

**Are Humanities Forever the Bridesmaid to STEM's Bride?  
- Outcomes of the Finnish Research Funding Model 2013-  
2016 for the Humanities and STEM Fields**

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## **ABSTRACT**

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The primary aim of this thesis is to see whether the outcomes of Finnish research-funding model, which was active during the years 2013-2016, is similar for STEM fields and the Humanities. The goal is to see whether this funding model unintentionally prioritises research in STEM field and overlooks the Humanities' research.

The study uses the theory of disciplinary differences (Becher 1989) and the conception of Knowledge Economy to explain the outcomes for STEM fields and the Humanities in the Finnish research-funding model, which was in place during the years 2013-2016. The data includes an overview of research policies from the years 2011-2016; a part of the funding model, which deals with research, and a numerical dataset, which corresponds to each studied component of the funding model (overall 5 components).

The results indicated that in the category of scientific publications STEM fields find themselves in a more privileged position than the Humanities due to their publication patterns. Therefore, it is possible to say that the funding model 2013-2016 unintendedly advances STEM fields in this category. However, the findings from four other categories did not come to produce direct answers to the research questions, but served as a rich source of background information for this study.

Keywords: Higher Education Policy, Science and Technology Policy, Humanities, Knowledge Economy

## FOREWORD

I clearly remember the day when I first came up with an idea, which later became my Master's thesis topic. It was one of my last days of stay in Oslo, where I did an exchange study semester in autumn 2017, studying Higher Education as a major. A few days before I took my last examination and that day was trying to browse through the topics, which I studied during the semester to find one which I could potentially use for writing my Master's thesis. It was one those of pre-Christmas days, a bright and a sunny one, filled with the joy of quiet laughter and the cheerful notes of cinnamon and mandarins, coming through the door from the university canteen. I was sitting in a luxurious main library of the University of Oslo, spacious, aesthetical and sophisticatedly designed, but in spite of the bright winter sunlight, coming from outside, I felt surrounded by a pitch and impenetrable darkness. Everything, which I was reviewing, seemed like nice topics for a classroom discussion, but not deep and extensive enough for a Master's thesis. All I could think of were a few ideas, which came to my mind while I was taking Norwegian literature classes, and a few other ones, briefly mentioned by my teachers during classes of French and Italian culture and literature in the University of Jyväskylä. However, throughout all years while I was a university student, I kept hearing both students and often professors saying that the research in the Humanities is of no value nowadays, that it is of no current interest and is not much needed anymore. In any case, as I majored in Education, I could not choose the topics, related to other fields. On that day during the holiday season, characterised by high hopes for the future, I felt like the unluckiest person in the whole city of Oslo. I kept telling myself, what on Earth did I do wrong? Why do I have to make myself do the work, which is not very much appealing to me, just because the world does not seem to value the work, which I enjoy doing anymore? Then after some time, a brilliant idea came to my mind. What if I could try to see whether the research in the Humanities is indeed not regarded as useful and valuable nowadays or it was just people's ungrounded opinions? After a few weeks of brainstorming, narrowing down my ideas, reading and meeting my second supervisor and

discussing my ideas with her, I finally came up with the topic, which is directly related to Higher Education studies and that is of genuine interest to me.

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## INTRODUCTION

Finland is the country, which went from the economy based on natural resources to a Knowledge Economy (KE) and built a world-class research and development (R&D) system in a relatively short period. Such a big advancement of the economy required big investments in the sectors of high technologies, science and ICT (Dahlman, Routti & Ylä-Anttila 2006; Ali-Yrkkö 2010). In this light, it would be very interesting to see how the other fields are doing in the country, which in a very short time became very technologically advanced and which policies are still mainly driven by STEM fields.

The issue of the Humanities being overlooked by policymakers, decision-makers and the public has been widely discussed in recent years in many countries worldwide. Bindé (2005) claims that as higher education institutions (HEI) started to adhere to international competition, several negative trends emerged. One of them is an enhancement of the key science and technology sector (namely STEM disciplines) at the expense of the Humanities (Bindé 2005). 'As Interest Fades in the Humanities, Colleges Worry' (2013) suggested that US faculties of Humanities are eclipsed by the science and technology sector and that the Humanities suffer from lower intake and the skills, acquired in the studies in the Humanities, become widely useless in today's world, driven by technology and innovation. Indeed, the argument that in the era of STEM fields' advancement and enhancement the Humanities are left chronically disadvantaged has almost become a classic (Nussbaum 2010; Heikkilä & Niiniluoto 2016; Guillory 2005). Since similar claims have been made in many countries of the world, it is intriguing to examine the same phenomenon in Finland. Given that the country in a relatively quick period became a KE and a highly technologically developed country (Dahlman et al., 2006), in what position did the Humanities find themselves in this sort of situation? A recent report on the position of the Humanities in Finland found that the Humanities are doing

relatively good (Heikkilä & Niiniluoto 2016). However, there are still plenty of aspects to be improved and developed when it comes to research in the Humanities in Finland. They include the more active participation of humanists in decision-making, improving framework conditions for research in the Humanities and wider coverage of Finnish research in the Humanities in international publication databases, to name only a few (Heikkilä & Niiniluoto 2016.) Besides, the research in the Humanities and STEM fields have different structural characteristics, which means that the structure of research output in two fields is also very different.

The purpose of the study is to see if policymakers take into consideration the disciplinary differences in STEM fields and the Humanities. The aim is to investigate whether STEM research is granted with more opportunities for advancement than research in the Humanities. These are my general research questions:

- Within the framework of KE, are the outcomes of Finnish research-funding model 2013-2016 identical for STEM fields and the Humanities?
- Do STEM fields find themselves in a better position concerning R&D and academic publishing than the Humanities in the funding model 2013-2016?

A more detailed explanation of my research questions and their operationalisation will be given in chapter three.

