analyses of the questionnaires can be interpreted properly, it is necessary to explain the utilized scale *Col1* ("Collectivism I: Institutional Collectivism") in the context of Individualism-Collectivism as a subject of cross-cultural research and its relation to other commonly used scales.

There is a long history of tensions between tendencies of individual freedom and collective will, with ups and downs for both sides of this social antagonism. Many efforts have been undertaken to find an optimal position between the two extremes. One of the most prominent is Rousseau's "*On the Social Contract*" (2003 [1762]).

What is best for the individual and what is best for society? Individual freedom may oppose the collective will and in its extreme may even jeopardize the collective well-being. However, a collective well-being can, in many ways, be seen as a precondition for individual prosperity. Different societies may have opposing requirements, e.g. sparsely populated countries that used to live in hunter-gatherer ecologies may have developed a more individualist culture, whereas densely populated agricultural ecologies may have evolved a pronounced collectivist culture. In the course of human history societies have established a certain status quo that provides written and unwritten rules for its members with regard to their rights and their duties towards society. Each society has found a specific solution for this antagonism that is reflected in norms and beliefs that form part of a society's particular culture. Cross-cultural research has tried to capture these cultural aspects and the Individualism-Collectivism antagonism is one of the main subjects of interest. It has even been called a paradigm of cross-cultural psychology (Gelfand et al., 2004). More than 1,400 articles have been published about individualism and collectivism (Gelfand et al., 2004), which makes it a very popular research topic, but also leads to a complex system with similar or same terms and meanings that are sometimes distinct. The argument that individualism is focussed on individual freedom, self-reliance and personal fulfilment is common among scholars. Collectivism is more related to conformity and loyalty and concerns the relation of the individual with others, i.e. with "the collective". However, the collective might refer to the family (even the term "family" may signify different concepts), organization, ethnic group or any other grouping. A distinction of different cultural levels seems to be advisable for further discussion. Erez & Gati (2004) propose a model of different levels of culture: individual, group, organizational, national and global. This model is modified slightly for the purpose of this work. The global level of culture is not relevant for this discussion and is therefore omitted, and society is used instead of nation for the "country level" of culture (refer also to section **3.2**). The adapted model is depicted in **Figure 19**:

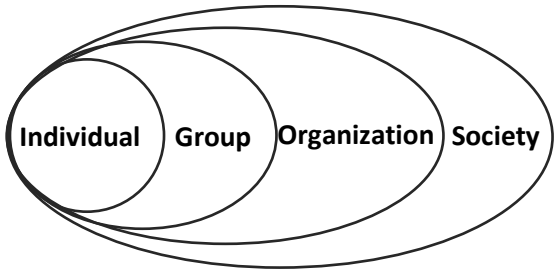

Figure 19: Model of cultural levels (adapted from Erez & Gati, 2004)

This distinction is important with regard to the different definitions of cultural dimensions that are commonly used in cross-cultural research, especially Hofstede's dimension IDV ("Individualism vs. Collectivism") and the GLOBE project's dimensions *Col1* ("Collectivism I: Institutional Collectivism") and *Col2* ("Collectivism II: In-group collectivism") differ in their definition. Hofstede (1980) put individual interests including the individual's immediate family (family nucleus) on one end of his IDV scale, and "*strong, cohesive in-groups, which throughout people's lifetime continue to protect them in exchange for unquestioning loyalty*" on the other end, (Hofstede, 1980, p. 51). Thus, *IDV* stands for the degree of interdependence of a society and its members. According to him, individualists assign higher priorities to their individual goals than those of the group, while collectivists either define or prioritize their goals in accordance with those of the group. Triandis (1994) argues that within individualism and collectivism there are more patterns, i.e. differences among individualist cultures and among collectivist cultures. Cultures may be defined by means of some common attributes, but they vary regarding additional aspects that cannot be captured by a simple contrast between individualism and collectivism (Triandis, 1994). The GLOBE project carefully created a more detailed approach and found two cultural dimensions that measure two different aspects of the Individualism-Collectivism antagonism. The first one "Collectivism I: Institutional Collectivism" relates to the extent to which people are integrated into collective structures including high level institutions such as the government. Rules that serve the good of all are respected (Chhokar et al. 2007). In so far as there is a certain overlapping with the cultural dimension, Uncertainty Avoidance is also characterized by a pronounced respect for rules and laws. This relation manifests in a significant

correlation between both dimensions. “Collectivism II: In-group collectivism” in contrast refers to the degree to which people are bound to inner groups such as family, close friends or small organizations (Chhokar et al. 2007). It is important to mention that Hofstede and the GLOBE project approached the Individualism-Collectivism antagonism from opposite angles. High scores on the *IDV* scale characterize individualist societies, whereas high scores on *Col1* and *Col2* scales designate collective societies. With respect to **Figure 19**, the two GLOBE dimensions and the Hofstede dimension stretch over different parts of the model. *Col1* includes the society and organization level in case of larger organizations, whereas *Col2* just stretches to the group level. Although not addressing explicitly any group level of collectivism, Hofstede’s *IDV* can be interpreted as covering the group and organization level. The dimension *Col1* was quite a novel approach when introduced by GLOBE and differs significantly from those dimensions that were previously used in academic literature (Chhokar et al., 2007). As with other cultural dimensions, the GLOBE project defined two variants within each dimension, one related to social practices (“as is”) and one to social values (“should be”), so that in total GLOBE used four cultural dimensions related to individualism-collectivism. **Table 35** shows the different scales related to Individualism-Collectivism[47] and how they correlate with each other (the variants of *Col2* are not included in the table as they are not in the scope of this discussion):[48]

[47] Scores for *COL1GV* and *COL1GP* from (House et al., 2004), for *IDV* from (Hofstede, 2016) and for *PatA* from (EPO, 2014)

[48] GLOBE refers to West Germany (former FRG) and England, whereas Hofstede, this work and patent statistics *PatA* refer to Germany and Great Britain

		Pat1	Col1	Col1GV	Col1GP	IDV	PatA
Pat1	Spearman's **ρ**	1,000	,782**	0,491	-0,539	-0,164	0,030
	Sig. (2-tailed)		0,008	0,150	0,108	0,651	0,934
Col1	Spearman's **ρ**	,782**	1,000	,697*	-0,624	-0,127	-0,297
	Sig. (2-tailed)	0,008		0,025	0,054	0,726	0,405
Col1GV	Spearman's **ρ**	0,491	,697*	1,000	-,842**	-0,515	-,673*
	Sig. (2-tailed)	0,150	0,025		0,002	0,128	0,033
Col1GP	Spearman's **ρ**	-0,539	-0,624	-,842**	1,000	0,248	0,503
	Sig. (2-tailed)	0,108	0,054	0,002		0,489	0,138
IDV	Spearman's **ρ**	-0,164	-0,127	-0,515	0,248	1,000	,648*
	Sig. (2-tailed)	0,651	0,726	0,128	0,489		0,043
PatA	Spearman's **ρ**	0,030	-0,297	-,673*	0,503	,648*	1,000
	Sig. (2-tailed)	0,934	0,405	0,033	0,138	0,043	

* Correlation is significant at the 0.05 level (2-tailed)

** Correlation is significant at the 0.01 level (2-tailed)

Table 35: Correlation between Individualism-Collectivism related scales (n = 10)

The table shows that *Col1* (this work) correlates with the GLOBE societal values *Col1GV* as expected and to a moderate extent negatively with societal practices *Col1GP* (statistically not significant). No significant correlation resulted between *Col1* and Hofstede's *IDV* or between *Col1* and the number of patent applications *PatA*. In contrast, Hofstede's *IDV* correlates positively with *PatA*, which is in line with the studies that investigated Individualism-Collectivism and innovativeness mentioned above. As with the cultural dimension Uncertainty Avoidance (see previous section), both GLOBE variants of Institutional Collectivism (societal values *Col1GV* and for societal practices *Col1GP*) correlate negatively. This systematic discrepancy was explained and discussed in the previous section. The relationships depicted in **Table 35** are not as clear and consistent as those in **Table 34** and therefore they cannot be easily shown in the form of a signpost analogue to **Figure 18**. Nonetheless, the most important relationship with regard to this work is the strong correlation between *Col1* and *Pat1*. Both were obtained from the questionnaire described in section **6.2**. How can this relationship be interpreted?

The beginning of this section outlined the expectation that individualism would relate to a patent-friendly view, because patents can be understood as individual rights against the collective. Patents as a type of intellectual property are actually just a particular type of property and the importance of individual property protection is a

typical characteristic of individualism. Individual property plays a less important role in pronounced collectivist societies. A positive correlation would therefore be an expected outcome of the analysis. However, the results show the opposite; a negative correlation between individualism and high regard for patents, given that the utilized cultural dimension *Col1* (Institutional Collectivism) provides high values for collectivist societies and low values for individualist societies. An explanation for this unexpected outcome lies in the definition of the dimension *Col1*. The four questionnaire items (refer to **Appendix 4**) that build the Institutional Collectivism *Col1* scale explicitly address group loyalty (item 14), collective interests in society (item 17), team sports (item 30) and group cohesion (item 31). All items refer more to generic concepts than concrete examples, e.g. groups are not specified and family is not mentioned. In fact, Institutional Collectivism is related to a more abstract group level, such as institutions and the society as a whole. This focus would suggest two opposing tendencies that may influence a patent-friendly view; on the one hand an emphasis on collective rights rather than individual rights and on the other a tendency towards institutions, rules and laws. The first tendency would explain low values on the *Pat1* (ethical patent valuation) scale, whereas the second tendency would suggest high values. The second tendency appears to be dominant. However, looking closer into the Institutional Collectivism scale, a certain inconsistency attracts attention. A pronounced individualist society requires an effective state with well-functioning institutions and laws; individual freedom is only guaranteed and protected by a strong collective structure. From this perspective, it might be concluded that institutional collectivism is a precondition for the successful development of an individualist society. As outlined above, the three different scales *Col1*, *Col2* and *IDV* differ regarding the focus of their "collectivist" extreme. They cover three different levels: group, organization, society (refer to **Figure 19**). However, neither Hofstede nor the GLOBE project specified exactly what they measure at the other end of their scales. How does the "individualism" extreme differ for the three scales? "Individualism" is implicitly defined as the respective opposite to the "collective" extreme of the scale. Thus, there are good reasons to doubt whether the "individualist" end of the *Col1* scale denominates the same as is commonly meant

by individualism in academic literature. Instead it should be interpreted as the "opposite of institutional collectivism", which resolves the contradiction described above. In fact, high regard for individual property rights is in line with pronounced Institutional Collectivism, because it concerns regulations guaranteed and enforced by strong collective institutions. High scores on the *Col1* scale correlate positively with ethical patent valuation, because patent rights are seen as codified rules that help to organize society and foster collective prosperity.

As mentioned in section **7.1**, the results obtained from the quantitative (statistical) analysis and from the qualitative analysis would ideally complement and amplify each other, which is the main objective of triangulation. In fact, the comments that were given in the questionnaires expressed opinions that were fully in line with the results of the statistics. The most negative comments about the patent system came from Polish respondents, whereas the most positive comments were derived from French participants. Both country samples were at the opposite ends of the ethical patent valuation scale *Pat1*. France had the highest score and Poland had the second lowest score. Although this cannot be judged as strong evidence, it might be taken as a further confirmation and an endorsement of the findings and conclusions.

7.4 Influence of future related cultural aspects on economic valuation

The analysis of the data obtained from the questionnaire did not provide any statistically significant correlation between any of the investigated cultural dimensions and the economic patent valuation scale *Pat2*. Nonetheless, a more detailed evaluation showed a significant correlation of one item with the scale *Pat2*. The relevant item forms part of the cultural dimension Future Orientation: Item 26 correlates negatively on a statistically significant level with economic patent valuation, i.e. the tendency to attribute high economic values to patents. The Future Orientation scale *FutO* consists of the four items 11, 12, 15 and 26 (refer to **Appendix 4**), whereas items 11, 12 and 15 are very similar and focus on planning for the future, with the respective opposite not to plan ahead, but to accept the status quo. In contrast, item 26 refers to the present-future antagonism: "I believe that people should: live for the present / live for the future".

A closer look at the definition of the cultural dimension *FutO* and its composition provides some answers to the question of why *Pat2* correlates with one item, but not with the other three. Future orientation may comprise a variety of aspects and be utilized differently as a cultural dimension by various scholars.

The reason for including *FutO* in this survey is that a patent application can be seen as an investment in the future. It requires time and money spent in the present, based on the expectation that this investment will pay off in the mid- or long-term future. Someone who tends to prepare for, and invest in the future will also tend to value such an investment higher than somebody who lives for the present.

Kluckhohn & Strodtbeck (1961) identified five basic types of value orientation within time orientation (past, present and future). They developed a questionnaire that included 5 items related to time orientation. Of these 5 items, one examines the willingness to plan ahead and three items concern the appraisal of past, present and future (e.g. the ways of the past were the best, the future will be better and brighter), i.e. these items implicitly investigate a position towards change. The last item

explores whether the primary focus of interest is more forward- or backward-looking (Kluckhohn & Strodtbeck, 1961).

Hofstede & Bond (1988) used the Chinese Value Survey (CVS) to define a cultural dimension that they called "Confucian dynamism". This dimension was later reinterpreted and renamed as "Long-Term Orientation" (G. Hofstede, G. J. Hofstede & Minkov, 2010). This cultural dimension scale consisted of just two items that relate to "respect for tradition" and "thrift" (G. Hofstede, 1994; G. Hofstede & Minkov, 1999). These two items implicitly test the willingness to maintain the status quo and to limit oneself in the present in order to benefit in the future. This dimension captures facets other than future orientation as defined by Kluckhohn & Strodtbeck (1961).

The GLOBE project defined its cultural dimension "Future Orientation" as "*the degree to which individuals in organizations or societies engage in future-oriented behaviours such as planning, investing in the future, and delaying individual or collective gratification*" (Chhokar et al., 2007, p. 3). As with other cultural dimensions, GLOBE defined two variants, one that addresses societal values ("should be") and one that captures societal practices ("as is"). According to this definition, Future Orientation covers various aspects of the temporal mode of a culture and therefore tries to capture these aspects through four different survey items. In contrast to its own declaration that "*Future Orientation is related to the Past, Present, Future Orientation dimension of Kluckhohn and Strodtbeck (1961)*" (Chhokar et al., 2007, p. 15), the related survey items only test present or future orientation and do not cover past orientation. As highlighted above, three of the four items are very similar and more related to planning ahead, whereas one item more generally concerns a personal stance towards present or future. This work argues that planning ahead is not necessarily a feature of a future oriented attitude and may just as well signify an expression of uncertainty avoidance. In order to test this supposition, the cultural dimension *FutO* was separated into two parts, whereas the first part *FutO'* consists of *Item11*, *Item12* and *Item15*. *Item26* is treated separately and constitutes the second part (*FutO'* and *Item26* scores can be found in **Appendix 5**). The results of the calculation are shown in **Table 36**:

		Pat2	UnAv	FutO	FutO'
FutO	Spearman's ρ	-,018	,770**	1,000	,915**
	Sig. (2-tailed)	,960	,009		,000
FutO'	Spearman's ρ	-,006	,855**	,915**	1,000
	Sig. (2-tailed)	,987	,002	,000	
Item26	Spearman's ρ	-,644*	-,103	,146	-,006
	Sig. (2-tailed)	,044	,776	,688	,987

* Correlation is significant at the 0.05 level (2-tailed)

** Correlation is significant at the 0.01 level (2-tailed)

Table 36: Correlation between selected dimensions (n = 10)

As presumed, *FutO'* clearly correlates with *UnAv* (ρ = 0.855; correlation is significant at the 0.01 level), whereas *Item26* does not correlate either with *UnAv*, or with *FutO'*. *Item26* definitely does not represent a whole cultural dimension in the sense of GLOBE or Hofstede, but it provides a useful measure of attitudes towards present and future. The modified dimension *FutO'* correlates stronger with *UnAv* than the original *FutO*. This is clear evidence that the three items that build *FutO'* capture cultural aspects that are intertwined between Future Orientation and Uncertainty Avoidance and that they fall short in their aim to separately measure a degree of future orientation. Some authors initially see a contradiction if countries like Sweden and Austria simultaneously show high values for *UnAv* and *FutO* (Szabo & Reber, 2007; Holmberg & Åkerblom, 2007), because the future is always uncertain. However, high ratings at both *UnAv* and *FutO* are explicable as planning for the future may indeed be motivated by the aim to avoid uncertainty concerning the future. Other scholars support this point of view and treat both cultural dimensions together, because of their correlation:

> "*Both cultural dimensions imply that people are concerned about the future, because of anxieties (uncertainty avoidance) or because they know that the future is important (future orientation).*" (Bledow, Frese & Mueller, 2011)

This work agrees, at least with the current definitions of *UnAv* and *FutO*, as it is plausible that they measure interconnected phenomena from different angles.

For further discussion, a correlation analysis has been undertaken between scales used in this work, related scales from the GLOBE project (societal values and

practices, as well as item 26 in the "should be" variant[49]) and from Hofstede (Future Orientation related scales data can be found in **Appendix 5**). The results are exhibited in **Table 37**:[50]

		Pat2	FutO	Item26	FutOGV	FutOGP	Item26GV	LTO	PatA
Pat2	Spearman's ρ	1,000	-0,018	-,644*	-0,365	0,115	-,636*	0,000	0,042
	Sig. (2-tailed)		0,960	0,044	0,300	0,751	0,048	1,000	0,907
FutO	Spearman's ρ	-0,018	1,000	0,146	0,377	-,927**	0,309	-0,426	-,697*
	Sig. (2-tailed)	0,960		0,688	0,283	0,000	0,385	0,220	0,025
Item26	Spearman's ρ	-,644*	0,146	1,000	0,470	-0,219	0,578	-0,280	-0,401
	Sig. (2-tailed)	0,044	0,688		0,171	0,544	0,080	0,432	0,250
FutOGV	Spearman's ρ	-0,365	0,377	0,470	1,000	-0,547	,772**	-0,515	-0,584
	Sig. (2-tailed)	0,300	0,283	0,171		0,102	0,009	0,127	0,077
FutOGP	Spearman's ρ	0,115	-,927**	-0,219	-0,547	1,000	-0,527	0,371	0,624
	Sig. (2-tailed)	0,751	0,000	0,544	0,102		0,117	0,291	0,054
Item26GV	Spearman's ρ	-,636*	0,309	0,578	,772**	-0,527	1,000	-0,195	-0,406
	Sig. (2-tailed)	0,048	0,385	0,080	0,009	0,117		0,590	0,244
LTO	Spearman's ρ	0,000	-0,426	-0,280	-0,515	0,371	-0,195	1,000	0,535
	Sig. (2-tailed)	1,000	0,220	0,432	0,127	0,291	0,590		0,111
PatA	Spearman's ρ	0,042	-,697*	-0,401	-0,584	0,624	-0,406	0,535	1,000
	Sig. (2-tailed)	0,907	0,025	0,250	0,077	0,054	0,244	0,111	

* Correlation is significant at the 0.05 level (2-tailed)

** Correlation is significant at the 0.01 level (2-tailed)

Table 37: Correlation between Future Orientation related scales (n = 10)

The table above shows that the two GLOBE variants of the Future Orientation scale *FutOGV* (societal values) and *FutOGP* (societal practices) are negatively correlated for the investigated country sample, albeit not on a statistically significant level. However, this is different for the GLOBE study, which compared 61 countries. For the GLOBE sample (n = 61) both variants are significantly negatively correlated: r = –.41, p < .01 (Ashkanasy et al., 2004).

Hofstede's dimension *LTO* does not correlate with any other scale in the table. This complies with expectations as, similar to the discussion above, his scale addresses different cultural aspects. Remarkably, both, the *FutO* scale of this work and the related societal values scale from the GLOBE project *FutOGV* correlate negatively with patent statistics *PatA*, although the latter is not on a statistically significant level. In contrast, the societal practices scale *FutOGP* correlates (almost significantly) with

[49] aggregated data on societal level for this specific item kindly made available by Prof. Paul Hanges

[50] GLOBE refers to West Germany (former FRG) and England, whereas Hofstede, this work and patent statistics *PatA* refer to Germany and Great Britain

PatA. This seems to suggest that societies that are *de facto* focussed on the future (future oriented with a strong uncertainty avoidance tendency, as discussed above) are inclined to file more patents, whereas societies that *wish* to be future focussed produce fewer patents. Support for this conjecture comes from the GLOBE project. The study showed that Future Oriented societal practices (*FutOGP*) are positively related to success in basic sciences, whereas the societal values variant *FutOGV* correlates negatively (Ashkanasy et al., 2004).

Notably, the separately regarded *Item26* correlates with its counterpart from the GLOBE project (*Item26GV*), albeit not on a statistically significant level. This result endorses the significance and reliability of the quantitative analysis of this work. This outcome also suggests that *Item26* in its practices ("as is") variant would probably correlate positively with *Pat2*. This would mean that societies that claim to "live for the future" would tend to choose "should live for the present" and value patents economically higher than societies that claim to "live for the present". This hypothesis is based more on speculation than evidence, but it would correspond with the findings related to patent statistics and success in basic sciences mentioned above. How can such a relation be explained? The most reasonable explanation indicates the "deprivation hypothesis" (Chhokar, Brodbeck & House, 2007), according to which a society that is *de facto* concerned about the future and thus focusses on planning and investing into the future, would actually *wish* to live more for the present, e.g. to enjoy the fruits of their work. There is the same discrepancy between societal values and societal practices, as mentioned in the two previous sections.