In chapter two, the concept of KE will be introduced and explained. The definitions of the two main disciplinary groupings, namely STEM fields and the Humanities will be given. A special focus will be made on KE's development in Finland and the role of both STEM fields and the Humanities in Finnish KE. Besides, the theory of disciplinary differences, elaborated by Becher (1989), used here to explain the differences in the structures of STEM fields and the Humanities will be presented and analysed.

Chapter three will explain the context of the study and operationalize the research questions.

Chapter four will introduce various types of data, used for this study, namely the Finnish funding model for the years 2013-2016, research policies in Finland for the years 2012-2016 and the numerical data. Information about data collection, research process and data analysis will be given in this chapter.

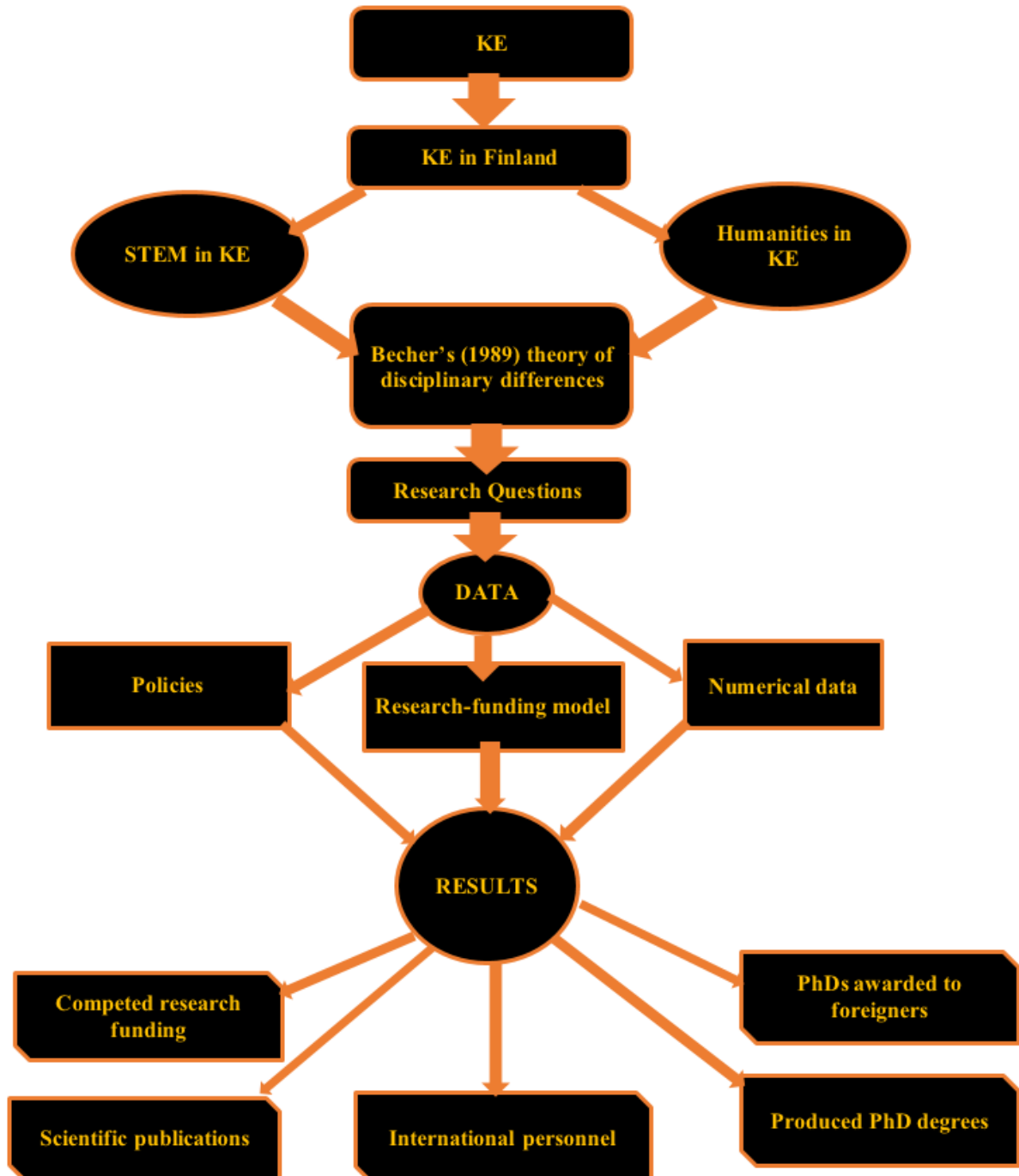
Chapter five will present the findings of this study, which are split into five main categories, corresponding to the main five components of Finnish research funding scheme.

Chapter six will discuss the findings of the study and inform the reader about the outcomes of the thesis. It will discuss the position of the Humanities and STEM under the 2013-2016 funding model and explain the results, produced in each of five categories, mentioned above.

Finally, yet importantly, the appendixes and references will be presented.

To comprehend the structure of this work more easily, figure one, featuring the main components of the study is presented here.

Figure 1. An outline of the study



## **2. THEORETICAL BACKGROUND**

### **2.1 Knowledge Economy and position of STEM in it**

This part will elaborate on the general concept of KE in the world and its significance in today's global economy. Besides, it will look into the concept of STEM disciplines and its role and significance in the era of KE.

#### **2.1.1 The concept of the Knowledge Economy**

The context of any study plays a crucial role in understanding an object of study and the background, within which it operates. Knowledge has historically been the primary force for driving society and advancing its development. The ability to invent, in other words, to produce knowledge and new innovative ideas, which are afterwards developed, advanced and after that demonstrated in the functioning of products, systems, and processes have always contributed in a great way to the development of human society. (David & Foray, 2002).

With the era of technological advancements starting back in the 1950s, the term itself emerged during the early 1960s. KE can be defined as "production and services based on knowledge-intensive activities that contribute to an accelerated pace of technical and scientific advance" (Powell & Snellman 2004, p. 199). It depicts an economic system where knowledge and ideas have a more significant role in the functioning of the economy than natural resources or physical power (Powell & Snellman 2004). The main drivers of this concept's emergence are an unparalleled pace of knowledge production, a rise of new industries, growth, and application for economic relevance and value (David & Foray 2001).

The KE has a few distinctive features, which differ from other economies. One of the most significant characteristics of KE is the fact that "the basic economic resource in KE is no longer financial capital, natural resources or labour, but is knowledge" (Drucker 2012, p.7). It is an application of productivity

and innovation, which are different forms of knowledge applied to work that create value. (Drucker 2012). The other features are high investments in education and R&D, knowledge dissemination and enhancement of the finest methods and high acceptance of industrial and economic modernisations (Dahlman, Routti & Ylä-Anttila, 2006). Therefore, it is rather logical to suggest that such fields as science, technology, engineering, and mathematics would play an important role in KE. The next part deals with this assumption.

## **2.1.2 Rise of STEM fields in Knowledge Economy**

### **2.1.1.1 The definition of STEM**

STEM, which is an acronym itself, can be translated as science, technology, engineering, and mathematics (Gonzalez & Kuenzi, 2012). STEM fields include a multitude of disciplines, which fall under these four broad categories. It might not be possible to include all the fields, which constitute STEM. However, universal STEM areas comprise

“aerospace engineering, astrophysics, astronomy, biochemistry, biomechanics, chemical engineering, chemistry, civil engineering, computer science, mathematical biology, nanotechnology, neurobiology, nuclear physics, physics, and robotics, among many, many others.”

(“Vertical Research @ University of Calgary: STEM”, 2019)

Therefore, the domains mentioned above of science are regarded as STEM fields in this paper.

### **2.1.1.2 STEM in the Knowledge Economy**

One of the distinctive features of the KE is the central role of science and technology in society. These two disciplines constitute the core of KEs, being the primary drivers of positive economic growth in the past few decades (Drucker 2012). Therefore, one can suppose that science and technology are very important

in education and research in KEs and are paid much attention. According to Stehr, since knowledge is primarily “the potential to start something going”, therefore, the knowledge in the field of technology or science is the ability to act (Stehr 2001, p. 89). He claims that science and technology have a privileged place in KE because the structure of knowledge in these disciplines creates opportunities to act rather than because the research findings in STEM fields are regarded as reliable and unbiased. (Stehr 2001).

Consequently, to promote the development and successful application of science and technology, KEs make huge investments in research and development (R&D). The share of R&D activities in countries’ GNP has been gradually increasing since the 1950s (Bindé 2005). When it comes to Finland, one can observe an overall growth of GDP in the country since the 1950s to 2010s, including slight variations over this time (World Bank 2019). However, starting from the 2010 a gradual decrease of R&D expenditure on GDP in Finland is observed, which might be a subject to variation. Besides, private companies, as long as the government allocate funding for research in Finland. Fluctuations in the market might have also contributed to the overall decrease in R&D share in GDP.

Other investments in intangible assets (such as education) are significantly rising compared to investments in tangible assets (Bindé 2005). Another indicator of the demand on economically important knowledge is the steep rise of granted patents, starting from the early 1960s onwards (Powell & Snellman 2004). These indicators might suggest a potentially significant influence of KE’s needs on the R&D goals and strategies.

## **2.2 Historical overview of Knowledge Economy development in Finland**

Finland is the country that turned into a KE in a relatively short period (Dahlman et al., 2006). To comprehend fully the context, in which KE evolved in Finland, it is necessary to go back in history and see in what circumstances Finland found

itself at the beginning of the 1990s. That was a situation of severe depression, but it was what contributed to the rapid development of KE in Finland and consequently, became a forceful driver for STEM fields' development. This way, it is possible to trace the history of STEM fields' raise in Finland.

### **2.2.1 1990s crisis**

In the early 1990s, Finland faced a severe economic crisis. There were several reasons for it, including a financial decline in the OECD countries; the dissolution of the Soviet Union, trade with which constituted about 15% of Finnish external trade; high-interest rate in other European countries and reducing progress in other European countries (Dahlman et al., 2006). The economic crisis was demonstrated by a financial depression, unemployment rate, which at some point was as high as 17% and GDP plummeting by little more than 10 % from 1990 to 1993 (Dahlman et al., 2006). Likewise, the public sector suffered serious budget cuts, including the HE sector (Välilä 2001). There was an urgent need for measures to overcome the crisis and start to revive again.

### **2.2.3 A way out of the crisis**

The middle of the 1990s witnessed Finland starting to be finding ways out of the crisis. The country overcame the crisis remarkably rapidly (Pajarinen, Rouvinen & Ylä-Anttila, 1998). Significant measures, which concerned various components of the country's economy, were taken to achieve this result (Dahlman et al., 2006). A new science and technology policy introduced the concept of a national innovation system, which became a significant tool for getting out of depression (Lemola 2003). Two most significant parts of this concept were national research system and education (Lemola 2003). These two concepts also contributed to the development of KE in Finland (Georghiou, Smith, Toivanen & Ylä-Anttila 2003).

National innovation system contributed to getting out of the crisis in the following way. Finland started to invest heavily in R&D, and even during the depression, the investments in this area and public support of R&D remained high while any other public expenditures were cut (Georghiou et al. 2003). What



concerns education, actions were taken to straighten the system of STEM education, such as creating Universities of Applied Sciences and increasing the number of study places at Universities in STEM fields (Lemola 2003).