During the interviews and in the questionnaire comments, the term "future" was mentioned four times. This is not particularly high, but the terms "past" and "present" were not used at all. Although the explicit term was rarely used, several participants felt motivated by the discussion on patents to talk about future related topics. They took the opportunity to reflect on the future of society, globalization, environmental degradation, climate change and the future of humanity in general. Neither in the interviews, nor in the questionnaire were the participants asked for their opinion on the future of mankind, globalization, destruction of the environment,

or any future related topic. It seems that participants instinctively associated patents with future related subjects. Whether or not this is coincidence, it makes sense, as patents are exclusive rights for a particular time period that stretches into the future and, from the point of view of the patent holder, they are investments in the future.

Although this interpretation is only based on a few statements from participants, it strengthens the initial idea that future related cultural aspects influence how people think about patents and their tendency to attribute economic value to concrete patents in this specific case.

7.5 Influence of personality on patent valuation

The relation between culture and personality is an important academic subject disputed in cross-cultural psychology and cultural psychology, with both branches representing opposing standpoints (Church, 2000). The first branch tends to treat culture as independent from personality (Lonner & Adamopoulos, 1997); the latter considers culture and personality as intertwined and mutually constitutive (Markus & Kitayama, 1998; Shweder, 1999). Triandis & Suh (2002) conclude that cultural dimensions, like individualism and collectivism, are reflected in variations of personality, but require differentiation on the level of analysis:

> "*The terms individualism and collectivism are used at the cultural level of analysis, where the number of observations is the number of cultures (…) whereas at the individual level of analysis (i.e., within-culture analyses), the corresponding terms are idiocentrism and allocentrism.*" (Triandis & Suh, 2002, p. 140)

This work shares the cultural psychology view, represented by Shweder (1999), which suggests that culture and personality are not independent. Culture can be seen as the context in which personality develops, or in other words, "*culture does not have a deterministic influence on individuals' behaviour. Rather, its influence is probabilistic*" (Benet-Martínez & Oishi, 2008, p. 543).

Cross-cultural studies and cultural psychology face the challenge of distinguishing societal values and individual traits that are actually superimposed on each other. In a homogeneous sample, where homogeneity regarding all non-personality related parameters (age, education, social stratum, religion, sub-culture…) is given, a normal distribution of individual traits could be expected. The mean value of each personality trait would constitute the characteristic value for a related cultural dimension of a society. This applies to individual traits that have an equivalent cultural dimension. For example, idiocentrism and allocentrism on an individual level would correspond to individualism and collectivism on a societal level, even though the cultural dimension would split into some additional facets, such as “Distance from Ingroups”, “Hedonism”, “Competition”, “Family Integrity” and “Sociability” (Triandis & Suh, 2002; Triandis, 1994; Triandis, 2004). For most personality traits and cultural dimensions there is no exact equivalent, therefore, even with ideal samples and the appropriate level of analysis, the distinction between personality and culture is challenging. Aggregated data on societal level does not identify variations in individual traits within the country sample, or this information is not considered in further analysis. The level of analysis determines the type of results that can be expected and the way these need to be interpreted. Intracultural variability relates to individual differences, thus personality; cross-cultural variability concerns societal differences, thus culture. The former requires analysis at an individual level whereas the latter needs analysis at a societal level. Both levels of analysis are statistically independent as the nature of dimensions might be different at distinct levels of analysis (Gelfand et al., 2004). This position is also clearly supported by Smith, Bond & Kagitcibasi (2006), who investigated the impact of different levels of analysis. Triandis (2001) highlights that results from the individual level of analysis may not be in line with results from the societal level of analysis.

The patent valuation scales, as well as the cultural dimensions scales taken from the GLOBE project, were explicitly designed for a societal level of analysis. Therefore, any individual level of analysis or analysis other than at societal level might create particular problems (Klein, Dansereau, & Hall, 1994) that need to be discussed and

considered when interpreting the results. Nonetheless, such an analysis on an individual level might uncover some other relevant relationships and phenomena:

> "*… the GLOBE scales were designed to measure organizational- or societal-level variability. The scales were never intended to meaningfully differentiate among individuals within a particular society. However, even though the scales were not constructed to provide such information, it may be interesting to assess whether similar factors differentiate individuals within a society.*" (Chhokar et al., 2007, p. 24)

Although societal and individual dimensions may not show the same results, both may contribute to an understanding of the underlying phenomena (Leung & Bond, 1989).

If respondents from different cultural backgrounds are merged into one large sample, this sample includes mixed influences from personality and culture. The statistical analysis results of this mixed sample contain both variations of culture and personality. This needs to be taken into consideration in the subsequent interpretation of the results. Ideally, results from the societal level and the individual level of analysis point in the same direction and thus can be utilized to reinforce each other.

With the aim to profit from the potential offered by an analysis on individual level, but cautious not to mix influence from culture and personality, this work undertook an intracultural analysis that only involved respondents from a few exemplary countries. Three sample countries were selected to cover the two extremes of the two patent valuation scales *Pat1* and *Pat2*. The lowest mean scores on *Pat1* were observed in the British sample and the highest in the French. The highest variation on *Pat2* was observed in the Dutch and the British (refer to **Table 19** in section **6.3**). Therefore, the three countries for the exemplary analysis on an individual level were Great Britain, France and the Netherlands. These three countries delivered completely different results. Within the British sample the scores for the scales *Pat2* and *Col1* correlated positively ($\rho = 0.650$, correlation is significant at the 0.01 level),

the French sample showed a positive correlation between *Pat1* and *Col2* (ρ = 0.429, correlation is significant at the 0.05 level) and the Dutch sample did not demonstrate any significant correlations for the two patent valuation scales. The detailed results can be found in **Appendix 5**. Evidently, separate analysis at the individual level for each country provides different results because overlying cultural values disguise the individual variations. As expected, this is not an appropriate way to analyze personality traits. A proper analysis would require dedicated research with bespoke survey items and a large enough homogeneous sample.

The only conclusion that can be drawn from these results with some caution is that individual traits, i.e. personality, may also influence the notion of patents and thus patent valuation. The relevance to this work lies in the fact that, as explained in section **3.3.2**, inventors play a decisive role in determining a patent's economic value, firstly by deciding whether the patent is worth the application costs and secondly through the annual decision of whether to pay the renewal fees. The renewal data based patent valuation method relies on the individual decisions of the patent holder and/or inventor. This indicates that economic patent valuation may underlie, among other factors, an influence of personality. This potential influence is also considered in the new model depicted in **Figure 22** in section **8.3**.

7.6 Cultural Change

Results from different cross-cultural surveys are only comparable to a limited extent. Firstly, this is because samples are never composed identically in all relevant criteria such as age, profession, industry and education (Hofstede, 2013). Secondly, studies may use different tools (e.g. survey items) and thirdly they may conduct the surveys at different points in time. The results from Hofstede and the GLOBE project differ considerably. One of the reasons for this is that the former undertook his survey in the 1970s (Hofstede, 1980) and the latter in the late 1990s (Chhokar et al., 2007).

Culture is subject to constant changes over different generations and even over age groups. As a result, culture may change faster than expected, so there may be limited current relevance for the results from cross-cultural studies conducted in the 1970s such as Hofstede's. Booth (2007) describes a significant change in English culture since the 1970s. The GLOBE project split the German sample into a Western (former FRG) and an Eastern (former GDR) part to capture differences that may have resulted from more than 40 years of separation of these two states and the different cultural development during this time (Brodbeck & Frese, 2007). The results obtained were indeed different, albeit to a less extent than expected. The change towards Western ideals of liberty and self-actualization only took place in West Germany in the 1960s (Brodbeck & Frese, 2007), but the observed cultural disparity may also, at least partly, be derived from historical differences between Western and Eastern regions within Germany, as it would if the sample had been split between North and South Germany. Therefore, it is not possible to quantify the extent to which the cultural differences result from the political divide for 40 years and the different cultural development during this time. It is undeniable that cultural change occurs. The GLOBE project suggests that culture develops from current practices ("as is") in the direction of current values ("should be") and that such transition is measurable over a time frame of several decades (Chhokar et al., 2007). Other scholars agree that culture is not set in stone, but changes over time, e.g. Hofstede (1980) and Inglehart & Welzel (2005).

Cultural changes occur over generations, i.e. the current generation does not stand for the same practices and values as their parents or grandparents. Culture is affected by many factors such as political change, scientific progress, economic development, communications technology, media, travel etc. Globalization may lead either to a convergence of cultures (Chhokar et al., 2007) or a fragmentation into sub-cultures. It is difficult to predict the directions of cultural change, but it seems plausible to expect acceleration in this process, because the influencing factors seem to multiply.

These considerations are relevant for this work as results and conclusions from cross-cultural studies need to be considered as snapshots of a general change and cultural

change needs to be considered when interpreting the results. One finding of the statistical analysis is particularly interesting in this context. This is the observed influence of age on cultural dimensions. The age groups of the participants correlate significantly negatively on a societal level with the scale *FutO* (refer to **Table 27** in section **6.4.5**), i.e. the older the participants, the less future oriented they are. This result is in line with conventional wisdom and several studies asserting "*youth are generally more optimistic about the future*" (Tonn & Conrad, 2007, p. 891).

The most important finding with regard to this work is that the age parameter does not correlate with the two patent valuation scales *Pat1* and *Pat2*. This means that the difference in mean ages of the participants from different countries does not seem to influence patent valuation in one or other direction on a statistically significant level. Cultural change needs to be considered and consequently different age groups may demonstrate different cultural patterns. However, the resulting effect can be ignored for the conclusions concerning this survey.

7.7 Miscellaneous

A number of other findings are discussed in this section: the (non-)relation between ethical and economic patent valuation, the influence of job roles and the relationship between economic indicators and patent valuation. The reputation of the patent system is also examined, based on the feedback gathered from the participants of this survey.

Relationship between ethical and economic patent valuation

This work started with the conjecture that current patent systems are coined by Western culture. Therefore, from an ethical point of view, opinions about patents would be influenced by cultural dimensions and these positions towards ethical patent valuation would impact concrete economic patent valuation. According to this line of argument, a positive view of patents would increase the willingness to assign high monetary values to patents. Contrary to this expectation, no direct relationship between ethical and economic patent valuation could be observed. This may indicate a certain "professionalism" or "objectivity", i.e. personal standpoints concerning the fairness or value of patent systems in general do not seem to systematically influence the willingness to attribute high economic value to a particular patent.

Another possible explanation derives from the distinct level of both valuations. The economic patent valuation scale *Pat2* relates to the concrete valuation of determined patents, whereas the ethical patent valuation scale *Pat1* concerns abstract moral judgments. This difference between the concrete and abstract level is similar to the distinction between societal practices ("as is") and societal values ("should be") of the GLOBE project (House et al., 2004). Ethical and moral judgement relates more to values, whereas the assignment of monetary values to concrete patents is more related to practices. The reason that both scales do not correlate significantly might be concrete-abstract antagonism. This is by no means an indication that both kinds of valuation are interrelated, although this reasoning means that the observed non-correlation is no proof of an independence of both valuations.

Job roles

Some 169 of the 215 questionnaire respondents could be assigned to six main different job roles within the telecommunications industry: R&D (Research & Development), ProdM (Product Management), SSM (Solution Sales Management), BPM (Business Development and Business Project Management), Care (Care Programme Management and Services Management) and Sales (Sales and Account Management). Surprisingly, a one-way analysis of variance revealed a significant inter-group difference, i.e. the six job role groups are significantly different ($p < 0.05$) related to the ethical patent valuation scale *Pat1* (refer to section **6.4.5**). How can this be interpreted and what does it mean for this investigation?

This result indicates the definite influence of a participant's job role on his or her approach towards patents. However, it does not suggest the type or the direction of this influence. A correlation analysis is not applicable, because job roles build a nominal scale, i.e. there is no natural order of (mapped) values for these parameters on a scale. How far the different job roles impact other results of the statistical analysis can also not be determined. Although, the country samples exhibit different compositions of job roles, there is no systematic difference that would indicate any specific impact in a single direction.

Job roles do not show significant group differences regarding the other utilized scales (*Pat2*, *UnAv*, *FutO*, *PowD*, *Col1*, *and Col2*). This might indicate that there are factors other than culture and personality that influence opinions about the patent system. It is plausible that people are considerably influenced by their daily work, especially if they are working for a long time in the same environment and with the same or similar roles. This is the case with regard to the questionnaire sample. The average professional experience reported by the respondents is 21 years. As there was no significant relation between educational background and any of the scales, this seems to indicate that an average of 21 years professional experience outweighs the influence of study at a university (typically 5 years), because of its longer duration and greater proximity in time. No further data is available about job (role) changes, but personal experience suggests that the overwhelming majority of the respondents

worked exclusively in the telecommunications industry all these years, with only a small number of changes of job roles during this time. Job roles may therefore be very influential in relation to personal positions towards patents.

No other impact than that described above is expected. This work concludes that an ideal sample should demonstrate homogeneity regarding the parameter job role, i.e. each group should have a similar composition of job roles. This finding will be incorporated into the recommendations for further research in the last chapter.

Economic indicators

The quantitative analysis in section **6.4.6** identified a significant correlation between the economic patent valuation scale *Pat2* and a specific economic indicator concerning the balance of IP payments and receipts (*IPnet*). This indicator can be interpreted as a measure of the economic importance of intellectual property charges. The result shows a plausible tendency: the more important IP charges, the higher economic patent valuation. This work does not aim to investigate factors that may influence patent valuation other than cultural, so this finding is a kind of by-product. However, this result fits into the overall picture, gathered from the evidence of other research, that cultural dimensions interrelate with economic performances of societies (Chhokar et al., 2007; Hofstede & Bond, 1988; Frijns et al., 2013; Yang & Somnez, 2007; Moores, 2008), whereas it remains open to determine cause and effect.

On a very general level it can be concluded that cultural aspects are just a few of the many factors that influence economic patent valuation: global, societal (economic and cultural environment), organizational (e.g. corporate culture) and individual factors (motivation, personality etc.).

Reputation of patents

The qualitative data gathered by means of the interviews and the comments given on the questionnaires show that the patent system is an emotionally charged subject. Many people do not know much about patents and consider it a complex topic more suited to experts. However, everybody has formed some opinion of patents. It seems that these opinions are very often unconsciously connected to other topics, such as international business, multinational companies, and excesses of capitalism. Articles and news in the media contribute to an ambivalent picture of patents, e.g. the astronomical sums of patent litigations which, from a European perspective, seem as strange as infamous examples of exaggerated compensations such as the "McDonald's hot coffee case" (CJ&D, 2016). Thus, opinions about the patent system often involve political standpoints, which are presumably connected to societal cultural values. The ethical valuation of patents raises questions that are of a more socio-political nature and thus outside of this research. Nonetheless, it seems appropriate to outline some of the more obvious conclusions and interpretations.

The statements gathered through the interviews suggest that the reputation of the patent system is very mixed, to put it mildly (see also section **5.1.3**). Patent litigation fights, broadly covered by the international media, give a negative impression of patents. There is also a perceptible unease derived from the suspicion that the patent system has changed from a useful and reasonable protective support for inventors into a monstrous system only benefitting multinational corporations. These corporations have learned to exploit this system, as a shield and sword in battles against competitors (Duhigg & Lohr, 2012, October 7). This point of view idealizes how the patent system worked in the past: only to the benefit of the inventor who otherwise would not have had the financial means to realize his invention or would have been prevented from enjoying the fruits of his labour by unfair imitation. Unfortunately, this view obscures the fact that as early as in the 19th century the patent system was subject to similar problems as today. A prominent example is the fierce battle between Edison, Westinghouse and Tesla in the final decades of the 19th century, in which patents already played an important role (Jonnes, 2003). Another

point of criticism is the misuse of the patent system or of Intellectual Property Rights in general, for the purpose of protectionism. Open protectionism is currently "outlawed"; the World Trade Organization (WTO) assumes the role of watchdog for free trade. Globally there is an unbroken trend towards larger trading blocs (EU, NAFTA, Mercosur, AFTA) and free trade agreements (TPP, CETA, TTIP). This does not mean there is no longer any protectionism; it just works in more subtle ways. Critics blame the patent system for playing a role of hidden protectionism (Mayer, 1998). According to these critics, industrialized countries utilize IPR as a final stronghold to defend a prosperity that is based on past achievements and to protect themselves against unfair competition. Some emerging economies, notably China and South Korea, have understood these mechanisms for a long time and are about to overcome these barriers through their own strong IPR systems. The critique mentioned above was both explicitly and implicitly mentioned in the qualitative data.

However, when looking at the questionnaire data, the picture surprisingly looks much more positive. Some 25% of the 215 respondents "strongly agree" that "*The patent system is overall beneficial for society*" but there is a notable difference among the different countries: from 59% in strong agreement (France) to 9% (GBR). At the opposite end of the scale, only one respondent chose "strongly disagree"; this is less than 1%. The mean score on this scale was 2.47, i.e. clearly on the positive side.

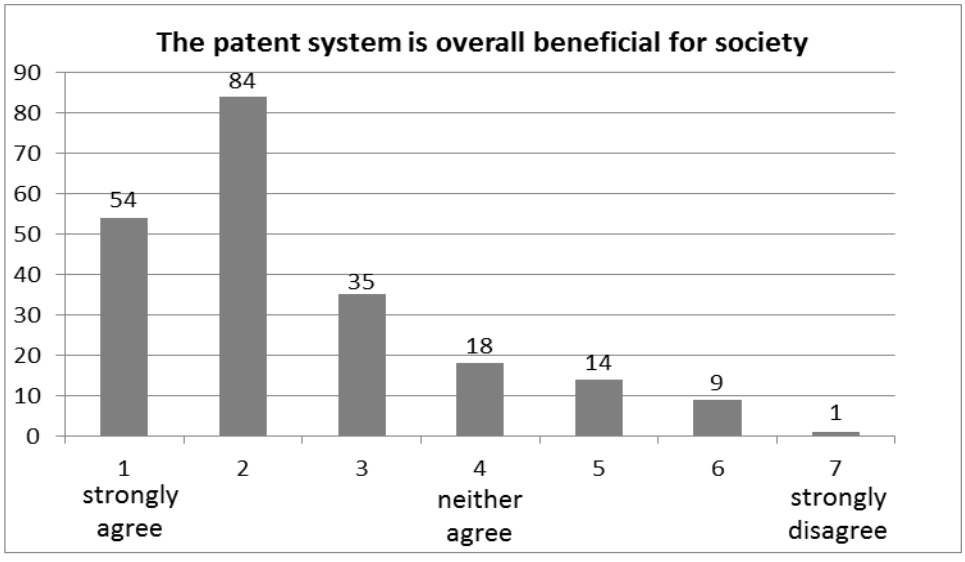

Figure 20: Score distribution for questionnaire item 1

The figure above depicts the score distribution for the first questionnaire item ("*The patent system is overall beneficial for society*"). The questionnaire sample is not representative of a general statement about what European societies think about patents. All respondents work in the telecommunications industry and were expected to be technologically minded (tertiary education in STEM area).

The example of the reputation of patents shows that triangulation, i.e. the comparison of results from qualitative and quantitative analyses do not always point in the same direction and do not always provide evidence that confirms the main conjecture. In this case, the impression gained from the qualitative analysis was much more negative than the results derived from the quantitative analysis. In fact, comparing both results should lead to a definite relativization. Although the survey sample is not representative in this respect and the results are therefore not generalizable, it can be concluded that the reputation of the patent system is problematic, but not as severe as many might think.

7.8 Summary

The main goal of this chapter is to discuss the results of the previous chapter; both the statistical analysis of the questionnaire data and the findings of the analysis of the obtained qualitative data. This discussion uses both types of data and takes a closer look in the light of relevant literature. The major findings confirm the influence of cultural dimensions, namely Uncertainty Avoidance and Institutional Collectivism, on the notion of patents, as well as the impact of specific future related cultural aspects on concrete economic patent valuation. These results allow the elaboration of a new model for the influence of culture on the valuation of patents, based on the conceptual model (**Figure 1**) developed in section **3.5**, and a response to the research questions in **Chapter 8**.

CHAPTER 8: CONCLUSIONS

8.0 Introduction

There are two main goals of this chapter. The first is to provide concrete answers to the two research questions formulated in section **3.4**. This chapter begins with two separate sections that explicitly address the two research questions and try to answer them in the light of all the discussions and interpretations presented in the previous chapter. The second goal is to transfer the conceptual model developed in section **3.5** into a more concrete model representing cultural impact on patent valuation. The aim of this model is to assemble the core findings of this work in a concise form.

The answers to the research questions and the model both constitute new theoretical knowledge and provide some practical applications. The contribution to knowledge, the limitations of this work and the recommendations that derive from its findings are presented in separate sections.