Overall, such measures as an implementation of a strong innovation system, a key role of R&D in the advancement of the industry sector and economy and, most importantly, embracement of KE became the primary drivers for getting out of the economic crisis (Lemola 2002). High increase of ICT cluster in R&D and GDP, excellent performance in technical innovations, the rapid development of knowledge-intensive industries, and a boost of STEM education system were the features, which characterised the development of KE in Finland. (Dahlman et al., 2006). Because of these measures, it did not take long for the country to become one of the most technologically developed in the world. The severe economic recession resulted in Finland having very strong STEM policies, underlining the importance of creating necessary conditions for producing innovation, leading-edge scientific research and ICT technologies (Lemola 2002).

In the 2000s, the policies continued to foster STEM fields. The amount of funding, allocated for science and technology fields by TEKES (the Finnish Funding Agency for Technology and Innovation) in the first decade of the twenty-first century remained on the same level as in the 1990s, even though the economic crisis was long behind (Ali-Yrkkö, 2010).

In the documents, called 'Development plans', we can observe how STEM policies continued to prevail throughout the 2000s in the educational policy. Development plans were the policies, adopted by the Finnish Ministry of Education and Culture every four years from the years 1990s to 2016 as guidelines for development of educational activities. These documents allow observing how the policies continue to put forward the importance of STEM fields. For overviewing what these policies say about the position of STEM fields, I am looking only at the parts of the Development plans, which deal with University Education and Research.

The development plan, which was issued for the years 2003-2008, highlights the importance of developing necessary conditions for creating technological innovations and strong necessity to continue development of national innovation system through funding research (Minedu 2002). The development plan, which was active during the years 2007-2012, gives priority to such activities as creating and developing strategic centers for science, technology and innovation, which should strive to be 'the best in the world' (Minedu 2007, p.39). Besides, the importance of strengthening scientific research in science and technology is highlighted.

The same policy was favoured in the 2011-2016 Development Plan. It is declared in the 2011-2016 Plan that the investments in R&D for these years would stay the same as in the 2000s around four per cent of GDP. Besides, the plan emphasizes the significance of investments in innovations and scientific breakthroughs, which are both under the STEM umbrella.

## **2.3 The Humanities**

In this section, I will present the concept of the Humanities and explain what disciplines make part of it. I will argue that the Humanities might tend to remain overlooked and underrated in the era of KE when all the attention goes to rapid economic development and cutting-edge innovations' production.

### **2.3.1 The definition of the Humanities**

To understand properly what stands behind such a multi-dimensional concept as the Humanities, it is necessary to define it in a clear and precise way. Defining such a concept as the Humanities is not an easy task. What logic should one use for bringing together a range of academic fields and call them the Humanities? This is an old and notably complicated issue (Holm, Jarrick & Scott 2014). Generally, the Humanities can be defined as "the branch of learning

concerned with human culture". (Oxford English Dictionary, 2019). Different scholars include various sets of disciplines in the Humanities. For instance, the U.S. National Foundation on the Arts and Humanities Act gives one of the most comprehensive definitions of the concept:

*"The term 'humanities' includes, but is not limited to, the study and interpretation of the following: language, both modern and classical; linguistics; literature; history; jurisprudence; philosophy; archaeology; comparative religion; ethics; the history, criticism, and theory of the arts; those aspects of social sciences which have humanistic content and employ humanistic methods; and the study and application of the humanities to the human environment with particular attention to reflecting our diverse heritage, traditions, and history and to the relevance of the humanities to the current conditions of national life."*

(National Foundation on the Arts and Humanities, 1965, p.1)

Though this definition is rather comprehensive and all embracing, it interprets the disciplines, which constitute the Humanities, in quite a broad way. If employed for investigation in this thesis, it might potentially cause inaccuracies or even lead to confusion.

Other definitions are more precise and include the names of specific disciplines. According to Bod, the Humanities can be broadly defined as the disciplines, whose purpose is to explore how the human mind is expressed. (Bod 2013). In this manner, "philology, linguistics, musicology, art history, literary studies, and theatre studies all belong to the realm of the humanities" (Bod & Kursell, 2015, p. 338).

As this thesis is about the situation for the Humanities in Higher Education and research in Finland, it would be logical to use a definition of the Humanities, which would be recognised and used by the Finnish government and policymakers. **FINTO service**, which was created by National Library of Finland, the Ministry of Finance, and the Ministry of Education and Culture, places the following academic disciplines under the term 'the Humanities':

*“Philosophy; theology; history and archaeology; other humanities; languages; literature studies; theatre, dance, music, and other performing arts; visual arts and design.”*

**(Finnish Thesaurus and Ontology Service)**

As far as this list is the closest to the context of Finland and was developed by the Finnish government, it will be used in this paper to define the Humanities.

The main topic of research in the Humanities are people, their thoughts, activities, relations with each other (Heikkilä & Niiniluoto 2016). Besides, the humanists are interested in the human culture as a whole, in all the cultural activities, which were undertaken by people since the beginning of humankind, including art, folklore, language, and religion (Heikkilä & Niiniluoto 2016).

### **2.3.2 The Humanities in the Knowledge Economy**

As I said before, in the era of KE STEM fields play a decisive role in the economy and go forward at a relatively high speed. It is interesting to see how this would affect the other fields' functioning. In particular, how do the Humanities feel in this kind of situation? As HEI became engaged in international competition, some destructive phenomena, with consequences, which are yet to be revealed, started to emerge (Bindé 2005). One of such phenomena is preferment of leading-edge fields, particularly belonging to STEM disciplines, at the cost of the Humanities (Bindé 2005). Many scholars mention the reducing importance, given to the Humanities by policymakers and society in the era of KE. One might argue that the Humanities are being cut away on all the levels of education all over the world because policy-makers regard it as 'useless frills' which need to be scaled down, so that the country could continue to stay competitive internationally (Nussbaum 2010, p.2). An alarming number of humanists have been leaving academia in a past few years, as they felt that nowadays, when much of intellectual energy is generated in the field of science, they do not have enough resources and opportunities to contribute to the development of the society (Cummings 2013). Some data reports about the low popularity of the Humanities

among university entrants and reducing the number of students who study the Humanities (Reisz 2018).