The final section summarizes this chapter and makes some concluding remarks about the completed research.

8.1 Answer to Research Question 1

Two research questions were formulated in section **3.4**. The first is:

What cultural dimensions influence the concept of patents?

Although the question is formulated positively, suggesting that cultural dimensions are indeed an influence, a possible outcome of this investigation could have been that there are no indications of the impact of cultural dimensions on the concept of patents. However, this also would not have proven that there actually is no influence. It could have just been the unsuccessful search for a black swan, according to the falsifiability theory (Popper, 2002 [1935]). Its non-existence is not proven just because it has not been found.

The conjecture that the same cultural and philosophical history that shaped our current patent systems also impacts our notion of patents is based on academic work about cultural influence on economic factors. Although cause and effect may remain unclear, there is significant evidence of the interdependency between societal culture and economic development (Rippl & Seipel, 2015). Landes (1999) concludes that culture is a decisive factor explaining the differing economic development of countries. In another work he states that "*culture makes almost all the difference*" (Landes, 2000, p. 2). With this statement he refers to Max Weber who had already identified the strong relation between cultural factors and economic development in 1905 (Weber, 1920 [1905]). A recent study supports this view and concludes that about 60% of the variance in GDP per capita among European Union countries can be traced back to cultural differences (Liñán & Fernandez-Serrano, 2014).

This research work found evidence of the impact of determined cultural aspects on the valuation of patents:

- "Uncertainty Avoidance" correlates positively on a statistically significant level with ethical patent valuation.

- "Institutional Collectivism" correlates positively on a statistically significant level with ethical patent valuation.
- A specific future related aspect (Item26: "I believe that people should: live for the present / live for the future") correlates negatively on a statistically significant level with economic patent valuation.
- Both patent related scales (ethical and economic patent valuation) do not correlate significantly with each other.

The findings regarding research question 1 are depicted schematically in **Figure 21**:

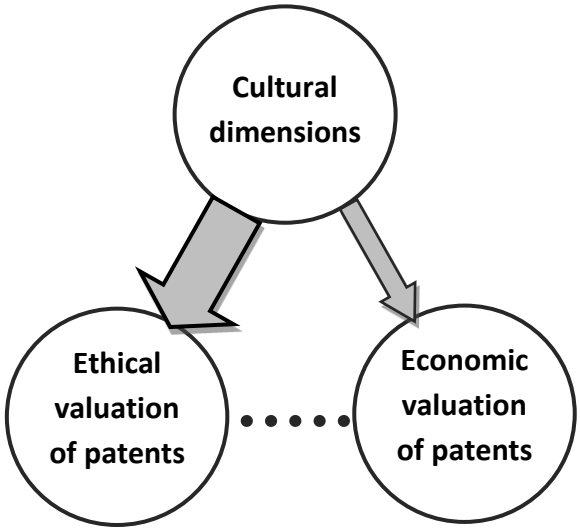

Figure 21: Schematic representation of findings

The country samples are homogeneous enough for a comparison of all relevant parameters, except their nationalities. The limitation on the telecommunications industry, similar to Hofstede's focus on IBM employees (Hofstede, 1980), leads to an exclusion of unintended influences from different industrial sectors, in the same way as other influencing factors such as educational background and social class have been excluded. Other potential influential factors, such as age and gender, have been controlled and analysis showed that they did not distort results on a statistically significant level. Hence, only societal differences have been compared, allowing for a sufficient generalizability of the findings.

The answer to research question 1, condensed into the following sentence:

> *The cultural dimensions "Uncertainty Avoidance" and "Institutional Collectivism", as well as specific aspects of "Future Orientation" influence the concept of patents.*

8.2 Answer to Research Question 2

The second research question is:

> *How, and why, do these cultural dimensions impact the economic and ethical valuation of patents?*

The first part of the question refers to the way that the specific cultural dimensions identified in the first research question impact patent valuation. This impact is summarized in the following:

> *The higher a society scores on the scales that represent the cultural dimensions "Uncertainty Avoidance" and "Institutional Collectivism", the more positive its members value patents from an ethical point of view, whereas both cultural dimensions correlate with each other. Also, the more a society declares to "live for the present", the higher the willingness of its members to assign high economic value to patents.*

The extent of this impact can only be determined relative to impact of other factors. It is discussed in the context of the new model constructed in the next section. The above findings represent an important part of this work's contribution to knowledge. A culturally biased appraisal of patents has a number of implications:

A. It could impact the motivation to apply for patents on an individual level and to invest in patents on a corporate and social level. Hence, cultural bias can be considered to be one of the factors that influence the number of patent applications and grants. This needs to be taken into consideration when

comparing patent statistics, especially when drawing conclusions concerning innovativeness, competitiveness or the overall value of a company's patent portfolio.

B. A cultural bias seems to influence the monetary value that is attributed to patents. It is ultimately the applicant (inventor or company/organization of the inventor) who decides whether the patent application is worthwhile or not (efforts, costs, business case) and whether an existing patent is worth the annual renewal fee. This impact is relevant to "direct" patent valuation methods, such as the "survey based method" and the "renewal data based method" (the different methods and the distinction in "direct" and "indirect" methods of economic patent valuation are described in more detail in section **3.3.2**). Although the impact is less pronounced and only significant for a specific future related aspect, this result should lead to further investigations in this direction.

C. If culture significantly impacts the notion of patents, it may also influence patent quality, e.g. related to depth, breadth, degree of innovation etc.

The second part of research question 2 concerns the supposed reasons for the reported impact. Why do these cultural dimensions influence patent valuation? The discussion in sections **7.2** to **7.4** tried to answer this question in detail. The main arguments can be summarized as follows:

*The **impact of "Uncertainty Avoidance" on ethical patent valuation** can be explained by the argument that this cultural dimension is characterized by low risk tolerance and therefore sees patents as a kind of insurance. The patent system is perceived like rules and laws.*

***"Institutional Collectivism" influences ethical patent valuation**, because patents concern regulations guaranteed and enforced by strong collective institutions; they are seen as codified rules that help to organize society and foster collective prosperity. "Institutional Collectivism" overlaps in certain aspects with "Uncertainty Avoidance", both cultural dimensions correlate with*

each other and both are positively related to high regard for the patent system.

There is an ***influence of a specific aspect of the dimension "Future Orientation" on economic patent valuation****. It is counterintuitive that societies that express greater affinity with the statement "people should live for the present" are willing to assign higher monetary values to patents than societies that have more affinity with "people should live for the future", because an investment in patents is certainly an investment in the future. Nonetheless, this apparent contradiction can be explained with the "deprivation hypothesis" (Chhokar et al., 2007). According to this hypothesis, people identify with "living for the present", but actually live for the future. Hence, they are willing to invest more in the future, which explains the observation that societies that state that "people should live for the present" are willing to assign higher monetary values to patents than societies that state the opposite.*

8.3 Proposal for a New Model

The aim of this section is to provide a new model that presents the answers to the research questions in a form that supports a theoretical and practical application of the learning. This new model is based on the conceptual model (**Figure 1**) developed in section **3.5**, revised and substantiated with the results of the present study.

For whom should the model be relevant and in which situations should it contribute to the understanding of cultural influence on patent valuation? The initial motivation for this work was the perception that culture influences economic patent valuation and that this influence would be worth investigating. Therefore, the fundamental goal of this new model is to provide practical support for business analysts and M&A professionals. How cultural bias relates to ethical positions towards patents also merits examination. This investigation delivers new theoretical knowledge and a practical application and so the model addresses both economic and ethical patent valuation.

Whereas the findings related to ethical patent valuation are expected to be primarily relevant for other researchers, the conclusions concerning economic patent valuation are directed at people who are in the position to conduct concrete patent valuations. There are various motivations for an estimation of patent values (Bader & Rüether, 2009; Neuburger, 2005; Munari & Oriani, 2011):

- transfer, sale, purchase
- licensing
- determining a company value (M&A, strategic alliances, stock market valuation)
- legal confrontation (indemnification for patent infringement, amount in dispute)
- taxation, accounting, financial reporting
- financing (securities for credits)
- management purposes (comparison to competition, patent portfolio management)

The motivation for the patent valuation determines which people with which job role conduct the respective assessment. This work introduced a distinction between "direct" and "indirect" methods for patent valuation (refer to section **3.3.2**) to distinguish between the various patent valuation methods used. The "survey based method" and the "renewal data based method" belong to the "direct" type of methods, because they are based on a person's immediate subjective judgement, which has a greater potential cultural influence. People who apply these methods are typically inventors and patent holders. However, these people are the real experts when it comes to the monetary value of "their" patents and it can be safely assumed that managers frequently consult them if they require an estimation of a single patent or of patent portfolio values. A study launched by the European Commission endorsed this view, revealing only minor differences between patent valuations by inventors and managers using the "survey based method" (PatVal, 2005). Hence, patent portfolio managers and business controllers constitute a company internal target group for the model. When the patent (portfolio) value is assessed from the outside, the target group for the model consists of M&A professionals, patent rating agencies and business analysts.

The new model presented in this section provides the above-mentioned target groups with some supplementary information that can be used to estimate monetary patent values in combination with other relevant information (e.g. remaining run-time, license revenue).

Quantification of Results

Quantification of cultural impact on patent valuation is challenging. All cultural dimensions investigated are measured on ordinal scales, which allows for a statistical analysis of the data gathered. However, strictly speaking, the results obtained are not of a quantitative nature. If the Likert-type scales are assumed to approximately represent equidistant values, they can be treated statistically in the same way as interval scales (Norman, 2010). This work aims to measure cultural impact on patent valuation and for this purpose it utilizes the two patent valuation related scales *Pat1*

and *Pat2*. The first of these two scales, *Pat1*, is also ordinal. Even a treatment as an interval scale would not provide any meaningful quantitative information, because the underlying values concerning judgement of the patent system, from an ethical point of view, are not standardized and thus not quantitatively comparable with scales outside this work. Consequently, cultural impact on ethical patent valuation will be discussed qualitatively only with regard to the model that is further elaborated below.

At first glance the scale *Pat2* promises more in terms of quantifiability, because it measures numeric numbers in Euro. *Pat2* is a logarithmic scale from 1 to 7 that covers a wide range of patent values from < €320,000 to > €1 billion. This data can be transferred into quantitative data, assuming that the scores from 1 to 7 correspond respectively to the logarithmic mean of the assigned patent value range. The mean patent value (*MPV*) that corresponds to each score can be calculated under this assumption by applying the following formula:

$$MPV = 5^{(\text{Score}-0.5)} * 64{,}000$$

The calculated mean patent values (*MPV*) can be found in **Table 38**:

Score	patent value range [€]	mean patent value [€] (*MPV*)
1	< 320,000	143.108
2	320,000 - 1.6 million	715.542
3	1.6 - 8 million	3.577.709
4	8 - 40 million	17.888.544
5	40 - 200 million	89.442.719
6	200 million - 1 billion	447.213.595
7	> 1 billion	2.236.067.977

Table 38: Calculated mean patent value (*MPV*)

In the next step the calculated mean patent values are assigned to the scores obtained from the 215 respondents of the questionnaire. The country means for this alternative scale *MPV* are included in **Table 39**:

	MPV [m €]	Item26	IPnet [US$]
ESP	136,38	3,77	-24,20
FIN	179,26	3,76	345,95
FRA	192,04	3,77	21,32
GBR	211,25	3,96	102,55
GER	269,74	3,67	58,15
GRE	110,48	3,95	-24,24
ITA	202,78	4,05	-27,80
NED	31,46	4,20	-436,54
POL	88,71	4,76	-62,62
POR	186,57	4,19	-45,44

Table 39: Resulting mean patent value (*MPV*) per country

The table above includes the aggregated data for *Item26* at country level and the values for *IPnet* (see also section **6.4.6**) as well as the alternative scale for economic patent valuation *MPV*, which can be seen as a quantified version of the scale *Pat2*. *Item26* represents the score for one specific Future Orientation related questionnaire item ("I believe that people should: live for the present / live for the future"), which correlated significantly with scale *Pat2*. *IPnet* constitutes the balance of payments and receipts per capita [US$] for "*charges for the use of intellectual property*" taken from the World Bank online database (World Bank, 2016). This economic indicator was also found to correlate significantly with *Pat2* (refer to section **6.4.6**). Based on the results from the statistical analysis in sections **6.4.3** and **6.4.6**, *Item26* and *IPnet* are the two scales most likely to provide a quantifiable relationship with economic patent valuation. *MPV* and *IPnet* are interval scaled by nature and *Item26* can be assumed to represent approximately equidistant values. Therefore, the Pearson's product-moment correlation coefficient **r** is an adequate measure to investigate quantitative relationships between the three scales. The results of this calculation are shown in **Table 40**:

		MPV	Item26	IPnet
MPV	Pearson's r	1	-0,574	,660*
	Sig. (2-tailed)		0,083	0,038
Item26	Pearson's r	-0,574	1	-0,447
	Sig. (2-tailed)	0,083		0,195
IPnet	Pearson's r	,660*	-0,447	1
	Sig. (2-tailed)	0,038	0,195	

* Correlation is significant at the 0.05 level (2-tailed)

Table 40: Product-moment correlation of selected scales (n = 10)

In contrast to the calculations of Spearman's ρ in section **6.4.3**, the calculation of Pearson's r does not show any significant correlation between *Item26* and the respective economic patent valuation scale (*Pat2* in the former, *MPV* in the latter case). This means that this attempt does not provide any quantifiable impact of culture on patent valuation. However, it shows that the economic indicator *IPnet* correlates on a statistically significant level with *MPV*.

Another approach to quantify cultural impact on a societal phenomenon was chosen by Husted (2000), Yang & Somnez (2007) and Yang (2008). They used a multiple regression analysis to determine the percentage share of one or more parameters on the total variance of SW piracy among countries (see also section **7.3**). Yang & Somnez (2007) came to the conclusion that the economic indicator GNI (Gross National Income), together with the cultural dimension of Individualism, according to Hofstede's definition, explains 73% of variance of SW piracy among 75 countries under investigation. Husted (2000) calculated the adjusted R^2 (coefficient of determination) to be 83% for the economic indicators GNP (Gross National Product) and income inequality, together with the cultural dimensions Individualism, Power Distance, Masculinity and Uncertainty Avoidance (all cultural dimensions according to Hofstede's definition). However, a flaw in the overall result is that not all of the dimensions are significant at the 0.05 level (Husted, 2000).

In contrast to linear regression (presented in section **6.4.1**) that is used to investigate the relation of one independent and one dependent variable, multiple regression is a statistical method to analyze the relationship of multiple independent variables and one dependent variable. Linear and multiple regression can be used to assess the

share of variance of the dependent variable that can be explained with the independent variable(s).

A stepwise multiple regression analysis has been conducted for this work (refer to **Appendix 5**) in order to examine whether this approach provides any quantitative result. For the dependent variable *Pat1* (ethical patent valuation scale) the independent variables *Col1*, *UnAv* and *FutO* together explain only 31% of the variance, however the result is not statistically significant ($p > 0.05$). Together *Col1* and *UnAv* explain 28% of the variance of *Pat1*, but this result is also not statistically significant. The only independent variable that leads to a statistically significant result is *Col1*. This variable explains 37% of the variance of *Pat1*.

An analogue proceeding related to the dependent variable *Pat2* (economic patent valuation scale) results in a 37% explanation of variance by the two independent variables *Item26* and *IPnet* together, although again it is not statistically significant. The same applies for the calculation if *Pat2* is exchanged by the quantified alternative scale for economic patent valuation *MPV*: here the two variables *Item26* and *IPnet* explain 40% of the variance; again, not statistically significant. The only independent variable that provides a statistically significant adjusted R^2 (coefficient of determination) is *IPnet*: 37% of the variance of *Pat2* as well as *MPV* is predictable from this independent variable (refer to **Appendix 5**). The quantitative relationship derived from the linear regression analysis is represented by the following formula:

$$MPV = 163.080 + 0.238 \times IPnet$$

As this result is statistically significant ($p < 0.05$) and both involved variables are measured on an interval level, a quantitative model of impact could be developed. The quantitative impact of different levels of *IPnet* (balance of payments and receipts per capita [US$] for “charges for the use of intellectual property”) on the mean patent valuation (*MPV*) was calculated for the 10 sample countries that are the subject of this investigation. Additionally, this calculation was conducted for a further 21 European Patent Office (EPO) member countries, because in principle the relationship of *IPnet* and *MPV* could be generalized and the basic data for *IPnet* is

available from the World Bank (2016) for a large number of countries. However, as outlined in section **4.4**, the patent regime of a country may have a major impact on patent valuation; therefore, this enlargement was restricted to EPO member countries. Two tables that contain the respective results for 10 sample countries and additional 21 EPO member countries can be found in **Appendix 5**. In any case, these results should be treated with caution. Although the data is based on statistically significant linear regression analyses results, its validity and practical application remains questionable. The main flaw in these results is that they are based on a forced post-quantification of the questionnaire scores and the scale *IPnet* has not been investigated in detail concerning its relevance to this type of investigation, e.g. whether there are systematic influences from factors that would need to be subtracted. Furthermore, the *MPV* scale is built on a specific sample of 215 respondents from 10 countries, whereas the *IPnet* scale involves data from all inhabitants of the respective countries. These potential issues would need to be investigated thoroughly before the quality of the results can be assessed. However, the objective of this work is the investigation of cultural impact, not of influence of economic factors. Therefore, this topic is not in the scope of this work and will not be further pursued. This task will be left for separate research work.

In summary, it can be said that the only quantifiable cultural impact on patent valuation is that of Institutional Collectivism (*Col1*) on ethical patent valuation (*Pat1*), whereas the first predicts 37% of the second's variance.

The impact of the economic indicator *IPnet* on economic patent valuation (*Pat2* as well as *MPV*) is quantifiable at an even more concrete level. However, this result is considered a by-product outside the scope of this work.

Therefore, the model of cultural impact on patent valuation presented below is a qualitative model.

Qualitative Model

The new model is not expected to quantify cultural impact, but it does show the degree of influence of cultural background on people who are the primary source of the subjective judgement of patent value. As pointed out above, these are primarily inventors and patent holders. Although the model does not provide concrete numbers, it gives an overview of all influencing factors on economic and ethical patent valuation. Conversely, cultural factors are the subject of this work and most of the other factors are presumed rather than confirmed. The model is based on calculations of Spearman's rank correlation coefficient ρ. An overview of the relevant results is provided in **Table 41**:

		Pat1	Pat2	UnAv	FutO	Item26	PowD	Col1	AgeGr	IPnet	PatA	GDP
Pat1	Spearman's **ρ**			,685*				**,782****				
	Sig. (2-tailed)			,029				**,008**				
Pat2	Spearman's **ρ**					-,644*				**,830****		
	Sig. (2-tailed)					,044				**,003**		
UnAv	Spearman's **ρ**	,685*			**,770****			,697*			-,661*	
	Sig. (2-tailed)	,029			**,009**			,025			,038	
FutO	Spearman's **ρ**			**,770****			,717*		-,648*		-,697*	-,709*
	Sig. (2-tailed)			**,009**			,020		,043		,025	,022
Item26	Spearman's **ρ**		-,644*							**-,839****		
	Sig. (2-tailed)		,044							**,002**		
PowD	Spearman's **ρ**				,717*							
	Sig. (2-tailed)				,020							
Col1	Spearman's **ρ**	**,782****		,697*								
	Sig. (2-tailed)	**,008**		,025								
AgeGr	Spearman's **ρ**				-,648*							
	Sig. (2-tailed)				,043							
IPnet	Spearman's **ρ**		**,830****			**-,839****						
	Sig. (2-tailed)		**,003**			**,002**						
PatA	Spearman's **ρ**			-,661*	-,697*							**,939****
	Sig. (2-tailed)			,038	,025							**,000**
GDP	Spearman's **ρ**				-,709*						**,939****	
	Sig. (2-tailed)				,022						**,000**	

* Correlation is significant at the 0.05 level (2-tailed)
** Correlation is significant at the 0.01 level (2-tailed)

Table 41: Spearman's ρ for the variables that are included in the model (n = 10)

Table 41 only shows the statistical analysis results of the quantitative data obtained from the questionnaire (refer to section **6.4**) that correlate on a statistically significant level and that are represented as arrows in the model depicted in **Figure 22**:

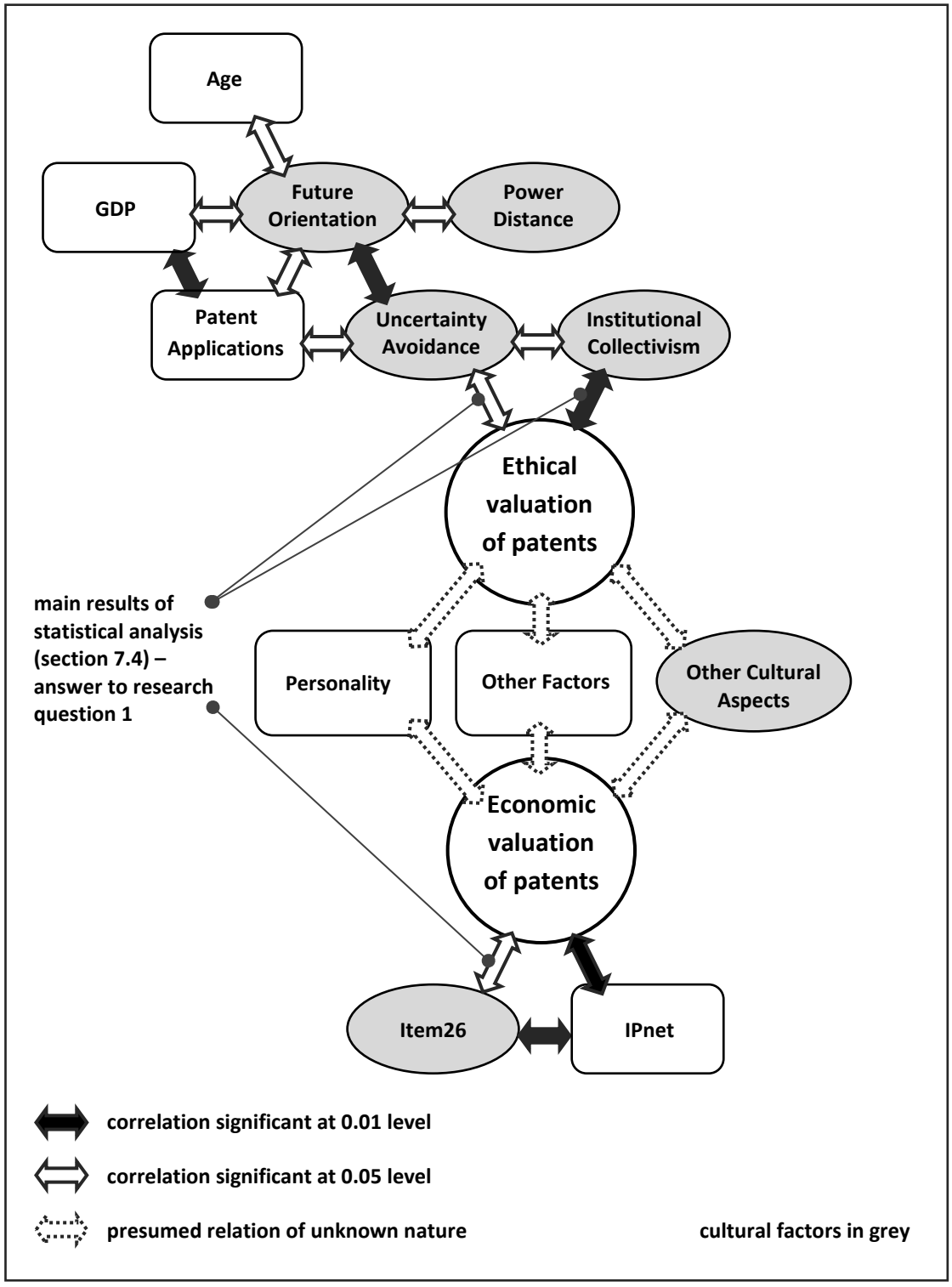

Figure 22: Model of cultural influence on patent valuation

The identified, as well as the presumed relations between the building blocks of the model are represented by bidirectional arrows. These arrows do not indicate mutual influences or cause and effect. Instead, the bidirectional arrows are meant to label three types of relationship:

- correlations that are statistically significant at the 0.01 level (solid black arrow)
- correlations that are statistically significant at the 0.05 level (solid white arrow)
- presumed relations of unknown nature (dashed arrow)

The model presented in **Figure 22** shows the cultural dimensions that were found to correlate significantly, either directly with patent valuation, or with other cultural dimensions. Technically the relationships between Uncertainty Avoidance (*UnAv*) and ethical patent valuation (*Pat1*), between Institutional Collectivism (*Col1*) and ethical patent valuation (*Pat1*) and between a specific aspect of Future Orientation (*Item26*) and economic patent valuation (*Pat2*) are correlations on a statistically significant level. They represent the main results of the statistical analysis described in section **6.4** and provide an answer to research question 1 (refer to section **8.1**). Nonetheless, the statistical analysis does not provide any explicit statement about cause and effect. There is no indication of correlations due to a common cause and there is no reason to imagine an impact of patent valuation on culture. In line with the argument of this work, supported by the literature review in **Chapter 3** and discussed in the light of the results of the analyses in **Chapter 7**, it is fair to assume that the observed correlations mentioned above indicate an influence of culture on patent valuation, not vice versa.

The model also shows the presumed impact of personality and predicts the influence of other currently unknown factors. Personality as one monolithic construct is expected to influence both types of patent valuation, whereas different aspects or facets of personality may only influence one or the other. Other factors might be ethical predisposition, religion, social stratum, education, profession, industrial sector etc. It can also be assumed that cultural factors other than the investigated dimensions may have an impact. The specific aspect of Future Orientation represented by *Item26* is also included in the model as it was found to correlate significantly with economic patent valuation.

To provide a broader and more holistic view of the subject, this work also investigated the influence of economic and other factors and uncovered the significant impact of age on Future Orientation as well as the influence of *GDP* (Gross

Domestic Product), the number of patent applications (scale *PatA*) and the balance of payments and receipts for Intellectual Property (scale *IPnet*). For completeness, these influences are also depicted in the model, as with the presumed influence of personality and other unknown factors, although these results can be seen as a by-product of this work. However, the identified relation between *IPnet* and the willingness to assign high monetary values to patents are a particularly interesting hint for future research in the area of economic patent valuation (see also recommendations for future research in section **8.6**).

The reliability and generalizability of the model mainly depends on the results of the statistical analysis (section **6.4**) on which the illustrated relationships between the building blocks of the model (depicted as solid black and solid white arrows) are based. The survey items and the sample of the questionnaire play a decisive role. The reliability of the survey items and scales is discussed in detail in **Chapter 5** and **Chapter 6** and summarized in section **8.5**. The questionnaire sample is limited to respondents from the telecommunications industry with a tertiary STEM educational background. This ensures homogeneity with regard to the parameters industry sector and education, which otherwise might have distorted the results. Also, this investigation is limited to EPO member countries to exclude potential influence of the ruling patent system. Other potentially influencing factors like age and gender were also controlled, so that the only significant heterogeneity of the questionnaire sample relates to societal cultures that are subject to this investigation. These precautionary measures and arrangements allow a sufficient generalizability of the findings for EPO member countries. Further details about the limits of generalizability of the results of this work can be found in section **8.5**.

As highlighted at the beginning of this section, the model depicted in **Figure 22** provides additional information for the target group of this work. The people that ultimately valuate a patent are typically the inventor or patent holder (e.g. indirectly through the decision to pay the annual renewal fee or through an estimation that they provide to their management). This model and the findings of this work are not expected to help inventors and patent holders to estimate the value of their patents,

but to help the target group (patent portfolio managers, business controllers, M&A professionals, patent rating agencies and business analysts) to classify, grade and compare the values of patent portfolios when using patent renewal data or survey based methods.

Furthermore, the model should enable other researchers to investigate further into the degree of cultural influence on how patents are perceived. The model encapsulates the findings of this work. It constitutes a major part of the contribution to knowledge of this research and may be used for practical application by the target group mentioned above.

8.4 Contribution to Knowledge

The main finding of this work is the confirmation of cultural impact on attitudes towards patents from an ethical point of view as well as on concrete estimations of monetary patent values. The model exhibits the correlation of Uncertainty Avoidance and Institutional Collectivism with ethical patent valuation and the correlation of a specific aspect of Future Orientation ("Item26") with economic patent valuation. The other influencing factors such as economic indicators and personality are added to complete the picture, but are not the focus of the work.

This work's contribution to knowledge is substantiated firstly by the answers to the research questions (see sections **8.1** and **8.2**) and secondly in the elaborated model of cultural influence on patent valuation (see previous section). The research objectives formulated in section **3.4** are implicitly fulfilled; the impacting cultural dimensions were identified (objective 1), a model was elaborated (objective 2a) and the reasons for cultural impact were investigated (objective 2b) and discussed in the previous chapter. The theoretical learning has some concrete implications presented below.

Implications

Are patent statistics of different countries and companies really comparable and are there really "*equivalent patent applications/grants"*, as suggested by the World Intellectual Property Organisation (WIPO, 2016a)? This work suggests that patent statistics may be used as an approximation of innovativeness if countries or companies that are similar with respect to other factors that determine innovation are compared. There is a more multi-factorial relation between innovativeness and patent production. The findings of this work show cultural influence on the notion of patents. These differences in the perception of patents may indeed have an impact on the probability that an inventor applies for a patent with his idea, or on the willingness of companies to invest in patents. Patent applications are investments and thus compete for company resources (financial and personnel). Thus, culture is one of the factors that determine the relation between innovativeness and patent production. This cultural influence needs to be considered when comparing innovativeness of countries (or companies) based on patent production. To a lesser extent, this also applies for competitiveness. Comparisons of competitiveness between companies and countries frequently refer to patent statistics as one determining factor. Here, cultural differences may also distort the results of such comparisons.

Another important implication from the findings of this work is that cultural impact on the notion of patents may also have an effect on patent quality (depth, breadth, degree of innovation etc.). Undoubtedly, comparing patent statistics of countries or patent portfolios of companies is sometimes like comparing apples with oranges. There are many different factors that influence patent quality and one very obvious factor is the patent regime. Therefore, this work is limited to European Patent Office member countries. But even under the same patent regime, patent quality may vary significantly from country to country or from company to company (Lanjouw, Pakes & Putnam, 1996; Schankerman & Pakes, 1986). Under the same patent regime part of these differences may be due to cultural factors. However, this is only suggested by

the results of this work and this topic requires further dedicated research to define how culture impacts patent quality (also refer to section **8.6**).

8.5 Generalizability and Limitations

A precondition for the generalizability and validity of the findings of this investigation and of the model based on these findings (refer to **Figure 22**) is the reliability of the utilized questionnaire items and sample. Special care was taken to ensure the required statistical reliability. Item candidates for the patent related part of the questionnaire that were obtained by means of semi-structured interviews were tested in a pre-questionnaire concerning their contribution to the scale efficiency and reliability. Cronbach's alpha and intra-class correlation (ICC) were applied to prove scale consistency and the reliability of test scores. The final items were complemented by cultural scales from the GLOBE project, whose reliability and consistency has been confirmed by numerous researchers and studies (Bertsch, 2012; Kabasakal et al., 2012; Krishnan & AlSudiary, 2016). The questionnaire sample complied with the requirements for statistical reliability – at least 20 participants per country (Hofstede & Minkov, 2013) – and with the preconditions to allow credible generalizations – at least 7 to 10 countries (Franke & Richey, 2010).

The country sample for this research consisted of 10 European countries that are all member states of the European Patent Office (EPO). This is relevant, because the patent regime of a country may influence the way patents are seen, particularly the reputation of the patent system. Therefore, this research is limited to EPO member countries to control the independent variable "patent system". This implies that the generalizability of the findings of this work is also limited to EPO member countries. Outside Europe this may be taken as a strong indication, but this would need to be underpinned with further research involving comparisons between countries under different patent regimes.

All 215 respondents to the questionnaire work in the telecommunications industry and have a tertiary STEM education. Although the sample is limited to a specific

industrial sector and a determined educational background, this work argues that neither restriction negatively impacts the generalizability of the results. A person's industry sector and education may impact their opinion about patents and this is exactly why the sample needed to be homogeneous with regard to these parameters. Otherwise cultural influences would have been mixed and overlaid with influences from industry and education. Furthermore, other potentially influential factors such as age and gender were controlled, so that the sample only differed significantly regarding the societal culture parameter under investigation. Similarly, Hofstede (1980) limited his survey to IBM employees without compromising the generalizability of his results. However, the parameter "job role" showed significant group differences regarding ethical patent valuation. This influence could not be quantified, or qualified. The compositions of the country samples do not show any systematic difference concerning job roles and there is no indication of a significant distortion of the findings of the analysis. However, as a precautionary measure future research should ensure sample homogeneity concerning job roles.

Language is not exactly a limitation, but an issue that should always be taken into consideration. This work was conducted in English, except for some interviews that were subsequently translated into English. No specific language issues were expected due to the fact that all people involved are fluent in business English. However, this work is aware that language is an important carrier of culture and even terms that are very basic for the understanding of this research, such as *idea*, *invention*, *property*, *ownership*, *possession* etc. may lose their exact meaning or unambiguity if translated into other languages. This is particularly true for languages that are not closely related to English, e.g. Finnish, Greek and Polish. Nonetheless, even translation into more closely related languages such as German and French might alter the exact meaning. For example, *ownership* and *property* are both translated to "*propriété*" in French by a reputable dictionary (Collins, 2016), even though the difference between both is important for the understanding of the concept and the history of intellectual property. In one of his influential works, Fichte (1793b) used the German expression "*Form des Gedankens*", which was translated to "*form of idea*" (Fichte, 1793a) and later on used as "*expression of idea*", e.g. in Biagioli (2011). These examples should

create awareness of potential language issues, which are inherent in cross-cultural research. These issues must be treated with consciousness and thoroughness.

Our cultural imprint is not only conditioned by the society we live in, but also through the "sub-cultural" groups we belong to, such as our generation, social stratum, education, profession and organisation(s). Hence, whenever conducting (cross-) cultural studies, researchers need to be very conscious and careful with parameters that relate to "sub-cultures".

Objectivity is another more general limitation. Based on a constructivist position, this work is fully aware that its proceedings and results are affected by the subjectivity and bias of the researcher. Research cannot be value-free and it is always influenced by the author's own values.

8.6 Recommendations

Practical recommendations for researchers

Likert-type scales are a proven means for questionnaires that aim to gather data for statistical analysis. There is considerable academic discussion of how many points an ideal scale should have and whether an even-point scale or an uneven-point scale is more appropriate (Carifio & Perla, 2008; Dawes, 2008; Guy & Norvell, 1977). Experience with this work suggests that a 7-point scale is robust, uncritical and well-suited. The proper phrasing of the items that make up a scale and the selection of the most suitable items is more important than the number of points on the scale. Researchers should expend effort on the creation of the scales and conduct a test phase in order to perform statistical tests for consistency and reliability. A pre-questionnaire that allows for testing of clarity and unambiguity of phrasing is highly recommended. This work found that even established survey items from the GLOBE project are sometimes difficult to understand by some participants. A thorough test phase is worthwhile even though it is unrealistic to expect 100% clarity and

unambiguity. The patent related part of the questionnaire that was developed for this study will be available to other researchers for future related studies.

Researchers should also be aware that respondents sometimes use the first of a series of similar items as an anchor and respond to all following items similarly or in relation to the first one. If this effect is undesirable a simple counter-measure is to use a mixed order for the items or to reverse code some of the items.

It was vital to provide a proper definition of perspective for the survey items that relate to economic patent valuation. This is a very specific item in this work and it is quite unlikely that any other research will repeat the same type of survey. However, the learning here is that it is important to define tasks in a survey as clearly as possible.

Recommendations for future research

The scope of this work is limited by time and other constraints but it provided various findings that could be useful to consider for future research in this area:

- Five specific cultural dimensions (Uncertainty Avoidance, Power Distance, Future Orientation, Institutional Collectivism, In-group Collectivism) defined by the GLOBE project (House et al., 2004) were investigated concerning their influence on patent valuation. Although the most plausible dimensions were taken, it does not mean that no other cultural dimensions or facets of culture are influential. As the example of *Item26* shows, even an aspect of a dimension may provide useful results and other specific cultural aspects may also be worth investigating.

- The influence of personality and its facets on patent valuation may be an interesting subject of investigation. Such research would involve other academic areas such as behavioural economics and cultural psychology.

- The model depicted in **Figure 22** also postulates an impact on patent valuation from "other factors", which could be ethical predisposition, religion, social stratum, education, profession, job roles etc.

- This work is limited to European Patent Office member countries. Therefore, future research could expand the scope to other societal cultures outside Europe.

- The main conjecture of this research was that culture significantly impacts the notion of patents. The findings confirm this assumption. Future research could investigate how far this effect may also influence patent quality, e.g. related to depth, breadth, degree of innovation, etc.

- A significant correlation between the economic factor *IPnet* (balance of payments and receipts for Intellectual Property) and economic patent valuation has been uncovered. However, as this relation does not relate to culture (at least not directly) it is not in the scope of this work and has not been investigated in detail. This task is left for future research.

Recommendations for policy makers

Patent reputation seems to be better than initially suggested by some statements obtained in the interviews (refer to section **7.7**). The surprisingly sound reputation among the respondents of the questionnaires is not related to a long-sighted patent policy. As current tendencies of public opinion concerning globalization and free trade (e.g. CETA, TTIP) may suggest, the reputation of the patent system may be under pressure in the future when some critical subjects concerning the limits of patentability (software, business models, genetically modified plants, human stem cells) are treated. Responsible policy makers are advised to take public opinion and reservations seriously and not to disconnect with their voters. Questions about patentability do not only concern economic interests, but also ethical principles. They

should not be left to technocrats, but should be the subject of democratic discussions.

8.7 Summary

Summary of this chapter

This final chapter starts with two dedicated sections in response to the research questions formulated in section **3.4**, followed by a section that presents a model of cultural impact on patent valuation. The answers to the research questions and the model constitute the contribution to knowledge. The rest of this chapter presents the implications of this work as well as its limitations. It closes with recommendations for researchers and policy makers.

Summary of this work

This research evolves from the recognition that current worldwide IPR systems are based on Western cultural and philosophical values and that there is probably cultural impact on the notion of patents. The contextual background is founded in the history of patents explaining the Western cultural influence and the importance of patents for international business. The latter is outlined with a short introduction into "patent wars" that currently involve numerous large multinational corporations. It becomes clear that the economic value of patents is a very important subject for business, despite, or perhaps because, patent valuation is a challenging task. There are many different methods that all produce estimations with no exact value.

A literature review at the beginning of this work confirms that no research has been undertaken (or at least has not been published) that investigates cultural impact on patent valuation. This work attempts to close this knowledge gap by defining and responding to two research questions; what cultural dimensions have an impact on

patent valuation, and how and why they impact. The literature review also critically analyzes works in the academic areas of culture and patent valuation.

Based on a constructivist worldview, the methodology chosen to answer the research questions is Mixed Methods Research (MMR). The sequence of applied methods starts with semi-structured interviews as a qualitative data collection method. The aim of this method is to create suitable survey items for subsequent usage in a questionnaire. Prior to that, a pre-questionnaire is used as a pilot for quality assurance. Data produced from both, pre-questionnaire and questionnaire is subject to a statistical analysis as a quantitative data analysis method. Qualitative data analysis is also applied twice, firstly on the semi-structured interviews and secondly on qualitative data derived from the questionnaires.

The results from the quantitative and qualitative analyses are then discussed and interpreted in the light of relevant theory. The findings of the discussions and interpretations provide a response to the research questions and the creation of a model representing cultural impact on patent valuation. This model is based on a conceptual model developed from the insights gained through the literature review. The analysis results are used to revise and substantiate this model.

The assumption that there is a cultural impact on the notion of patents was confirmed. The conjecture that standpoints towards the ethical valuation of patents would also influence the economic patent valuation could not be proven. However, a cultural impact on economic patent valuation could be shown for a specific aspect even if not for a complete cultural dimension. Possible explanations for this were discussed in the previous chapter.

Concluding thoughts

This research has been a challenging endeavour. It involved qualitative and quantitative research methods and touched on two diverse scientific fields with very few connections: patent valuation and cross-cultural studies. Various areas of theory were also broached, such as the history of patents, philosophy of (intellectual)

property and cultural psychology. These are relevant for the understanding of the subtle and complex relationship between culture and patent valuation. The identification of cultural impact on patent valuation has a number of implications, not only on economic patent valuation, but also on the interpretation of patent statistics, e.g. with regard to assessing innovativeness and competitiveness. Many questions remain open and new questions evolved from the answers that this work provided. In this sense, the developed model is as much a starting point for future research as a definitive design that can be immediately applied in practice.

The transparent, replicable and reliable economic valuation of patents and patent portfolios remains an issue with major business significance. This is primarily due to the obvious financial aspects, e.g. revenue (licensing, sale), company valuation, accounting and credit financing, and secondly, because “patent wars” continue and can be expected to intensify rather than subside (Mawad, 2016, January 26). There is a clear need to understand all factors that determine the value of a company’s patent portfolio, which may make up a considerable share of the overall company value (Waters, 2011, August 15) and that also provides information about its means of defence and its ability to attack competitors (Duhigg & Lohr, 2012, October 7). The reference to “patent wars” closes the circle of this exploration; it connects to the initial idea for this undertaking outlined in the contextual background. This work closes with the confidence that the findings of its investigations make a relevant contribution to the understanding of the cultural factors that play a role in patent valuation and may stimulate fruitful research in this area in the future.

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Appendix 1: Interview Guide

Interview Guide (phase 1)

Q1: What comes to your mind when you hear "patent value"?

Q2a: How do you think one could capture the personal viewpoint on patents?

Q2b: How would you proceed if you intended to create a similar scale for "viewpoint on patents"?

Q3a: What do you think of the following questions?

(Example items for the proposed ethical patent valuation scale were shown)

- Patent protection is in general useful for society
- Patent protection runtime should be extended (20 years currently)
- Software should be patentable
- Genetically modified plants and animals should be patentable

Q3b: Would you think they would serve as a scale?

Q3c: Which one? Which one not? Why?

Q3d: What are your ideas?

(Thought experiment regarding patent valuation was presented)

"*Imagine your company possesses the following patent and one of your direct competitors would be interested in buying it from you - what is the smallest amount for which you would be willing to sell it (in €), assuming that the buyer would subsequently exercise its full patent rights?*"[51]

[51] wording based on quote from Harhoff, 1999, p. 2

Q5: Which of the following example patents are suitable for the purpose to assess personal tendency in attributing low or high values to patents? Why?

(Example items for the proposed economic patent valuation scale were shown)

- Damper system for cabinet hinges that allows the smooth and silent closing of furniture doors.[52]
- Inflatable bike helmet that looks like a scarf and transforms into a head protecting airbag in case of a crash.[53]
- Liquid lens of compact size that uses electrical current to change its focal length.[54]
- Electronically tintable glass that saves energy by controlling the intensity of light that shines into buildings.[55]
- Self-healing cement that contains limestone-producing bacteria and improves the lifespan of buildings and other constructions made of concrete.[56]
- A new class of polymers called "*vitrimers*" that are able to change from a solid to a flexible consistency, controlled by temperature.[57]
- Energy-efficient water purification based on water-purifying proteins (aquaporins).[58]
- The QR code, a two-dimensional bar code can be found virtually everywhere, e.g. product packaging.[59]

Q6a: Any other patent that could be a suitable example?

[52] European patents EP 1920128 B1 and EP 1199433 B1
[53] European patent EP1947966
[54] European patents EP 1870742 B1 and EP 1662276 B1
[55] European patents EP0831360 and EP164690
[56] European patent EP2247551
[57] European patent EP1465930
[58] European patents EP1885477 and EP1937395
[59] European patent EP0672994

Q6b: Any other thoughts or ideas on the topic? Suggestions?

Q7: If you were in charge, if you were responsible, what would you do?

Interview Guide (phase 2)

Q1: What comes to your mind when you hear "patent value"?

Q2a: How do you think one could capture the personal viewpoint on patents?

Q2b: How would you proceed?

Q3a: Do you think the following questions could capture the personal viewpoint on patents? Why?

(Example items for the proposed ethical patent valuation scale were shown)

- It is fair that inventors can protect their inventions with patents
- The patent system is overall beneficial for society
- A well-functioning patent system is an important business factor
- Government policy should encourage patent protection to promote innovation
- In principle, software should be patentable as well
- Genetically modified plants should be patentable under certain conditions
- Medical treatments developed from human stem cells should be patentable under certain conditions

Q3b: What are your ideas?

(Definition of perspective for valuation was presented)

"*Imagine your company possesses the following patent and one of your direct competitors would be interested in buying it from you - what is the smallest amount*

for which you would be willing to sell it (in €), assuming that the buyer would subsequently exercise its full patent rights?"[60]

Q4: Do you think this definition makes sense? How would you formulate it?

Q5: Which of the following example patents are suitable for the purpose to assess personal tendency in attributing low or high values to patents? Why?

(Example items for the proposed economic patent valuation scale were shown)

- Damper system for cabinet hinges that allows the smooth and silent closing of furniture doors.[61]
- Inflatable bike helmet that looks like a scarf and transforms into a head protecting airbag in case of a crash.[62]
- Liquid lens of compact size that uses electrical current to change its focal length.[63]
- Electronically tintable glass that saves energy by controlling the intensity of light that shines into buildings.[64]
- Energy-efficient water purification based on water-purifying proteins (aquaporins).[65]
- Solar cells based on polymers. This new class of photoactive polymers improves efficiency by more than 60% at significantly reduced costs. Moreover, its production is environmentally friendly.[66]
- Painkiller without side-effect. New pharmaceutical based on a protein produced naturally in the human body.[67]

[60] wording based on quote from Harhoff, 1999, p. 2
[61] European patents EP 1920128 B1 and EP 1199433 B1
[62] European patent EP1947966
[63] European patents EP 1870742 B1 and EP 1662276 B1
[64] European patents EP0831360 and EP164690
[65] European patents EP1885477 and EP1937395
[66] imaginary patent, not existing

Q6: Any other thoughts or ideas on the topic? Suggestions?

Additional candidate items tested in interviews

Items for the proposed ethical patent valuation scale

- Patent protection should be faster and cheaper than it is today
- Software piracy (e.g. mp3 and Microsoft Office) should be punished more severely
- Companies should get stronger juridical support to defend their Intellectual Property Rights
- Human genes should be patentable under certain conditions

Item for the proposed economic patent valuation scale

- Medicament that cures poliomyelitis. Despite the existence of an efficient vaccination against poliomyelitis there are still 1,500 new cases every year, especially in India and Nigeria.[68]

[67] imaginary patent, not existing
[68] imaginary patent, not existing

Appendix 2: Categorised Interview Transcripts

Question 1: What comes to your mind when you hear “patent value”?

Opinions and judgements
B: If one has a medicament, this should be usable by a broad spectrum of the population D: I think of licenses or how you can get money out of patents (…) the patent system as such is there to guarantee access for all to the invention, that's the IP value (…) most people know little about it, the mass of people (…) a big economic conspiracy, all is driven by money and they try to kick out all people that are not 100% convinced. If the (patent system only serves) to strengthen the whole automatic mechanism of the economic system H: money (you are not thinking in moral value?) no (…) the fact that I didn't get anything does not prevent me from associate patents primarily with money (…) as a researcher it was more for reasons of prestige - patent value is not only economical, but also related to professional realisation, status, career, curriculum J: I think in the significance for society of this patent, on the one hand side. On the other hand side in the economic aspect, how much it is valuated (…) I would think of the importance for the area, for the technological field. You can say it is important for society, an important aspect, it yields a lot and then I would immediately assume, especially with German mentality, that it has a high economic value, with the German mentality, if we talk of other cultures that may be different (…) I would have thought that Europe is rather all the same thing (…) I would have thought that the Europeans are that far developed that they all think in a similar way (…) But for Germany, patent has a very high value. As high as in Germany it is maybe only in the USA. And the valuation of patents has also to do with society, in Germany it is so important, because they are rather technically oriented, even if it is not from an technical area, if it is from medical science, it has a technical aspect in the sense that you do something in this area, that's one thing. The other thing is that it has also to do with the development of the country and with the political system. Due to this reason it is possible, that there are countries, like Romania, that see it like patents have no high importance. France, I am asking myself, I would also not see them so high. Regarding the Finns I would see it higher (…) importance in society as well in the sense of the person, the person that has got this patent, receives in Germany a higher reputation (…) to have a patent has a high status in Germany, in other countries less (…) questionnaires are the best, especially using contradictory questions, because then you get from people a clear statement L: what is the potential of this patent to exploit in reality, in terms of money, but also companies and society (…) there are thousands of patents and the majority is not realisable, or people that are patenting round corners (…) there are great patents that allow you to realise something. How much "content" has a patent, how much innovation? (…) what type of patents are these, in which direction they go, whether they are only to protect some design, or are these patents really innovations or inventions? (…) I think that dependent on different cultures there is a different opinion about patents - ask me and ask a Chinese what we think about patents - I rather think that there is a difference U: it's the monetary value, it's a kind of protection for an inventor or company, innovation and also for the society, they have to somehow to disclose the innovation to society, that's the aim of a patents, and what society gives back to these inventors, the value of only been able to produce this innovation (…) from an ethical point of view, whether this makes sense or not, it is always a big question. I don't have a clear perspective from my side (…) really protection for big companies (…) I think that everything could be patented, but not related to humans or human treatment, some ethical things, weapons (…) business methods, there are

great ideas, wow, so why not? (…) medical treatment of people you cannot patent (…) Portugal, look at the number of patents they have, it is ridiculous (…) even if it is growing (…) in Portugal, also technical people, not everyone, but majority don't know S: patent value is, especially in engineering, a topic related to innovation and creativity. Innovation in the sense whether it is really something new, then it is more valuable than it is just a modification of something existing. Patents are primarily inventions, innovative products (don't think at first of the money behind, but rather in the sense what can you do with it?) exactly R: the value of a patent is justified by this. I file a patent to protect my intellectual property P: I have a patent and you are a company that wants to buy it. That's the value of a patent (so you firstly think in the economic value?) exactly
Personal ideas and learning
not only about economic value, but somehow about quality of the patent

Question 2: How do you think one could capture the personal viewpoint on patents? How would you proceed?

Lack of clarity
B: maybe you need to define "personal stance/standpoint/viewpoint" H: my doubt is, if you talk about valuation, it is a valuation from the point of view of the valuator, the technician, the companies apply for patents, is it the patent examiners in the patent office that you are referring to? To assess the quality of the patent? Or how this question is meant? Or is it a more generic valuation? (…) what is the objective? To which conclusion do you want to come? J: if you say "personal viewpoint", do you mean from perspective of a person that values patents, so it's his job, where he works at?
Insecurity
P: it is a difficult question. I have no idea concerning patent value (...) I needed to think, it does not come immediately
Ideas and proposals
F: patent friendly, this is a sort of category, these are property related questions (…) the question of property is always connected, this is the central question, related to patent friendliness and patent hostility (…) categories of property (…) a literature review would provide a typology of the discussion, main arguments, a sort of mind map, different arguments, how they graphically stand to each other, it could be charted/mapped, key arguments, guided arguments, a type of structuring what exists in literature. Maybe first a list of pros and contras, relations between these arguments, emphasis and doubts, maybe this is very abstract, geographical clusters within this map, maybe all the Chinese interviewees are in the right upper corner of this map (…) it is always good to distract people in order not to get too conventional answers (…) you are always talking about national cultures (…) for such questions different cultures may not be distinguishable along national borders (…) (it might be that engineer see these questions differently than sociologists) or linguistic culture, for example German speaking countries (…) needs to be reproducible R: you need to conduct a survey (…) I would use questionnaires, because this is more concrete, because there is a certain structure, maybe to read a bit between the lines also interviews, because you can stimulate some more details (…) maybe I would take one question that falls out of line P: I would ask what do you think about patents. Is it something positive? Or that it stimulates innovation. Or do you think this is only for big companies? I would just ask directly

Opinions and judgements
Y: if you ask many people it will be balanced, you will get a real picture
Personal ideas and learning
a statistical analysis of condensed information will lose out detailed aspects. The question is whether to do a more qualitative analysis and consider more detailed information, or to do it purely quantitatively. In the first case I would indeed need more questions

Question 3: Do you think the following questions could capture the personal viewpoint on patents? Why? What are your ideas?

Lack of clarity
F: why you have 3 controversial items in the first part, but these are not reflected in the second part, is this intentional? (…) I was thinking about the significance of these items, but it's not about this R: it is only about the judgement of the questions? (…) it is about whether these questions are reasonable?
Insecurity
B: you can only ask people who are experts in patents, I don't know nothing about patents (…) ok, but you need to ask really patent experts
Ideas and proposals
B: you maybe find out more if these were a semi-open questions so that you really can say something D: whether they are aware that patents play an enormous role in their daily lives (…) that they are protected. (…) whether they have a telephone and whether they know how many patents are related to it. Do you have any idea how much is this worth and do you think this is ok. So if anybody designed a button on it and got a lot of money for this (…) what would you think if somebody has a good idea that means progress to society because it's something new, would you think it's ok if he gets protection for this? A patent, what means he could prohibit all others to use it or he could ask for money if somebody wants to use it? If this is ok in general (…) ask more into the general. Do you think that pirate copies of mp3 in the internet are ok? (…) pirate copies of movies and so on (…) would you let others use your patent? F: add a question related to end date of patents (…) you could give some more information (…) you could explain that it is normally 20 years and so on H: before, you could ask whether I agree with the protection of intellectual property. Do you agree with the concept of patent protection? J: the main problem is because of usury, because of the exorbitant prices. When I buy the same medicament in Germany, Austria or Italy. In the States you get a large bottle of Aspirin for a few dollars and her you pay for 20 pills L: how long should a patent be valid? Should it be valid for an eternity, or for 5 years? Should it be valid for 30 years? The lifetime of a patent until it can be utilized by everybody. That would be a question that I would ask in addition (…) these rules are valid since I don't know how many centuries and nowadays the world is faster. And maybe one should think about shortening this validity W: you may want to ask people to pronounce their reasons in the first section. Something like: Give me two reasons why you think that patents are positive/negative U: also business methods, should they be patented or not?
Doubts and disagreement
B: these four questions, what kind of insight they would provide you? I judge them too few

(…) how you are doing it is not interesting D: I would ask differently F: (need to reduce these seven questions in the end) Wow, so few? (...) thought you want to get more info about the context J: I ask myself whether these are enough or if these are too little. We discussed a lot, but if I had to answer them, this would go very fast (…) 40? Oh, that's challenging R: why these three? I imagine there could be ten thousand
Personal ideas and learning
if Bayer invents a medicament against cancer then this is rather immoral if they have patent rights on it, there should be generic medicament so that everybody could use it (…) protectionist measures from one country against another (…) to go back one step and have a bird's view on the whole topic? (…) watch out not to mix up many things, e.g. emotions, regarding religion, political convictions

Answers to Q3 - directly related to "ethical" items

"Ethical" Item	**Lack of clarity**
„fairness"	Y: whether it is ok that inventors can protect their inventions with patents, right? (…) "fair" means also fair in German?
"run-time"	Y: validity (translating "run-time")
"software"	Y: patentable means not that code is protected, but some procedures? S: does this mean software is not patentable?
"Ethical" Item	**Insecurity**
"faster and cheaper"	J: well, I don't know details about patenting
"run-time"	Y: personally I wouldn't know what to respond (…) if you are not an expert, you don't know
"business factor"	P: I personally would have some problems to judge. I think for this you need to know more about economics, in general most people who you talk about this do not know too much about economics in order to come to correct answers
"GM plants"	W: I know nothing about genetically modified plants (similar as other people won't know much about SW). I am not familiar with any debate to this regard
"Ethical" Item	**Ideas and proposals**
"society"	S: (this) is of course a principle question. There is a cultural factor, maybe also a political positions, social positions, communism against capitalism
"run-time"	D: you could ask, a medicament needs, until it is approved for market, it must be tested and so on, at human test groups, and this takes up to 10 years. Do you think it is ok that for these patents protection is prolonged? Then you have first the general question and then more detailed. 20 years is already sufficient, or should it be longer. Copyright is 70 years, why patents only 20? W: for accuracy, you may want to say "20 years from filing". Usually, 3-5 years pass by during the approval process, leaving you 15-17 of time of the patent
"government"	Y: I would not have recognized it by myself, the implicit one I wouldn't have noted it. But you can separate them
"software"	W: you may want to add some introduction about the debate, so that

	the questioned people can think this rationally
"GM plants"	D: what do you think of genetically modified plants and animals, in general, and then in a second question to ask whether it is ok to have patents on it. Then you can relativize it. (…) I would try to include some more. To broaden it a bit. You could take this question for example more nuanced if you say a company has genetically modified rice, or maize, so that it can grow with bad soil and much less water and thus would provide food for 1 billion people (or herbicide-free) and it would provide a many people with food so that they do not die by hunger. Would you think it is ok to have a patent on it in such a case? W: I would answer this question with the same spirit as questions before. In other words, my answer does not really add information to your research. Unless you give me first an introduction about the discussion on genetically modified plants and patents S: (very controversial and this could impact the answering) as you are investigating cultural impact this might be also a possibility to get some insight
"human genes"	W: I would answer this question with the same spirit as questions before. In other words, my answer does not really add information to your research. Unless you give me first an introduction about the discussion
"stem cells"	S: (very controversial and this could impact the answering) as you are investigating cultural impact this might be a possibility to get some insight P: not only related to stem cells, but related to medicaments in general
"Ethical" Item	**Opinions and judgements**
„fairness"	F: very reasonable, (...) short, (...) quite clear (...) also for non-experts, I think it's clear J: you would certainly strongly agree L: makes sense and (is) consistent Y: this is a good introductory question, sure (it is understandable?) yes (...) clear, it is a good question (...)shows a certain basic position, regarding society and politics W: very clear S: clearly understandable, classifiable as well (capture personal viewpoint consistently?) for sure R: good (...) well suited P: perfect
"society"	F: very reasonable, (...) short, (...) quite clear (...) also for non-experts, I think it's clear H: (suitable?) yes J: here it is also very strong L: makes sense and (is) consistent (...) good question (...) my favourite Y: also a good question (...) maybe some people will also think in medicaments and so on (...) shows a certain basic position, regarding society and politics W: very clear U: good, it makes sense S: is of course a principle question. There is a cultural factor, maybe also a political position, social position, communism against capitalism (...) I am a bit concerned whether the personal stance plays a role, more than

	a neutral reflection R: also a good question (...) well suited P: yes
“faster and cheaper”	J: you need a strong company that supports you in order to patent something. If I am a small R&D guy in a small company, it is possible that I invent something fantastic, it is very difficult to get a patent (…) yes easier, faster, but it needs to have a value (…) quality must not suffer L: makes sense and (is) consistent Y: good understandable (...) if you are (pro-patent) you would probably have also a clear opinion on this W: clear to me since I have hands on experience with the process and cost. But I wonder how people (including engineers) who haven’t gone over the process will respond to this. Their answer will probably be driven by some prejudice which may be all inaccurate U: it is really expensive; it is not accessible for everyone (…) why should it be charged? (…) at least accessible for a private person. Nowadays it's extremely expensive (…) not only because of the fee, but you are charged there and there, the attorneys, you pay a lot. I cannot see that an individual can easily get thousands of Euros to get a patent, tens of thousands of Euros (…) I am not saying that there is not individual benefited by the system, but the costs are too high (…) for big companies it might be ok. Some are pushing, but for others it might be ok if it takes 10 years
"run-time"	H: (suitable?) yes Y: unambiguous, well, personally I wouldn't know what to respond (the question is understandable, but difficult to answer?) exactly, so if you are not an expert, you don't know (...) requires more thoughts W: very clear U: good, it makes sense
“business factor”	F: very reasonable, (...) short, (...) quite clear (...) also for non-experts, I think it's clear Y: ok (...) shows a certain basic position, regarding society and politics W: very clear S: everybody has an opinion, whether well-founded or not, everybody can answer it, at least everybody who ever had something to do with patents (capture personal viewpoint consistently?) for sure R: well suited P: justified (...) would have some problems to judge
“government”	F: very reasonable, (...) short, (...) quite clear (...) also for non-experts, I think it's clear Y: I like it as well (...) if someone thinks government should promote it, then he probably thinks also that it promotes innovation. Maybe it is actually only one question. The two sub-questions do not contradict each other, it is going into the same direction (…) shows a certain basic position, regarding society and politics W: very clear S: this is a good question R: well suited P: difficult
"software"	D: people that think that software should not be patentable will be

	probable also not very positive about the first two F: very reasonable, (...) short, (...) quite clear (...) also for non-experts, I think it's clear (...) H: (suitable?) yes J: regarding software I would rather say that it should become a patent, whereas I would define some limits,..., no trivial things, real innovations, something special L: makes sense and (is) consistent Y: this is a (sensible) topic, the question is good to understand, but it is very difficult to answer, maybe other persons would answer them easily, e.g. fans of open-source, they would say there (should be) no patents (...) I personally think that (software) code can be protected, but "patentable" means that often some nonsense is patented, for these there should be actually no patent W: I know my answer here, but I am not sure that everybody will be aware of the discussion U: good, it makes sense (...) software is also problematic, some freaks want everything free-of-charge, no one should really patent for it conflict area S: with background information this question is answerable R: understandable and reasonable P: good
“SW piracy”	J: there are people who want to be very free and then they consider software piracy great (…) things that have been free of charge already, e.g. mp3, a free of charge mentality emerges (…) the question is what means "punish more severely". It is exaggerated sometimes (…) it's the question how I define piracy
“juridical support”	J: there are too many juridical fights, that's exaggerated (…) these are ridiculous things ... there should be limits
"GM plants"	D: there are many very pro-patent minded people that would give here a negative statement. This is rather a moral question. People would rather answer whether they find it ok if plants and animals should be modified in the first place. So they would rather answer that and not whether it is ok to have a patent on it (...) if somebody thinks you should not do it, then he is of course against patents on it F: very reasonable, (...) short, (...) quite clear (...) also for non-experts, I think it's clear (...) conflict area H: (suitable?) yes J: you are against it if you are affected. Here you are affected, because sooner or later you are eating these things. Then certain fears emerge (…) people that … say piracy is ok, that's no problem, than they are getting more uneasy here (…) If it's not patented, everybody can do what he wants (referring to safe food) (…) If somebody makes a very simple combination of two plants and a big company patents it then he cannot plant it into his garden anymore L: I am not sure whether this is a good thing at all (...) a bit specific, more in direction to ethical questions Y: unambiguous (...) I even would respond with "yes" W: I know nothing about genetically modified plants, I am not familiar with any debate to this regard (...) I would answer this question with the same spirit as (the questions before), in other words, my answer