An article, written by Goldin and Katz (2007) shows that universities have to allocate more and more funding to STEM fields and the doubts are cast on whether this might mean that the Humanities in universities might soon become extinct. Edelstein (2010) casts doubt on whether this might mean that the Humanities in universities might soon become extinct.

Another article, written by Bullen, Robb & Kenway (2018) also raises a concern about the gradual decline of the Humanities in universities in the era of KE. According to the article, it happens because the main focus is in STEM fields and thus offer their solution to preserve a place for the Humanities in HEIs and KE.

## **2.4. Theory of disciplinary differences**

In this part, the theory of disciplinary differences will be presented. It is essential to understand it in this thesis because it explains important differences between STEM fields and the Humanities. According to this theory, both the Humanities and STEM fields are very different in structure. An output, produced in these two disciplines, also comes in quite different forms. This piece of information is essential to understand the differences in publication cultures in STEM fields and the Humanities. The understanding is necessary for comprehension of this study's results.

### **2.4.1 The concept of disciplinary differences**

It can be argued that disciplines serve as 'life-blood', 'organising base' and 'social framework' of HE (Becher 1994). They integrate systems of historical practices, construct identities and suggest reasonable knowledge arrangement methods.

Becher (1989) elaborated on a way to identify the interconnections between academic cultures and knowledge types. As stated by him, each academic discipline has a distinctive culture, which is shaped by the structure of

knowledge in that discipline. Two dimensions of knowledge structures are presented by Becher's theory, namely a cognitive and social one. A cognitive dimension, which was introduced by Biglan (1973), classifies disciplines according to four parameters: hard and soft versus pure and applied, where hard and pure matrix refers to the nature of knowledge and pure and applied axe indicates the degree of the practical applicability of a discipline. We can see this matrix in table 1.

**Table 1.** Becher's classification (adapted from Biglan 1973 - "Cognitive" aspects) (Becher 1989, p.11).

	<b>Pure</b>	<b>Applied</b>
<b>Hard</b>	Hard- pure (Physics)	Hard-applied (Engineering)
<b>Soft</b>	Soft-pure (Anthropology)	Soft-applied (Education)

Each disciplinary grouping has its own set of specific features. For instance, hard pure disciplines, which include pure sciences, are 'cumulative' and 'atomistic', whereas soft pure disciplines (such as the Humanities) are 'reiterative' and 'holistic' (Becher 1994). More information about the features of each disciplinary field is presented in table 2.

**Table 2.** Knowledge and culture by disciplinary cultures, the Becher-Biglan typology (Becher 1989, p.11-16; Nerland, personal communication, 11.9.2017).

<i>Disciplinary grouping</i>	<i>Nature of knowledge</i>	<i>Nature of disciplinary culture</i>

<i>Pure sciences</i> (such as chemistry): <i>'hard-pure'</i>	Cumulative; 'tree-like'; concerned with universals and quantities; resulting in discovery/explanation.	Competitive; politically well-organised; high publication rate; task-oriented.
<i>Humanities</i> (such as literature) and pure social sciences (such as sociology): <i>'soft-pure'</i>	Continual; 'river-like', concerned with qualities and complication; resulting in understanding/interpretation.	Individualistic; loosely structured; low publication rate; person-oriented.
<i>Technologies</i> (such as engineering): <i>'hard-applied'</i>	Purposive; pragmatic; concerned with comprehension of physical environment, which results in products and techniques.	Entrepreneurial; dominated by professional values; cosmopolitan; role-oriented.
<i>Applied social sciences</i> (such as public health): <i>'soft-applied'</i>	Functional; concerned with improvement of professional practice; results in protocols and procedures.	Evident-looking; dominated by intellectual fashions; uncertain in status; power-oriented.

Apart from that, each of these four disciplinary groupings has its own disciplinary culture. As reported by this classification, hard pure sciences are 'competitive', 'fast-moving' and their publication rate is high, while soft pure disciplines are 'pluralistic', 'loosely structured' and their publication rate is low (Becher 1989, p.11-16).

A social dimension also divides the disciplines into four aspects, such as convergent, divergent, urban and rural (as presented in table 3). Convergent-divergent axe refers to the uniformity of research standards, while the urban-rural aspect concerns a people-to-problem ratio and degree of interaction (Trowler 2014). Respectively, the Humanities may be characterised as divergent

rural in this matrix and science as convergent urban. What concerns technology and engineering, which belong to STEM disciplines, they might be characterised as hard applied and divergent rural disciplines in these two dimensions.

**Table 3.** Becher’s classification - "Social" aspects Becher 1989 p.9-10; 79-80

	<b>Urban</b>	<b>Rural</b>
<b>Convergent</b>	Convergent-urban	Convergent-rural
<b>Divergent</b>	Divergent- urban	Divergent- rural

#### **2.4.2 Differences in disciplinary cultures**

Literature, which is published in a field, is the most reachable and reliable demonstration of the field’s research activity (Becher 1994). For instance, we can see that books and monographs are the main publication type in urban disciplines, while rural disciplines most often favour journal articles (Becher 1994). Concerning the pace and density of publications, there are quite significant discrepancies between disciplinary groupings, too. Thus, the hard-pure disciplines tend to be published at a much higher speed than soft pure specialisms (Becher 1994). When it comes to publications’ frequency and length, scholars who research hard pure disciplines normally produce more publications with a lower number of words, while soft pure groupings tend to issue fewer publications with a greater number of words (Becher & Trowler, 2001). Concerning competition between the disciplines, the more urban is the discipline, the higher is competition, and vice versa (Becher 1994).