	does not really add information to your research U: good, it makes sense (...) even if you are very patent friendly this one is very connected to some beliefs S: some people are a bit biased, press releases and general positions concerning gene manipulation (...) very controversial and this could impact the answering of these questions R: understandable and reasonable P: very difficult (...) you need to understand something, but the question is ok
“human genes”	L: nobody can patent the genome, nobody has invented it, it's simply nature (...) a bit specific, more in direction to ethical questions
“stem cells”	F: very reasonable, (...) short, (...) quite clear (...) also for non-experts, I think it's clear (...) conflict area Y: I am extremely unsure, but it is understandable, very, very difficult to answer W: I am not familiar with any debate to this regard S: some people are a bit biased, press releases and general positions concerning gene manipulation (...) very controversial and this could impact the answering of these questions R: understandable and reasonable P: most polemic
“Ethical” Item	**Doubts and disagreement**
„fairness“	H: there is one question missing, just before (this one)
“faster and cheaper”	J: with that I would have a problem, with that I would see an extreme, where everybody, just to mention an extreme, just to tell his friends that he has a patent, or to be seen better from his boss in the company, he would write some nonsense on the paper and would file it for patent, because it's free of charge. Then, of course, in the end it results in nothing, but it produces work that would delay other more valuable patents W: I wonder how people, including engineers, who haven’t gone over the process will respond to this. Their answer will probably be driven by some prejudice which may be all inaccurate
"software"	W: I am not sure that everybody will be aware of the discussion about “should software be at all patentable?” R: why software and not hardware? Why do you distinguish between software and hardware?
"GM plants"	D: people would rather answer whether they find it ok if plants and animals should be modified in the first place. So they would rather answer that and not whether it is ok to have a patent on it (…) I don't think this is a bad question but what answer will they give you really? W: I know nothing about genetically modified plants, so I would answer this question with the same spirit as questions above. In other words, my answer does not really add information to your research
“stem cells”	P: why only from human stem cells? (...) I thought that there are still many problems with patents on medicaments in general, without any need to go to specifics like stem cells
“Ethical” Item	**Experience and information**
"society"	U: from discussions I have at work, a fundamental question, is it to the benefit of society or not
“faster and	U: I don't know the exact prices anymore, they have been changing (…)

cheaper”	sometimes there are different aspects around the same topic and you need to protect them all (…) a friend in Portugal, they have a small company with very limited budget, they really were afraid if with their product they were infringing any patent, an existing product, they started a patent application, but the outcome is not clear
"run-time"	D: for medicaments it is already standard that patent lifetime is prolonged H: medicaments is not 20 years, it is different
"software"	Y: strange news in the press, about pressing the right mouse button, with a patent
“juridical support”	J: there was this cow, there was a patent dispute, there is a yoghurt for children, this was totally ridiculous (…) I think it was Bahlsen, "happy morning" or similar they called their cookies and there was somebody in Stuttgart or else who called his café, no chain, also "happy morning" or so, and the big company sued him and they even won
“Ethical” Item	**Personal ideas and learning**
“faster and cheaper”	I could also ask should it be free-of-charge, because if it is good for society (…) or cheaper as it is at the moment (…) the question could also be, could it be easier and faster to patent, or something like that (…) not the intention that it reduces quality, the intention is that it gets faster and cheaper (…) I need to formulate the question that way that it becomes clear that it is meant without degradation of quality
“government”	maybe the question arises why the government should promote it. Well, but you are right, I can maybe separate them
“SW piracy”	pirate bay (…) if someone is patent-friendly it does not mean that he doesn't consider software piracy as really bad (…) it's clear that this question is a bit complex
"GM plants"	patent friendly, but religious, then this question will deteriorate the average (…) or herbicide-free (…) maybe I have to replace this one, or put it together on a different scale
“stem cells”	I could also ask a simpler question

Definition of perspective for valuation: “*Imagine your company possesses the following patent and one of your direct competitors would be interested in buying it from you - what is the smallest amount for which you would be willing to sell it (in €), assuming that the buyer would subsequently exercise its full patent rights?*”[69]

Question 4: Do you think this definition makes sense? How would you formulate it?

Lack of clarity
Y: but it is not meant you make money out of the patent and then you close the company, you as an entrepreneur? P: only to buy the patent, or also to license it?
Insecurity
H: I don't know the legal aspects. I don't know whether I have the right to ask for anything regarding my patents, I have no idea

[69] wording based on quote from Harhoff, 1999, p. 2

Ideas and proposals
D: Many would not let use it at all. You can also follow the Apple strategy and let nobody use your patents (…) you could add a second question. To check determined positions in general. Somebody who is not really convinced of the patent system would get into trouble with his conscience. In the third world you have 3 billion of people. But these are things you want to investigate, this is expandable. Then you could leave space that one could give some comments (…) imagine you were boss in 1982 and you had a patent on compact discs. How much would you have offered to buy the patent? (…) are you aware of the fact that every CD player, every CD-ROM, every recordable CD, that we paid for 20 years always money for Phillips Y: you would need to say "imagine you are a company" W: I think that this exercise needs to clarify whether my company is making any use of the patent in question or if it is capable to do so in the future. Then, it should give some indication about the company's trust in the patent's strength (is it somewhat easy to provide the same solution without infringing the patent's protection?)
Opinions and judgements
H: in the end patent value is the value that the other is willing to pay (…) it's very subjective, like a painting. How much is a painting worth. It's the value that you are willing to pay (…) a painting something unique (…) you never have a unique patent, oh yes, you could J: whether this patent fits into my company strategy, whether it is important. Or, then I rather sell it. Doesn't matter who is the competitor. Because then he is no competitor any longer, for this patent, because it's not useful to me. If I cannot bring it to market, this patent, then it's not useful for me S: I think this is a very good definition, it makes it a bit more comprehensible R: it makes sense, because it provides a structure, it defines the frame (…) under the condition that you give this definition, am I the entrepreneur who owns the patent? Then I have some insight into the market and then I can estimate what it would be worth for me. You can always take a choice, the question is only how accurate your estimation is P: it is clear and makes sense
Doubts and disagreement
J: it's more about how much profit is behind, less about whether it is patented L: these are two different situations, I think the question how much a patent values is not dependent on the culture, but rather dependent on the situation or starting point (…) I can't imagine that it is dependent on culture, for example this question how much value has a patent (…) I don't see the connection with culture (…) regarding the economic value, because this is not only dependent on culture, but also on the person. The type of person, whether this person thinks in the long-term or in the short-term, whether he wants to get money fast, or whether he saves money for something bigger. That's less dependent on the culture, from where he comes, or where he lives, but rather on this person Y: this definition has a weak point. You can imagine, for a private person 1 million is a lot of money, or 3 million or so, but if I am responsible in a company then it is not that much (…) somebody would answer very differently if he can imagine very well. If he is in a mid-size company he would not close down, because it's a family business, so he has a different view. If somebody founded a start-up and he gets an offer to buy a patent for 3 million then he would agree easily U: if a person is not patent friendly, why should he answer here low value or high value? If the society would buy it to provide it free-of-charge, if the company would sell it to be free, which is not possible, but then the patent non-friendly people would answer it is not (highly?) chargeable. But if I sell it to a competitor who would also continue to be the only producer of this (product?). If I sell it cheap to him and society cannot profit (…) you believe there is a cultural influence on this?

R: this depends on the topic. For example if you take energy efficiency topics this may be interesting in Germany, so the selection of the (example) patents is decisive
Experience and information
H: (did you get any money from your patents?) no (…) it never has been used, but it could be used U: a colleague showed me a patent that was sold in 2014 and if you had seen it you would never think to sell it, it was really a high price (…) we don't get any feedback if one of our patents is sold (…) (a friend), university, post-doc, where she takes care of PhD students, she has one (a patent), if you ask her the value, she don't know, people are not aware

Question 5: Which of the following example patents are suitable for the purpose to assess personal tendency in attributing low or high values to patents? Are they understandable? Are they easy or difficult to estimate?

Lack of clarity
F: is it with a scale? (…) why these items? Do you have a certain classification of goods? Where you could experiment different evaluations? Environment, medicaments, comfort and security?
Insecurity
F: for me it's difficult to decide L: for me this is very, very difficult, you need to know a bit about it in order to access it (in the sense of being an expert) (…) I am not so sure, because, well, it depends what person you are Y: as a normal person you would probably not be able to think more deeply about (…) well I am not so fast and from time to time I have difficulties with English. Well, it is difficult to imagine (…) I don't know how much a good patent is worth. Do you have examples of real values? (…) actually this is a strange world to me P: I am not a patent lawyer and also no patent examiner, but you need to understand what you are talking about
Ideas and proposals
D: with air bags I don't know. ESP maybe? (or ABS?) this is something that people are really using. And you could say there are 60 million cars (…) or the case of HIV virus that government invalidate patents (…) medicaments (…) statement that the patent system is only there to make the big companies even richer and to squeeze out private inventors. As a statement, just to ask "do you agree, or not". These are more emotional questions; they are less well-thought-out, more emotional (…) a new developed bullet that explodes when it hits soft material, do you think this is ok? (…) a drone that drops bombs (…) create two groups of questions, one with the rather objective questions and one with the others, So that you get two values where you could play around a bit. On the emotional level they are strongly negative and when it comes to concrete questions they consider these rather ok Y: you can hear often that patents are not protected very well, and concerning this one you can imagine as non-expert that ... competitors may somehow partly copy and modify it a bit and describe and file an own patent (…) I have some doubt whether it is watertight, you could also state above the patents "these patents are watertight", if you write there is no other way to circumvent this patent, then it might be evaluated differently (…) one issue is the water tightness, so that anybody else cannot invent the same, and the person who estimates is influenced by this possibility and estimates lower. But this is part of it (…) also depends on the political position, whether you accept the economic system or not U: things like treatment of cancer, people like such, chemical treatment where you don't suffer so much

S: when I have placed the first one I could compare the others with it, I need a basis (…) if you would mention a patent at the beginning as a basis? (…) each person does his own calibration (…) it is decisive where you lay the first anchor point (…) maybe you can use the whole range of patents, also real bad ones
Opinions and judgements
D: you really need to have the right examples S: the very first question would be always difficult, difficult to know what is it really worth (…) the logarithmic scale is good in order to differentiate more easily (…) I personally would estimate all seven very high
Doubts and disagreement
D: it needs to be answerable within 1 or 2 minutes. And you are probably a person that can do this easier than others S: are seven questions enough? (…) these seven questions you hope will be answered differently from culture to culture? (…) do you really think someone chooses less than 5 thousand Euros?
Personal ideas and learning
I took out the pictures because most people that I showed they found them confusing (…) jpeg, mp3, ABS, SMS (…) you could also take a hypothetical patent. The patent for the air bag. Probably there are 50 different ones from different companies. But you could say "the" patent for the air bag (…) I could define some patents that do not exist, for example a new painkiller without any side effects (…) but actually, I don't need real ones (…) for example, this patent was sold for 1 million (…) to use this as an anchor (…) this would mean a certain calibration. But this is what I don't want, because I would like to capture different valuations

Answers to Q5 - directly related to “economic” items

“Economic” Item	**Lack of clarity**
"damper"	Y: (difficulties with English)
"bike helmet"	Y: (difficulties with English) P: I have some small problems because of the language
"variable lens"	J: well, I am not sure about this
"tintable glass"	Y: what does "tintable" mean?
"solar cells"	P: what are "polymers"?
“polio”	Y: (explaining "polio")
“painkiller”	Y: (explaining "painkiller" and "side-effects")
“Economic” Item	**Insecurity**
"damper"	B: you cannot imagine what is a "damper system" and so on S: it is difficult for me to judge what a "high value" is, 50 million or 500 million
"water purification"	W: I’m not that familiar with such industrial processes S: you need to think a bit (…) I would need more time to value this one
“solar cells”	S: you need to think a bit (…) I would need more time to value this one P: I am not an expert (...) regarding solar energy for example I think this is outside my competency
“painkiller”	W: here I’m still thinking about the “side-effects” that traditional painkillers may have
“Economic” Item	**Ideas and proposals**
"bike helmet"	S: I would relativize it. I would say bike helmet is not for many people, it doesn't look nice, so I would conclude that it is less worth than the first

"water purification"	S: what are really the use cases for these patents? If you don't know where these can be used exactly, how many people will use them
“solar cells”	S: what are really the use cases for these patents? If you don't know where these can be used exactly, how many people will use them
“polio”	F: maybe it is a question related to a rejection of patentability, a question of life and death Y: you would take into consideration that the market is small
“Economic” Item	**Opinions and judgements**
"damper"	B: cannot imagine what is a "damper system" D: easy to understand (...) it is cool, but nobody really needs it (...) people who have e.g. a MBA, or work for McKinsey, they could estimate how many people in Germany have kitchen furniture (... suitable?) yes (...) I would immediately start to calculate F: good (...) very clear H: this one does not make sense; it is very cultural, very German. It is very small (...) in Spain and Portugal this makes no sense (...) with my cultural background and the country where I live I say this one has absolutely no value J: this is of high value, and it's clear that it's patented, definitely yes (it is understandable and suitable?) Yes, absolutely (…) understandable (…) really good L: I am IKEA, I have enormous capacities, I can produce as many as I can sell, I would not sell this patent, I would mark here 500 million, why, I would be the only one who owns this technology and I have an advantage that my competitors do not have (...) well described, I understood them, it's relatively short and concise, that's ok (...) this is easy, everybody understands it W: very clear U: I could understand them and I could measure S: clear, everybody knows what it is, most probably a very high value R: ok, I can well imagine. I would also dare to mark it with a cross P: good
"bike helmet"	D: the bike helmet is good (...) good understandable (... suitable?) yes H: this one also has no value J: that's also something valuable (…) understandable (…) really good L: well described, I understood them, it's relatively short and concise, that's ok Y: it is in principle good, so I would (be able to) decide W: very clear (...) nice to have U: I could understand them and I could measure R: very good understandable P: good
"variable lens"	D: the lens is anyhow very good (...) good understandable (... suitable?) yes F: I understand less (...) I don't understand (...) it says nothing to me H: could be very interesting, it has a very versatile application (...) this has an universal value J: understandable (…) really good L: well described, I understood them, it's relatively short and concise, that's ok (...) if you read (this) some people will get crazy W: very clear

	U: I could understand them and I could measure R: understandable P: good
"tintable glass"	D: (suitable?) yes F: I understood only at second read H: this one is good, I like it, it should have a good value J: understandable (…) really good L: well described, I understood them, it's relatively short and concise, that's ok Y: that is 500k (...) I have some doubt whether it is watertight W: very clear U: I could understand them and I could measure R: ok P: yes, also (good)
"self-healing cement"	D: the cement tells me very little (...) understandable H: from ecological perspective this is very bad (...) or probably genetically modified bacteria, and how will the bacteria live, I don't believe in this patent U: suitable
"new class of polymers"	D: understandable H: this is interesting, yes, interesting, good, it's like wall paint, this is a good one
"water purification"	D: is impacted by your idealism. You could say that this is important for the third world that it is cheap available. There shouldn't be any patent, people are dying (...) understandable (...) this one is vitally important for 3 billion people (...) I would say the inventor should make the patent available free-of-charge H: this one is great J: very good (…) understandable (…) I don't think (it is) problematic, water, it is for industrial scale L: ok Y: if this patent would be watertight, then 5M to 50M (understandable?) yes W: to me this would be a little more difficult to estimate than the others since I'm not that familiar with such industrial processes S: you need to think a bit. What are really the use cases, I would need more time R: understandable P: ok
"QR code"	D: very good (...) understandable H: this one is nice (...) I like this one
"solar cells"	F: very clear J: very good (…) understandable (…) I don't think (it is) problematic L: ok Y: you could say 50 million W: very clear S: you need to think a bit. What are really the use cases, I would need more time R: understandable
"polio"	F: a bit crude, because who cares about 1500 cases in India and Nigeria? (...) I would not take J: very good (…) understandable (…) I see

	the humanitarian aspect covered by charity, by taxes and by governments et cetera (…) (this is) problematic (…) where people are directly affected they demand a certain protection, imagine you have a medicament without any patent then you could put anything into it (…) how do I make sure that this medicament is really effective L: ok Y: I would be able to estimate (...) it is not much and does not concern industrialized countries W: very clear
“painkiller”	J: very good (…) understandable(…) (this is) problematic (…) where people are directly affected they demand a certain protection, imagine you have a medicament without any patent then you could put anything into it (…) how do I make sure that this medicament is really effective L: ok Y: that is 500 million worth, yes 500 million W: to me, this one is a little more abstract than the previous ones. The benefit of all previous ones was quite clear, but here I’m still thinking about the “side effects” that traditional painkillers may have S: would be used by everyone R: ok
“Economic” Item	**Doubts and disagreement**
“solar cells”	P: how would that work? (...) I cannot imagine how it works, the others I can imagine how it works, but this how should it work?
“Economic” Item	**Experience and information**
"damper"	U: this one I remember, they earned a lot of money for it, it is a small company
"water purification"	H: I have a colleague who works with aquaporins
“Economic” Item	**Personal ideas and learning**
"damper"	maybe I need to translate these into German for the interviews (…) I am even more convinced that this question makes sense, then the Portuguese sample gives little value to it and the Germans more (…) maybe I should simplify the language, well some parts can be described more simple
"tintable glass"	trying to explain the patent "tintable"- I recognise it is not 100% clear to me
"new class of polymers"	I now recognise that it is too much text
“polio”	and then different things are mixing up and someone would consider this a really important patent but values it very low because he thinks it just should not be patentable

Question 6: Any other thoughts or ideas on the topic? Suggestions?

Experience and information
D: Phillips got 20 years really a lot of money for their patent on Compact Discs and even the share price dropped when the patent ended (…) in the EU there is also a commissioner for that, e.g. copyrights on books (…) it's the Fraunhofer Institute that has this patents (…) a patent is actually regional F: here are often discussions whether something is innovative enough to be patented (…) exclamations like "life is not patentable" H: you cannot patent ideas, can you? It needs to be a material thing (…) you cannot patent communism L: Apple has bought a company a few years ago, specialised in the development of finger print sensors, and that is what they integrated into the iPhone, the competitors of Apple were not able in the last 2 years to offer a similar sensor on their smartphones, because Apple owns all patents (…) ARM is a company that develops processors, they don't have any production on their own, they don't produce chips, they don't make equipment, they just develop this core, the IP - the only thing they do is to sell the related patents, so if you want to produce an ARM processor you need to talk to them and you need to pay for it W: when I was at Company X the situation was different than in Siemens or Ericsson, they have all the patents, so they tried to stimulate all the engineers to file patents and they gave incentives for this, they supported with lawyers and so on, so you only needed an idea, you made some description and some graphs, that's all, it was very easy, and if was accepted you got a double salary or something like that (…) when in Company Y we filed many patents, 3 or 4, of course, we had no budget. Some lawyer friends told me, USA and Germany, no other country, and by help of an American lawyer, he made if for free and the idea was that if the company took off he would take a little share. So we decided to do some filings to be offensive, because we were so small so that our strategy needed to be offensive... so that in case that investors would be interested in us we would have some patents - only the number of patents is what counts, so if somebody asked us "how many patents do you have?" we would say "3 and another 3 under process" (…) his business model is exactly the defence of the patents they have - (…) it is to buy new handsets from X, from Y, from Z, have a look at them and "look, they are infringing our patents". First they write a friendly letter, they contest it and then take some lawyers. In many cases they reached settlements and in many cases they came to court, e.g. against X in USA and against Y in Europe and they gained a lot of money U: we many times discussed it with colleagues (…) telecommunications, it is 99.9 % companies that file the patents R: regarding cultural differences, I experienced today a situation ... where do you concentrate your reflection on? So the typical German engineer is concentrated on finding a solution, that's my opinion, less on marketing of the solution, and even less on the protection of intellectual property. He doesn't even think about this, he just wants to find a solution for a problem. We had today in our area some people who really did a great job, but which did not appear to the outside, because nobody does marketing for this, no self-marketing. I very often experience this with engineers, but to promote some ideas you need also marketing, otherwise you are just not recognized, not seen, even if you have good solutions

Beyond categories

Personal ideas and learning
maybe as a cultural achievement - similar to human rights or democracy (…) maybe there is already a certain sub-culture of patent examiners in the EPO, you as a group maybe think

differently about patents than, for example, Siemens engineers (…) I need to add, it is cultures in the sense of Hofstede - no distinction of sub-cultures, and no distinction whether a Frenchman is from Bretagne or Southern France (...) it might be that engineer see these questions differently than sociologists (…) or I ask voters of the Greens and the CSU - maybe a bigger difference than between Portugal and Finland (…) need to define culture - other variables need to be unchanged, e.g. only engineers in the telco industry (…) it is people like me and you who have to take the first decision whether this patent is worthwhile to file a patent... the first valuation comes from people like me and you

Appendix 3: Pre-questionnaire

PART 1

Please tick a box for each statement to indicate how much you agree or disagree.

1. It is fair that inventors can protect their inventions with patents						
disagree strongly			neither agree nor disagree			agree strongly
1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐

2. The patent system is overall beneficial for society						
disagree strongly			neither agree nor disagree			agree strongly
1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐

3. A well-functioning patent system is an important business factor						
disagree strongly			neither agree nor disagree			agree strongly
1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐

4. Government policy should encourage patent protection to promote innovation						
disagree strongly			neither agree nor disagree			agree strongly
1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐

5. Patent protection period should be extended (nowadays usually 20 years from filing)						
disagree strongly			neither agree nor disagree			agree strongly
1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐

6. Patent protection should be faster and cheaper than it is today, but without compromising quality

disagree strongly			neither agree nor disagree			agree strongly
1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐

7. In principle, software should be patentable as well (which is currently not the case in Europe)

disagree strongly			neither agree nor disagree			agree strongly
1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐

8. Genetically modified plants should be patentable under certain conditions

disagree strongly			neither agree nor disagree			agree strongly
1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐

9. Medical treatments developed from human stem cells should be patentable under certain conditions

disagree strongly			neither agree nor disagree			agree strongly
1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐

PART 2

Imagine your company possesses the following patents and one of your direct competitors would be interested in buying it from you - what is the smallest amount for which you would be willing to sell it (in €), assuming that the buyer would subsequently exercise its full patent rights?

1. Smart glass with electronically controllable opacity (level of transparency). This allows for control of light intensity that shines into buildings, which reduces energy consumption for air conditioning.							
less than 5,000 ☐	5,000 - 50,000 ☐	50,000 - 500,000 ☐	500,000 - 5 million ☐	5 million - 50 million ☐	50 million - 500 million ☐	more than 500 million ☐	I am not able to estimate ☐

2. Liquid Lens with a variable focal length that is controlled by electrical current. Its small size makes it suitable for consumer devices such as smartphone cameras.							
less than 5,000 ☐	5,000 - 50,000 ☐	50,000 - 500,000 ☐	500,000 - 5 million ☐	5 million - 50 million ☐	50 million - 500 million ☐	more than 500 million ☐	I am not able to estimate ☐

3. A new class of plastics (polymers) that is able to change its state from solid to mouldable (shapeable) and back, controlled by changes in temperature.							
less than 5,000 ☐	5,000 - 50,000 ☐	50,000 - 500,000 ☐	500,000 - 5 million ☐	5 million - 50 million ☐	50 million - 500 million ☐	more than 500 million ☐	I am not able to estimate ☐

4. Energy-efficient water purification. Water is filtered through membranes that comprise of layers with naturally occurring proteins (aquaporins). This low cost method supplies ultrapure water for the semiconductor and photovoltaic industries.							
less than 5,000 ☐	5,000 - 50,000 ☐	50,000 - 500,000 ☐	500,000 - 5 million ☐	5 million - 50 million ☐	50 million - 500 million ☐	more than 500 million ☐	I am not able to estimate ☐

5. Method that reduces power consumption for LTE (4G) signalling for download traffic. Mobile network operators reduce their energy costs and mobile devices save battery power.							
less than 5,000 ☐	5,000 - 50,000 ☐	50,000 - 500,000 ☐	500,000 - 5 million ☐	5 million - 50 million ☐	50 million - 500 million ☐	more than 500 million ☐	I am not able to estimate ☐

6. Coexistence of LTE (4G) and Wi-Fi in unlicensed spectrum. This method allows the usage of LTE equipment independent from mobile network operators, e.g. in the 5 GHz band.							
less than 5,000 ☐	5,000 - 50,000 ☐	50,000 - 500,000 ☐	500,000 - 5 million ☐	5 million - 50 million ☐	50 million - 500 million ☐	more than 500 million ☐	I am not able to estimate ☐

7. Lithium bromide battery. Rechargeable battery with a lithium bromide electrolyte that achieves a 20% higher energy density than common lithium batteries.							
less than 5,000 ☐	5,000 - 50,000 ☐	50,000 - 500,000 ☐	500,000 - 5 million ☐	5 million - 50 million ☐	50 million - 500 million ☐	more than 500 million ☐	I am not able to estimate ☐

8. Novel solid state drive (SSD) flash memory architecture that allows for an increase in reading/writing access speed by 30%.							
less than 5,000 ☐	5,000 - 50,000 ☐	50,000 - 500,000 ☐	500,000 - 5 million ☐	5 million - 50 million ☐	50 million - 500 million ☐	more than 500 million ☐	I am not able to estimate ☐

9. The QR code. Two-dimensional barcode consisting of black-and-white squares that became widely-used thanks to its simplicity, fast readability and error robustness. 							
less than 5,000 ☐	5,000 - 50,000 ☐	50,000 - 500,000 ☐	500,000 - 5 million ☐	5 million - 50 million ☐	50 million - 500 million ☐	more than 500 million ☐	I am not able to estimate ☐

10. Solar cells based on polymers. This new class of photoactive and conductive plastics (polymers) improves efficiency at significantly reduced costs. Moreover, its production is environmentally friendly.							
less than 5,000 ☐	5,000 - 50,000 ☐	50,000 - 500,000 ☐	500,000 - 5 million ☐	5 million - 50 million ☐	50 million - 500 million ☐	more than 500 million ☐	I am not able to estimate ☐

11. Painkiller without side-effects. New powerful pharmaceutical that relieves pain by utilising properties of a specific protein produced naturally in the human body.							
less than 5,000 ☐	5,000 - 50,000 ☐	50,000 - 500,000 ☐	500,000 - 5 million ☐	5 million - 50 million ☐	50 million - 500 million ☐	more than 500 million ☐	I am not able to estimate ☐

How long did it take you to answer the 20 questions above?

minutes

This questionnaire is

quite ok	somewhat difficult to answer	too difficult to answer
☐	☐	☐

THANK YOU VERY MUCH!!!

Appendix 4: Questionnaire - Cultural Influence on the Valuation of Patents

Please provide some personal information for statistical purpose:

professional experience years

thereof in telecommunications years

Please indicate your age group please choose...

gender please choose...

nationality please choose...

educational background please choose...

Please tick <u>one</u> box for each statement to indicate how much you agree or disagree.

PART 1

1. The patent system is overall beneficial for society						
strongly agree			neither agree nor disagree			strongly disagree
1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐

2. Government policy should encourage patent protection to promote innovation						
strongly agree			neither agree nor disagree			strongly disagree
1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐

3. Patent protection should be faster and cheaper than it is today (without compromising quality)						
strongly agree			neither agree nor disagree			strongly disagree
1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐

4. In principle, software should be patentable as well (which is currently not the case in Europe)						
strongly agree			neither agree nor disagree			strongly disagree
1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐

PART 2

Imagine your company possesses the following patents and one of your direct competitors would be interested in buying them from you – what is the smallest amount (in EURO) for which you would be willing to sell them, assuming that the buyer would subsequently exercise the full patent rights?

5. Smart glass with electronically controllable opacity (level of transparency). This allows for control of light intensity that shines into buildings, which reduces energy consumption for air conditioning.						
less than 320,000 ☐	320,000 – 1.6 million ☐	1.6 million – 8 million ☐	8 million – 40 million ☐	40 million – 200 million ☐	200 million – 1 billion ☐	more than 1 billion ☐

6. Energy-efficient water purification. Water is filtered through membranes that comprise of layers with naturally occurring proteins (aquaporins). This low cost method supplies ultrapure water for the semiconductor and photovoltaic industries.						
less than 320,000 ☐	320,000 – 1.6 million ☐	1.6 million – 8 million ☐	8 million – 40 million ☐	40 million – 200 million ☐	200 million – 1 billion ☐	more than 1 billion ☐

7. Method that reduces power consumption for LTE (4G) signalling for download traffic. Mobile network operators reduce their energy costs and mobile devices save battery power.						
less than 320,000 ☐	320,000 – 1.6 million ☐	1.6 million – 8 million ☐	8 million – 40 million ☐	40 million – 200 million ☐	200 million – 1 billion ☐	more than 1 billion ☐

8. Coexistence of LTE (4G) and Wi-Fi in unlicensed spectrum. This method allows the usage of LTE equipment independent from mobile network operators, e.g. in the 5 GHz band.						
less than 320,000 ☐	320,000 – 1.6 million ☐	1.6 million – 8 million ☐	8 million – 40 million ☐	40 million – 200 million ☐	200 million – 1 billion ☐	more than 1 billion ☐

9. Novel solid state drive (SSD) flash memory architecture that allows for an increase in reading/writing access speed by 30%.						
less than 320,000 ☐	320,000 – 1.6 million ☐	1.6 million – 8 million ☐	8 million – 40 million ☐	40 million – 200 million ☐	200 million – 1 billion ☐	more than 1 billion ☐

PART 3

10. I believe that orderliness and consistency should be stressed, even at the expense of experimentation and innovation.

strongly agree			neither agree nor disagree			strongly disagree
1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐

11. I believe that people who are successful should

plan ahead						take life events as they occur
1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐

12. I believe that the accepted norm in this society should be to

plan for the future						accept the status quo
1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐

13. I believe that a person's influence in this society should be based primarily on

one's ability and contribution to the society						the authority of one's position
1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐

14. I believe that in general, leaders should encourage group loyalty even if individual goals suffer.

strongly agree			neither agree nor disagree			strongly disagree
1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐

15. I believe that social gatherings should be

planned well in advance (2 or more weeks in advance)						spontaneous (planned less than an hour in advance)
1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐

16. In this society, children should take pride in the individual accomplishments of their parents.

strongly agree			neither agree nor disagree			strongly disagree
1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐

17. I believe that the economic system in this society should be designed to maximize

individual interests						collective interests
1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐

18. I believe that followers should

obey their leader without question						question their leader when in disagreement
1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐

19. I believe that a person who leads a structured life that has few unexpected events

has a lot to be thankful for						is missing a lot of excitement
1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐

20. I believe that societal requirements and instructions should be spelled out in detail so citizens know what they are expected to do.

strongly agree			neither agree nor disagree			strongly disagree
1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐

21. In this society, parents should take pride in the individual accomplishments of their children.

strongly agree			neither agree nor disagree			strongly disagree
1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐

22. I believe that society should have rules or laws to cover

almost all situations			some situations			very few situations
1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐

23. I believe that leaders in this society should

provide detailed plans concerning how to achieve goals						allow the people freedom in determining how best to achieve goals
1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐

24. I believe that people in positions of power should try to

increase their social distance from less powerful individuals						decrease their social distance from less powerful people
1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐

25. How important should it be to members of your society that your society is viewed positively by persons in other societies?

it should not be important at all			it should be moderately important			it should be very important
1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐

26. I believe that people should

live for the present						live for the future
1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐

27. When in disagreement with adults, young people should defer to elders.

strongly agree			neither agree nor disagree			strongly disagree
1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐

28. Members of this society should

take no pride in being a member of the society			take a moderate amount of pride in being a member of the society			take a great deal of pride in being a member of the society
1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐

29. I believe that power should be

concentrated at the top						shared throughout the organization
1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐

30. In this society, most people prefer to play

only individual sports			some individual and some team sports			only team sports
1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐

31. I believe that

group cohesion is better than individualism			group cohesion and individualism are equally valuable			individualism is better than group cohesion
1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐

Additional comments:

THANK YOU VERY MUCH FOR YOUR TIME!!!

Appendix 5: Results from statistical analysis of questionnaire data

ANOVA, means and variances for scales *Pat1* and *Pat2*

	Pat1		Pat2		
	Mean	**Variance**	**Mean**	**Variance**	**n**
ESP	5,75	0,73	4,15	1,24	22
FIN	5,48	1,43	4,41	0,72	21
FRA	5,93	1,26	4,04	1,64	22
GBR	5,05	1,11	4,53	0,77	23
GER	5,61	1,58	4,24	0,90	24
GRE	5,50	1,12	4,50	0,82	20
ITA	5,62	0,94	3,91	1,05	21
NED	5,28	1,29	3,75	1,18	20
POL	5,13	1,31	3,90	0,88	21
POR	5,35	1,77	3,77	0,83	21
ANOVA	F(9,205)=1.211 p=.290		F(9,205)=1.270 p=.255		215

Pearson's r for *Pat1* and *Pat2* and world development indicators 2013 (n = 10)

		IPpay	**IPrec**	**IPnet**	**PatA**	**GDP**	**HiTe**	**RD**
Pat1	Pearson's **r**	-,245	-,241	,161	,096	,224	,074	,200
	Sig. (2-tailed)	,496	,503	,656	,793	,533	,840	,580
Pat2	Pearson's **r**	-,395	-,253	,662*	,047	,180	-,355	,233
	Sig. (2-tailed)	,259	,481	,037	,897	,619	,314	,516

Spearman's ρ for *Pat1* and *Pat2* and world development indicators 2013 (n = 10)

		IPpay	**IPrec**	**IPnet**	**PatA**	**GDP**	**HiTe**	**RD**
Pat1	Spearman's **ρ**	-,285	-,115	,212	,030	,103	,176	,152
	Sig. (2-tailed)	,425	,751	,556	,934	,777	,627	,676
Pat2	Spearman's **ρ**	-,055	,115	,830**	,042	,103	-,164	,176
	Sig. (2-tailed)	,881	,751	,003	,907	,777	,651	,627

Pearson's r and Spearman's ρ for *Pat2* and *IPnet* for a reduced country sample (without Finland and the Netherlands, n = 8)

		IPnet
Pat2	Pearson's **r**	,660
	Sig. (2-tailed)	,075
Pat2	Spearman's **ρ**	,810*
	Sig. (2-tailed)	,015

Linear Regression Analysis for *Pat2* and *IPnet* for a reduced country sample (without Finland and the Netherlands, n = 8)

		Unstandardized Coefficients		Standardized Coefficients		
Predictors: (Constant), IPnet		B	Std. Error	Beta	t	Sig.
Dependent Variable: Pat2	**(Constant)**	4,131	0,080		51,421	0,000
	IPnet	0,003	0,002	0,660	2,150	0,075

Spearman's ρ on individual level of analysis for samples GBR, FRA and NED

			Pat1	Pat2	UnAv	FutO	PowD	Col1	Col2
GBR (n = 23)	Pat1	Spearman's ρ	1,000	0,176	-0,190	-0,196	-0,023	0,209	-0,234
		Sig. (2-tailed)		0,422	0,385	0,370	0,918	0,338	0,282
	Pat2	Spearman's ρ	0,176	1,000	0,042	0,010	-0,273	,650**	0,036
		Sig. (2-tailed)	0,422		0,849	0,966	0,207	0,001	0,870
	UnAv	Spearman's ρ	-0,190	0,042	1,000	,615**	,476*	0,119	0,302
		Sig. (2-tailed)	0,385	0,849		0,002	0,022	0,589	0,161
	FutO	Spearman's ρ	-0,196	0,010	,615**	1,000	0,082	-0,027	0,112
		Sig. (2-tailed)	0,370	0,966	0,002		0,710	0,904	0,609
	PowD	Spearman's ρ	-0,023	-0,273	,476*	0,082	1,000	-0,084	-0,016
		Sig. (2-tailed)	0,918	0,207	0,022	0,710		0,704	0,942
	Col1	Spearman's ρ	0,209	,650**	0,119	-0,027	-0,084	1,000	0,257
		Sig. (2-tailed)	0,338	0,001	0,589	0,904	0,704		0,237
	Col2	Spearman's ρ	-0,234	0,036	0,302	0,112	-0,016	0,257	1,000
		Sig. (2-tailed)	0,282	0,870	0,161	0,609	0,942	0,237	
			Pat1	**Pat2**	**UnAv**	**FutO**	**PowD**	**Col1**	**Col2**
FRA (n = 22)	Pat1	Spearman's ρ	1,000	-0,159	-0,166	-0,169	-0,009	-0,352	,429*
		Sig. (2-tailed)		0,479	0,461	0,452	0,967	0,108	0,046
	Pat2	Spearman's ρ	-0,159	1,000	-0,082	-0,094	0,161	-0,126	-0,085
		Sig. (2-tailed)	0,479		0,716	0,676	0,473	0,578	0,707
	UnAv	Spearman's ρ	-0,166	-0,082	1,000	-0,105	0,235	0,152	0,098
		Sig. (2-tailed)	0,461	0,716		0,643	0,292	0,500	0,663
	FutO	Spearman's ρ	-0,169	-0,094	-0,105	1,000	-,449*	0,283	-0,029
		Sig. (2-tailed)	0,452	0,676	0,643		0,036	0,202	0,898
	PowD	Spearman's ρ	-0,009	0,161	0,235	-,449*	1,000	-0,085	-0,237
		Sig. (2-tailed)	0,967	0,473	0,292	0,036		0,707	0,289
	Col1	Spearman's ρ	-0,352	-0,126	0,152	0,283	-0,085	1,000	-0,122
		Sig. (2-tailed)	0,108	0,578	0,500	0,202	0,707		0,589
	Col2	Spearman's ρ	,429*	-0,085	0,098	-0,029	-0,237	-0,122	1,000
		Sig. (2-tailed)	0,046	0,707	0,663	0,898	0,289	0,589	
			Pat1	**Pat2**	**UnAv**	**FutO**	**PowD**	**Col1**	**Col2**
NED (n = 20)	Pat1	Spearman's ρ	1,000	0,413	-0,250	0,225	0,067	0,074	0,424
		Sig. (2-tailed)		0,071	0,287	0,339	0,779	0,756	0,063
	Pat2	Spearman's ρ	0,413	1,000	0,029	0,380	0,073	0,306	0,291
		Sig. (2-tailed)	0,071		0,904	0,098	0,761	0,189	0,214
	UnAv	Spearman's ρ	-0,250	0,029	1,000	0,434	0,323	0,172	-0,168
		Sig. (2-tailed)	0,287	0,904		0,056	0,165	0,468	0,478
	FutO	Spearman's ρ	0,225	0,380	0,434	1,000	0,393	,660**	-0,139
		Sig. (2-tailed)	0,339	0,098	0,056		0,086	0,002	0,559
	PowD	Spearman's ρ	0,067	0,073	0,323	0,393	1,000	0,314	-0,289
		Sig. (2-tailed)	0,779	0,761	0,165	0,086		0,177	0,217
	Col1	Spearman's ρ	0,074	0,306	0,172	,660**	0,314	1,000	-0,112
		Sig. (2-tailed)	0,756	0,189	0,468	0,002	0,177		0,637
	Col2	Spearman's ρ	0,424	0,291	-0,168	-0,139	-0,289	-0,112	1,000
		Sig. (2-tailed)	0,063	0,214	0,478	0,559	0,217	0,637	

* Correlation is significant at the 0.05 level (2-tailed)

** Correlation is significant at the 0.01 level (2-tailed)

Predictors: (Constant), UnAv		Unstandardized Coefficients		Standardized Coefficients							
		B	Std. Error	Beta	t	Sig.	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
Dependent Variable: Pat1	**(Constant)**	3,806	0,961		3,962	0,004	0,524	0,274	0,183	0,24758	2,401
	UnAv	0,407	0,234	0,524	1,738	0,120					
Predictors: (Constant), Col1		Unstandardized Coefficients		Standardized Coefficients							
		B	Std. Error	Beta	t	Sig.	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
Dependent Variable: Pat1	**(Constant)**	3,321	0,862		3,854	0,005	0,663	0,439	0,369	0,21764	2,205
	Col1	0,469	0,188	0,663	2,503	0,037					
Predictors: (Constant), Item26		Unstandardized Coefficients		Standardized Coefficients							
		B	Std. Error	Beta	t	Sig.	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
Dependent Variable: Pat2	**(Constant)**	6,061	1,093		5,543	0,001	0,533	0,284	0,194	0,26260	2,137
	Item26	-0,484	0,272	-0,533	-1,780	0,113					
Predictors: (Constant), IPnet		Unstandardized Coefficients		Standardized Coefficients							
		B	Std. Error	Beta	t	Sig.	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
Dependent Variable: Pat2	**(Constant)**	4,130	0,074		56,088	0,000	0,662	0,439	0,368	0,23247	1,924
	IPnet	0,001	0,000	0,662	2,499	0,037					
Predictors: (Constant), Item26		Unstandardized Coefficients		Standardized Coefficients							
		B	Std. Error	Beta	t	Sig.	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
Dependent Variable: MPV	**(Constant)**	655,944	250,652		2,617	0,031	0,574	0,329	0,245	60,19850	2,444
	Item26	-123,522	62,357	-0,574	-1,981	0,083					
Predictors: (Constant), IPnet		Unstandardized Coefficients		Standardized Coefficients							
		B	Std. Error	Beta	t	Sig.	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
Dependent Variable: MPV	**(Constant)**	163,080	17,482		9,328	0,000	0,66	0,436	0,365	55,21089	2,394
	IPnet	0,238	0,096	0,660	2,485	0,038					

Predictors: (Constant), FutO, Col1, UnAv		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics		R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
		B	Std. Error	Beta			Tolerance	VIF					
Dependent Variable: Pat1	(Constant)	5,301	2,029		2,613	0,040			0,736	0,542	0,313	0,22715	2,032
	Col1	0,348	0,297	0,492	1,175	0,284	0,436	2,296					
	UnAv	0,449	0,464	0,578	0,969	0,370	0,215	4,653					
	FutO	-0,682	0,597	-0,527	-1,142	0,297	0,358	2,790					

Predictors: (Constant), Col1, UnAv		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics		R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
		B	Std. Error	Beta			Tolerance	VIF					
Dependent Variable: Pat1	(Constant)	3,257	0,977		3,335	0,013			0,665	0,442	0,283	0,23205	2,285
	Col1	0,428	0,295	0,604	1,451	0,190	0,461	2,171					
	UnAv	0,062	0,323	0,080	0,193	0,852	0,461	2,171					

Predictors: (Constant), IPnet, Item26		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics		R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
		B	Std. Error	Beta			Tolerance	VIF					
Dependent Variable: Pat2	(Constant)	5,205	1,080		4,819	0,002			0,713	0,509	0,368	0,23253	1,963
	IPnet	0,001	0,000	0,530	1,789	0,117	0,800	1,250					
	Item26	-0,269	0,269	-0,296	-0,998	0,352	0,800	1,250					

Predictors: (Constant), IPnet, Item26		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics		R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
		B	Std. Error	Beta			Tolerance	VIF					
Dependent Variable: MPV	(Constant)	462,981	249,476		1,856	0,106			0,73	0,533	0,399	53,71479	2,207
	IPnet	0,182	0,104	0,504	1,746	0,124	0,800	1,250					
	Item26	-74,956	62,208	-0,348	-1,205	0,267	0,800	1,250					

Quantitative impact of *IPnet* on *MPV* for sample countries

	IPnet [US$]	MPV [m €]	Impact*
ESP	-24,2	157,32	-2,20%
FIN	345,95	245,42	52,56%
FRA	21,32	168,15	4,53%
GBR	102,55	187,49	16,55%
GER	58,15	176,92	9,98%
GRE	-24,24	157,31	-2,21%
ITA	-27,8	156,46	-2,74%
NED	-436,54	59,18	-63,21%
POL	-62,62	148,18	-7,89%
POR	-45,44	152,27	-5,35%

*The impact of *IPnet* on *MPV* relates to the average of *MPV* of all ten sample countries (160.87 m €).