#### **2.4.3 Disciplinary differences in the Humanities and STEM disciplines**

As the Humanities are considered as soft sciences, it is not always easy to do justice to the result of their activity. As the research, done in the Humanities, is most often qualitative and open to interpretation, it is often labelled as inaccurate



and is not taken seriously (Heikkilä & Niiniluoto 2016). If one compares the field of STEM to Humanities, it is not hard to notice that disciplinary cultures in these two fields are very different. STEM fields have a higher publication speed, high competition among researches and a greater number of academic journals; they appear to have higher chances of advancing the knowledge at higher speed and having their pieces of work published in high-ranked journals. The Humanities, in turn, tend to publish books and monographs at a seemingly lower speed than STEM fields; they have less highly ranked journals and normally do not offer immediate economic benefits. This might potentially lead them to going unnoticed by the policymakers. Besides, due to the difference in content and publication cultures, the publications in STEM fields are more international, while the Humanities tend to have more publications that are domestic. (Heikkilä & Niiniluoto 2016). As the Publication Forum rates international academic journals most highly, the Humanities researchers might have fewer chances to be published in them. To some extent, this might be another predisposition for them having fewer opportunities to thrive than STEM fields.

### **3. METHODOLOGY**

#### **3.1 Context of the study**

As it was shown in the literature review, the Humanities have traditionally been contrasted against STEM fields. Since both fields belong to different disciplinary groupings, as it is explained by Becher (1989) and today, in the era of KE, all the attention and funding are directed to the sectors of innovation and technologies, little attention is given to the Humanities (Holm et al., 2014). In this light, it would be very interesting to see the position of the Humanities in Finland, given its focus and priorities, fixed on STEM fields. In the literature review, I said about a prevailing role of STEM fields in KEs and mentioned the claims of the Humanities being forgotten by policymakers and society, made in various countries of the world. However, would similar claims be true for Finland? In

this thesis, I am looking into the funding model of research in Finland to see whether the fields have equal financial opportunities and whether scholars in both fields have equal possibilities for publishing and funding. Since the country's main interest has been innovations and R&D for a few decades, the main investments have also been aimed at these fields. This makes me wonder about the position of the Humanities, a traditional STEM's opponent, in this situation. It is interesting to see whether the advancement of STEM fields that can be seen in the policies has potentially had any effect on the performance of Humanities research. Would prioritising one field, which is viewed as more important for the progress of the economy, mean that this field is bound to success in KE and other fields are not? Is it necessarily so that while one field is prioritised by the policies, the other one is left unnoticed? To produce an answer, each of the research funding model's components will be studied and will contribute to generating an answer to these questions.

### **3.2 Aims & Research Questions**

Taking all of that into account, this study aims to investigate whether the Humanities and STEM fields have equal financial opportunities for research in the context of the KE in Finland. It wants to explore whether the disciplinary differences in these two fields are taken into account in the research-funding model, which functioned from 2013-2016 and whether fair possibilities are allowed for research in different fields. These are my research questions and their operationalisation:

- *Within the framework of KE, are the outcomes of Finnish research-funding model 2013-2016 are identical for STEM fields and the Humanities? To investigate this issue, I will aim to find out whether Becher's (1989) theory of disciplinary differences is taken into account in the research-funding model 2013-2016.*
- *Do STEM fields find themselves in a better position concerning R&D and academic publishing than the Humanities in the funding model 2013-2016? To*

answer this question, I will look at whether the funding model is constructed in such a way that STEM fields have improved chances to advance their research and produce more publications than the Humanities.

### **3.3 DATA**

Various types of data were taken for this study. Firstly, the policy development lines during the years 2011-2016 are regarded as a part of data in this thesis, even though they are not studied directly. Secondly, the components of the funding model, which deal with research, are explained and studied in this thesis. Even though this information does not contribute to producing the results of this study directly, it helps to understand how academic publications are classified in Finland. In turn, this is necessary for understanding the results of the thesis. Thirdly, I study the numerical data, which corresponds to each funding model's component, dealing with research. This type of data directly contributes to producing the numerical results of this study.

#### **3.3.1 STEM fields in the policies in 2011-2016**

This is not the type of data, which directly contributes to the generation of numerical results. However, since this piece of information is quite closely related to the numerical results, which I got, and to a certain extent is the textual version of the same data, I put it in this part.

The reason, why these policies are closely connected to my numerical data, is the following. A funding model is an implementation of policies. Therefore, the funding model, which directly contributed to the generation of numerical data, is based on this text. To understand the policy lines, which served as a basis for creation of the funding model, one should look into the content of the policies.

This section deals with the Development Plan, which was issued for the years 2011-2016. Only the parts, which concern University Education and research are studied. It was the last development plan, issued by the

government, after that the government decided to stop the tradition of development plans, which lasted for almost thirty years.

The plan mentioned above was adopted on the 15th of December 2011 and functioned during the years 2012-2016. It continued the policy of highlighting the importance of STEM fields, which was discussed in detail in chapter two. The elements of the policy, which deal with University Education and Research, indicate that STEM fields' development is regarded as a very high priority by the government. For example, the plan declares that as economic growth and long-term competitiveness rest on the competence of very high standard, it requires a strong intensification of basic research and R&D (Minedu 2011). Among the actions, which were taken for an enhancement of the research system, such action is mentioned as establishing of research prerequisites, which would 'enable innovations and scientific breakthroughs generated by basic research and R&D to be produced continually' (Minedu 2011). Another measure, mentioned in the development plan, is an improvement of the creative economy and new growth areas, such as 'environmental and energy technologies, new materials and natural resource industries' (Minedu 2011). All the mentioned areas could be regarded as those, which belong to STEM fields. Since the document emphasizes the importance of investing into and further developing the areas, which are all under the STEM umbrella, it is possible to say that the policy treats these fields as crucially important ones for the development of research. Since a funding model is an implementation of policies, one might suggest that the funding model would also provide some incentives for the areas, which are under STEM fields as well.

### **3.3.2 Research funding formula for universities**

To understand the context of STEM and the Humanities in Finland in a better way, it is necessary to look into the components of the funding model, which deal with research funding. Since a funding model is an implementation of the

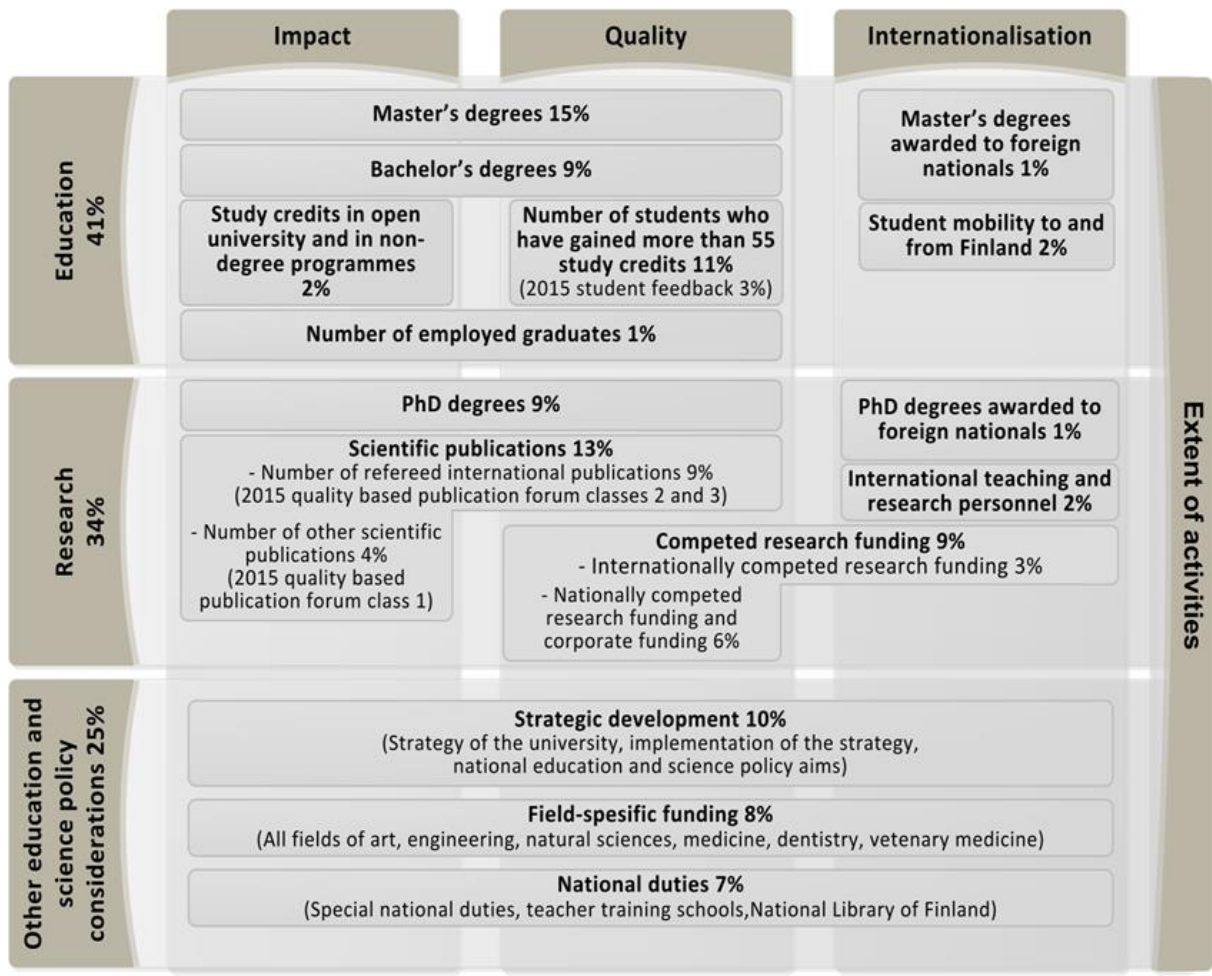
policies, which were described earlier, it is fundamental to comprehend how the components of the model, dealing with the research, operate. A special emphasis is made on the segment, which deals with scientific publications. As it is indicated in chapter five, this part of the funding plan will generate the main data, which will help to answer the research questions. This is why it is significant to understand how this specific part works.

The funding model in Finland is reviewed and updated every four years. It consists of various components, which are the fields for allocating the budget (such as education and research), and the areas, which are most important for the development of the HE system, namely, impact, quality, and internalisation.

For this study, I take the funding model, which was active in 2013-2016 for two reasons. Firstly, as this funding model is based on the development plan, described in section 2.3.3, it would be very interesting to observe in what ways the priorities, mentioned in the development plan, are implemented in the funding model. Since the funding model 2013-2016 is directly based on this policy, the funding model certainly comprises many of its elements. Secondly, the numerical data I am describing for this study is taken for the years 2013-2016. The data available for the earlier years is incomplete and the data for the later years is not yet complete. Therefore, the only funding model, for which a complete set of numerical data can be found, is the one, which was active during the years 2013-2016.

Figure two depicts the outline of the Finnish HE funding model for the years 2013-2016.

**Figure 2.** The core-funding model for Universities for the years 2013-2016 (The Ministry of Education 2013)



For this study, only the components, which deal with research are taken into consideration. A special focus is made on scientific publications because this component of the funding model directly generates the results of this study. More information about it will be given in chapter five. The other components of the funding model are not studied in this work.

### 3.3.2.1 Funding of scientific publications

In the Finnish HE funding model 2013-2016, the use of publications in the funding model can be explained by two elements: quality of publication channels and the publication metadata, which correspond to the whole output of universities (Giménez-Toledo et al. 2016).

To understand the basic principles of scientific publications' funding, there is a need to look into different categories of publications and publishing channels first.