Quantitative impact of *IPnet* on *MPV* for further 21 EPO member countries

	IPnet [US$]	MPV [m €]	Impact*
Austria	-79,67	144,12	-13,43%
Belgium	0,74	163,26	-1,94%
Bulgaria	-23,56	157,47	-5,41%
Croatia	-60,37	148,71	-10,67%
Czech Republic	-73,39	145,61	-12,54%
Denmark	125,61	192,97	15,91%
Estonia	-30,02	155,94	-6,34%
Hungary	34,82	171,37	2,93%
Iceland	42,04	173,09	3,97%
Kosovo	-1,35	162,76	-2,24%
Latvia	-17,86	158,83	-4,60%
Lithuania	-6,30	161,58	-2,95%
Macedonia, FYR	-15,65	159,36	-4,28%
Malta	-397,10	68,57	-58,81%
Norway	-71,71	146,01	-12,30%
Romania	-37,24	154,22	-7,37%
Serbia	-24,68	157,21	-5,57%
Slovak Republic	-100,74	139,10	-16,45%
Slovenia	-95,48	140,36	-15,69%
Sweden	522,07	287,33	72,59%
Switzerland	846,00	364,43	118,90%

* The impact of *IPnet* on *MPV* relates to the average of *MPV* of all 31 EPO member countries included in both tables above (166.48 m €).

Future Orientation scales *FutO*, *FutO'* and *Item26*

	FutO	FutO'	Item26
ESP	4,68	4,98	3,77
FIN	4,62	4,90	3,76
FRA	4,93	5,32	3,77
GBR	4,60	4,81	3,96
GER	4,61	4,93	3,67
GRE	5,08	5,45	3,95
ITA	4,92	5,21	4,05
NED	4,46	4,55	4,20
POL	5,02	5,11	4,76
POR	4,90	5,14	4,19

Comparison of GLOBE (House et al., 2004) and Hofstede (2016) scores for selected scales

	GLOBE Values				GLOBE Practices			Hofstede		
	UnAv	FutO	Col1	Item26*	UnAv	FutO	Col1	UAI	LTO	IDV
ESP	4,76	5,63	5,20	4,86	3,97	3,51	3,85	86	48	51
FIN	3,85	5,07	4,11	4,26	5,02	4,24	4,63	59	38	63
FRA	4,26	4,96	4,86	4,25	4,43	3,48	3,93	86	63	71
GBR [1]	4,11	5,06	4,31	3,90	4,65	4,28	4,27	35	51	89
GER [2]	3,32	4,85	4,82	4,40	5,22	4,27	3,79	65	83	67
GRE	5,09	5,19	5,40	4,42	3,39	3,40	3,25	100	45	35
ITA	4,47	5,91	5,13	5,01	3,79	3,25	3,68	75	61	76
NED	3,24	5,07	4,55	4,63	4,70	4,61	4,46	53	67	80
POL	4,71	5,20	4,22	5,21	3,62	3,11	4,53	93	38	60
POR	4,43	5,43	5,30	4,47	3,91	3,71	3,92	99	28	27

[1] England (GLOBE) and Great Britain (Hofstede)

[2] West-Germany (GLOBE) and Germany (Hofstede)

* GLOBE data for *Item26* kindly made available by Prof. Paul Hanges

Appendix 6: Categorised Questionnaire Comments

The following table lists all coded data, whereas "dross" has been excluded. It is sorted by categories and countries:

1. Topic is interesting
GRE: …an interesting topic, the questions had me thinking a lot how different cultures will perceive them. (…) if possible of course and you do not mind, please share the results, it would like really interesting to see the difference between the south and the north. GRE: I have to admit that I haven't had spent so far time to think about patents and society, but it was a nice trigger to do so from now on. GRE: Interesting topic! POR: Some of the questions are really interesting and honestly I have never thought seriously about them. GBR: A very interesting subject. GBR: …the survey was an interesting exercise (…) I'd be interested to know what patterns you eventually observe when the study completes (…) But then, that becomes is an interesting experiment in itself. If your study does show trends of any sort with a sample size of 20, it would be evidence of quite a strong mechanism to concentrate opinion. ESP: …they are really interesting, you made me think about society and how our kids should grow up (I have 2 young ones). ITA: Very interesting questionnaire. ITA: Very interesting task. FRA: Interesting initiative. FRA: …interesting patent questionnaire, especially the second part. FRA: …it seems really interesting. FRA: …interesting questionnaire. This questionnaire made me thinking twice. I really appreciate it (…) Just based on your Questionnaire content, I fell a promising doctorate thesis, I would be interested to read once published. POL: Interesting and challenging questions. POL: Interesting subject, would be great to have an opportunity to read your doctorate thesis in the future once completed. NED: Interesting questions.
2. Positive opinion about patents
POR: …on the other hand I think that patents create bandwidth to capture investors and thus finance the execution of more complex projects that otherwise would not come to existence. GBR: …strong protection is necessary to allow innovation. GER: Patents provide competitive advantages for companies if they are protected and respected by the competition. Also innovation can be fostered by this. FRA: I am strongly for the enforcement of patent protection. FRA: Regarding patents, I think it is very important especially for worldwide potential addressable markets. FRA: But R&D and innovation must remain profitable… NED: Patents encourage innovation, as it takes quite some effort to get those, they should be protected well.
3. Negative opinion about patents
POR: On one hand I believe in free circulation and sharing of ideas and projects… GER: However, resources are wasted as well, if several companies or countries do research

and development rather against each other than together. FRA: …between Samsung and Apple the judgment of courts involves very high amount of money which looks to me completely unreasonable for one single feature (…) Some companies live only with patent portfolio, is it fair for competitors? POL: …many times I see that many companies which are in more power than other are pushing for some solution only because they are IPR driven and not always a better solution. In my opinion the whole patent system should be revised in order to let people be innovative and because of that getting more funds for further research and less company driven and patent chasing. POL: …it is against me to answer it. In the current moment of my life I am more against patents. I think it stops society to be innovative, because you cannot use someone else invention freely to develop some new solution unless you pay, additionally it may lead to abusing others by placing very high prices for some invention, especially in the medical market it can be irritating the most. (…) our society now is just aiming in getting richer and richer, what makes patenting necessary, but I think often patenting can lead to abusing and manipulation.
4. No patent expert – no response
POR: …you should try to find somebody who is really more inside this topic. GER: I do not know what to do with some of the questions (part 2). I am too far away from technology. ITA: …exception of economical part for which I do not have proper knowledge and experience to do. FRA: I'm not sure I can help on this one. FRA: I have no competence to estimate IP right costs for the different examples you gave; so I prefer to decline your offer. FRA: I have no clue about value of patents/features. FRA: Sorry, patents are not really my expertise. FRA: … far more experience in this area than me. NED: I have no knowledge of the subject. NED: I have little to no experience with patents so perhaps better if you try to find people who do have.
5. No patent expert, but response
GRE: Note that I am not an expert in patents, so my answers - especially the ones related to the value of specific patents - were roughly estimated. POR: … not aware of patent politics. POR: I am personally not a patents expert. ESP: I have not been able to answer any question on patents, as I really unknown the process and the value of those, so I have no opinion on the topic. ESP: I have no idea about patents and figures. GER: I have never worked with patents with regards to content and have never applied for any. GER: I can only guess related to the patent questions. I don't know what the value of a patent is for a company. GER: I have no idea for how much Euro a patent would sell, because I do not work in that area. ITA: I am not an expert in patents, so the answers relevant to the patent values are really a rough estimation. FRA: I don't have valuable competences and knowledge about patents to answer at your questions. FRA: I have no idea about the amounts related to the patents listed. FRA: I do not know so much about the valuation of patents.

FRA: I am not a patent specialist.
POL: I do not have the sufficient knowledge how to price the patent rights.
POL: My knowledge about the patent values is minimal.
NED: I do not have experience with patent value and sales price.
NED: I have no experience with patents.
NED: …my area of expertise resides around the process & IT angle inside Nokia and not so much in the technical solutions of the products we sell.
NED: I'm afraid I don't have the knowledge in these areas.

6. Not typical for own country

FIN: Attached my answers. They may be untypical for Finland.
FIN: I'm most probably not the typical Finn, due to a life almost 40% of my 28 years carrier out of Finland (UK, Germany, Canada).
FRA: …as a truly global individual I have to say that I cannot be put in any local cultural "drawer". I have been living 25 years abroad and people in Asia remarked that I don't behave like a European. So I don't want to disturb your study with my own input as I don't count myself as typical French.
POL: I've spent the greater part of my professional career abroad.

7. Patent questions judged difficult

FIN: …to value the patents really is difficult as such. You can always question whether a shared profit would be useful as part of selling or to allow use of patents.
FIN: The quantification in Part two was a bit difficult.
FIN: …monetary valuation of patents is extremely challenging (sum of several attributes/conditions…).
FIN: Difficult to give an estimate on patent grant sizing.
FIN: …part 2 with payments size is very difficult to evaluate.
POR: Part 2 requires more information in order to be answered exactly!
GBR: I did not have sufficient information to properly answer part 2.
GBR: Part 2 was really a guess as I would imagine there are lots of factors that could come into play.
GBR: I couldn't really answer the patent rights question as it would depend upon the likely or forecasted gains from being able to utilise the right.
ESP: For me it was difficult to fill the patents part, regarding the cost value.
GER: It was very hard for me to answer Part 2 because some background information (…) was missing.
FRA: Re patent prices, this is very hard to assess without knowing the value people could extract from these patents.
POL: …it was hard to assess those amounts in a credible way as I am not fully aware of the exact sums that are paid for IPRs.
POL: I'm unable to answer those questions w/o business case investigation of all cases.
POL: …was very tough for me.
POL: I could not respond two questions in Part 2 – there is not enough information offered to assess patent's value.

8. Relative patent values

FIN: I was more thinking of the relative perceived value between the innovations, rather than the absolute value.
ESP: …so I took the election of doing it by importance. I mean, the higher price means more important than lower price.
ESP: I could only make a comparison among them.
NED: …based on my feeling and relative value against each other.
NED: Scoring should be read seen as relative to each other rather than absolute.

9. Culture questions judged difficult
POR: …some of the questions are open to several interpretations, leading to possible misunderstandings or different answers. GER: Some questions here are difficult to answer, because to me they appear to be false alternatives or ambiguous alternatives (not completely specified enough). GER: The questions are not that easy. GER: In part 3 some of the questions are difficult as well. For example, “When in disagreement with adults, young people should defer to elders”. This depends heavily on the arguments. (…) Another question, e.g. “Members of society should take a great deal of pride in being a member of the society”. POL: I think some answers may vary depending on family status (married/single, children etc.) like having children forces one to plan ahead. And looking for some stabilisation rather than for excitement. POL: For many I couldn’t find the correct answer. Why? There is no simply answers like yes, no for many social questions. The correct answer is yes/no it depends on several conditions.
10. Ideas and Suggestions
FIN: …patent valuation is highly dependent of surrounding attributes (biz case, number of alternatives, dependency on other topics, counterpart, monetization potential, investment need, timelines…). POR: The correct answer would be to sell the patent in line with the expected profit in case that our company would develop the technology. POR: The questions related to the quantification of patents depend obviously on the expected business volume. I valued the items based on my perception how new/innovative they are. GBR: How broad are the claims, and how difficult would it be to derive a different mechanism to achieve the same result? Particularly with regard to the LTE patents, it is often required that patents that are essential to a global specification are offered on Fair, Reasonable, and Non-Discriminatory (FRAND) terms. It's very difficult to assess the worth of the patents without knowing whether they are essential to the spec, and what the mandatory terms for licensing them are. I've assumed that they're standard-essential, moderately hard to work around, and I've allowed for the pace of change in the tech sector - essentially, my valuation is how much I think you could make from the invention over the lifetime of its value. ESP: …it depends on the investment in developing the R&D. ESP: …the value I think they can have from a business point of view. ESP: I think it is more intuitive to express this as a percentage on turnover, or else on benefits; and it is important for the seller whether he has an interest in the market himself, whether he would keep rights to produce, etc. GER: …how much the company invested for the patent. GER: development costs plus business risks need to be honoured by an appropriate profit. FRA: Can the marginal price remain the same whatever amount of license has already been sold and whatever patent’s age? I would say no. POL: …made invention has invested time and effort, which should be gratified. NED: I think the market makes the price, e.g. via (e)auction.
11. Moral and philosophical views
GBR: Balance is required in society to ensure that society as an organism can survive. As our environment changes our approach needs to change/adapt. In some cases Strong leadership is required, concentrating power with a few, and at others power needs to be distributed more evenly. Patent Law & Management needs to reflect this to be successful. As a society we still haven't found a mechanism to evaluate the benefit to society of a patent and as such we possibly are in the situation where technologies and ides that can contribute significantly to the overall health of society are being held back by capitalism (only available for those that

have the resources) so the benefit to our collective society is lost, and our progress is slowed.
GBR: If individualism and group cohesion are in conflict, leadership is getting it wrong. The job of the leader is to provide a vision that the group self-organises to deliver. Anything else, and you lose out on the resourcefulness and intelligence that separates a human from a robot. Given the rapid advances in machine learning, it's critical that we remain aware of and maximise this distinction (…) I am a very strong adherent of the British philosophy of law, which (according to my limited understanding) holds that there is a common understanding of what is right, and it is the job of the system of law to discover and represent that - and that it is a fluid thing which can change. So I am strongly in favour of a strong system of law, but strongly against writing it all down in advance. Originally, patents were about giving innovators a chance to benefit from their inventions, but globalisation has changed the way things work. Any new product is immediately on a global stage. It will immediately (as soon as it is successful enough to be noticed) be subjected to reverse engineering, and copied if feasible and realistic to do so - by large organisations that can bring significant legal force to bear. So it is not realistic for small entities to defend their inventions. However, globalisation has also created the necessity for strong global standards, collaborated on by major global organisations - and it is to the benefit of all parties that these standards are innovative as possible. But organisations providing inventive solutions to these standards need an incentive for a return on investment, without being incentivised to cripple the system for their own benefit. FRAND is a reasonable solution to this: it gives companies a reason to invest, and a decent return, without making the cost of using new solutions so high that everyone is forced to cut their own path. Patents do a reasonable job of enabling this system, but it could probably be tuned to work better. (…) Probably what the patent system needs is a better way to manage licensing costs. Is it to the benefit of society that only Ford cars can have heated windscreens? There needs to be a way to force Ford to license the patent to their competitors at a rate that lets all purchasers of cars enjoy the benefit of Ford's creativity, at the same time as allowing Ford to obtain a good and fair return on investment for the work they put in to the invention.
ESP: …nowadays of crisis and attacks, I strongly believe that whole Europe should take a more firm position joining in favour of human rights and values (world around), because it is the world area that more clearly evolved to support and practice these aspects… but if we don't join enough, we are seeing that other people or areas can be still extremely confused.
GER: …it makes my stomach turn to see the greed for profit of some companies. Also, the money that CEOs or football players et cetera earn today is in my view completely inadequate.
GER: We don't have blind loyalty and what is the consequence of absolute respect towards elder people? (like in China – reason for the massacre on the Square of Heavenly Peace was reportedly missing respect towards older people). (…) As a young man I would have said: I don't care about society – now, over 60 I think that we can be proud that the Germans changed a lot during the last 70 years and many want to protect peace, … even though the same people who came as refugees from Sudetenland or from elsewhere, do now criticise refugees as Pegida.
FRA: …to speed up our survival regarding climate change due to our energy production pollution, as per Elon Musk sample for Tesla, I would encourage the sharing of patent which can contribute to reduce energy consumption, keeping a price to get a relative benefit to encourage private company to follow investment on it. Social is possible if individual objectives are firstly satisfied in reasonable proportion. I am for merit society based.
FRA: …since lead to interrogate myself in essential concerns for our future, taken into account, current world turns with human survival challenges.
FRA: I believe that the most important in life is to act in line with his own values and to find a correct balance between individual and collective objectives. Of course, you should be in line

with the company's values because you spend most of your time to work for the company.
POL: our society now is just aiming in getting richer and richer, what makes patenting necessary, but I think often patenting can lead to abusing and manipulation, and also when thinking about far future - thousands years ahead may lead to human and earth degradation.

12. Miscellaneous

GRE: I was very neutral in the approach.
FIN: BTW in Finland one is in principle entitled to "fair" compensation even for patents you make for your employee (…) employers may have different opinion about what is "fair" than individuals.
GBR: …since the questions related to mobile innovation are too close to Nokia business I left these unanswered.
GBR: …why are the patents being sold, rather than licensed? (…) Finally, there's areas such as drug research, where the cost of deriving a new viable product is vast, copying it is easy.
GBR: I prefer not to participate in this.
GBR: I am always very cautious, how did you get my name?
GBR: I would respectfully like to decline your invitation. These questions relate to my personal opinions, which I wish to keep to myself. They are strongly held and may be in conflict with the company's perceived values.
ESP: I do not know if 1 billion is too high or too low.
ESP: I do not know how reasonable those values are.
ESP: I guess that your questionnaire will reflect how the different European countries see certain social values or positions.
ESP: I have experienced it as a quite confusing questionnaire (...) I was also unable to give absolute numbers on how much someone should pay to own a patent. (…) As a matter of cultural bias when dealing with patent applications, I think there certainly is one, which in practical terms will impact the application of e.g. article 56 on inventive step. There is indeed such a thing as software patents; we call it computer implemented inventions, CII. If you want to find differences between both, good luck, let me know! There are books explaining how to obtain patents from the EPO on software, as CII, of course.
GER: I have often chosen the middle box.
GER: …to my information SW and SW methods or procedures are patentable in Europe. (…) to 8 – isn't that already existing? Smart phones and tablet/notebooks currently are using this.
GER: What exactly is meant with "valuation"? Patentability, financial value (like in the examples), ethical/moral, technical, extent of innovation, et cetera?
GER: For me the questionnaire sounds more like sociology.
GER: For questionnaires I normally do not give extreme answers.
ITA: It was quite difficult to understand the logical sequence of questions and reason for these questions.
ITA: I need a disclaimer from Internal Communication that is saying that the questionnaire is ok before to send it back to you.
FRA: …some non-European players are not fairly dealing with intellectual property, as per seen on Telecom Industry.
FRA: I did not answer to questions in part two since reading the question I understand the patent is belonging to my company so I do not see myself questioning even the idea of selling the patent.
FRA: …on which criteria you have chosen to send me your email?
FRA: …very complex to answer.
FRA: I would compare it with music business.
POL: I am not sure how would be the best way to reward them, before regulating patents in XIX, mathematicians, physicians did patent everything
POL: I've spent most of my professional career in Nokia hence my views might be distant

from the open market opinions.
NED: I have no idea for which price I want to sell patents.
NED: I couldn't comment on the patent evaluation as it was not clear if selling the patent would mean losing all rights to the patent. In these cases as a business using the patent I would never sell the patent to the competitor but grant the use of the patent for a reasonable amount.
NED: I am really sorry but cannot answer most of the questions, frankly speaking. I just don’t know the answers.
NED: …some questions that mean very little to me.