### 3.3.2.2 Publication classification types

There are various publication classification types, recognised internationally, from category A to category I. A category depends on the target audience of the publication channel and the objective of publication. The detailed information about these classification types is presented in Appendix 1. Here I present an overview of each category:

**Publication channels A to C** are aimed at generating new scientific information and advancing science and a certain scientific field. Publication types A to C are regarded as scientific publications, which contribute to the funding formula in the most significant way, since the points, which are awarded for publications in these categories are the biggest ones. More information about this can be found in table four.

**Publication channel D** is supposed to feature research-based knowledge, which is to be used by a professional society. Publications channels D are defined as professional publications.

**Publication channel E** features publications, which promote scientific knowledge and information for the general public.

**Publication channel F** contains public outputs of artistic work.

**Publication channel G** is mainly aimed at featuring theses.

**Publication channels H** includes all the other publications, which contain the results of research activities, but have a pattern of publishing different from all the previously mentioned publication types.

Based on this classification, the government determined four levels of scientific publications. Each university's contribution to scientific publications is computed based on the number of published materials in each category (Finlex 2012). The Ministry of Education and Culture regulates the number of funds, allocated for financing scientific publications' production, which are generated

by all universities in the country. The number of funds and publications' classification might change yearly and the review of rating 0-3 is made once in four years. (The Publication Forum 2018). Each university gets some funds depending on the percentage of share of the total points of publications nationally (Mathies 2015).

The public body, which is in charge of evaluating publications in Finland, is called the Publication Forum. It published its first publication outlets' classification in 2012. This classification was updated in 2015. However, the 2012 Publication Forum Classification is used for the funding model 2013-2016 (Giménez-Toledo et al., 2016). The Publication Forum divides scientific publication channels into three levels. More details about each level can be found in Appendix 2.

**Level 1** comprises "domestic and external publication channels, which are most relevant from the Finnish research perspective" (The Publication Forum 2012). Level 1 encompasses "80% of classified journals and 90 % of classified book publishers" (The Publication Forum 2012). However, "Finnish publication channels, where two-thirds of editorial board work for the same research organisation, were not granted level one rating", even though they met all the necessary criterion for level 1 publication (The Publication Forum 2012).

**Level 2** includes "mostly international publication channels, featuring research outcome, produced by various countries" (The Publication Forum 2012). Besides, it also includes "Finnish and Swedish-speaking publication channels, which are aimed at presenting Finnish culture and society" (The Publication Forum 2012). "These publications are intended for an international expert audience" (The Publication Forum 2012).

**Level 3** includes "the publication channels, featuring the state-of-art research, which is highly impactful" (The Publication Forum 2012). "All level 3 publication channels are international" (The Publication Forum 2012). "The editorial boards of level 3 publication channels consist of the leading experts in the fields" (The Publication Forum 2012).



Channels, “which do not meet the criteria of a publication channel, are marked as **level 0**” (The Publication Forum 2012). Level zero also includes “a few peer-reviewed channels, such as doctoral dissertation series and local channels with the authors largely from one organization” (The Publication Forum 2012).

Table four shows the weighting system of publications, introduced by the Publication Forum (The Publication Forum 2018).

**Table 4.** The weighting system of different publication types (2012; updated in 2015)

Type of publication	Level 2+3	Level 1	Level 0 or none
A1- 4 Refereed papers	3	1.5	1
C1 Published monographs	12	6	4
C2, D5, E2 edited books and professional + popular	0.4	0.4	0.4
B1-3, D1-4, E1 Non-refereed papers, professional + popular papers, development reports	0.1	0.1	0.1

Starting in 2015, a weighting coefficient was given to different types of scholarly publications, based on the publications’ type and the publication forum’s classification. In this table, we can see the weightings of different publications, depending on the level of their publication channel. Based on this table, we can see that weighting coefficient of peer-reviewed monographs is much higher than for all the other publications: 12 in the level 2, 6 in the level 1 and 4 in the level 1. The peer-reviewed articles in category A have a lower weighting than peer-reviewed monographs. However, their coefficient is still relatively high: 3 for level 2 and 3, 1.5 for level 1 and 1 for level 0. The weighting coefficient is 0.4 for

special issue editors, the articles by book and non-peer-reviewed monographs are 0.4 for all the levels. The weighting coefficient is 0.1 for non-peer-reviewed publications of various categories.

An allocation of publication points takes place in a following way. Each publication, produced by an institution, generates a certain number of points. A certain amount of publication 'points' is awarded for each publication, depending on its weighting coefficient (Mathies, Kivistö & Birnbaum, 2019). The points, generated by academics for their produced publications are summarised by the Finnish Ministry of Education and Culture. Afterwards, these points are used to allocate funding to each institution, depending on the quantity and the type of publication they produced (Mathies et al., 2019). It is to note that funding is allocated based on the points, obtained by each institution and not on individual publications.

### **3.3.2.3 PhD degrees funding**

As stated in the core funding formula, 9 % of research funding goes to PhD degrees. The number of each Finnish university's PhDs degree production depends on each university's area of specialisation, intake of students in each field, number of PhD applicants. As it is stated in the law, what is taken into consideration in the funding formula is the number of doctoral degrees completed at the University up to the target set for the contract period (Finlex 2012). Therefore, the universities are to produce a certain number of degrees, which is set by the government. In the data analysis, this part of the funding model will be analysed as a part of background information and will be discussed in more detail in section 5.1.

### **3.3.3 Numerical data**

The main type of data, used for this study, is numerical data. All the data, used for this study, was retrieved from online databases, such as Vipunen, Education Statistics Finland and the Publication Forum of Finland.

Each set of data corresponds to the components of the funding model, dealing with research funding. The funding model and the way it works were described in detail in the methodology part. The components of the model, analysed for this study, are the following:

- PhD degrees (9% of funding);
- Scientific publications 13%, which include: number of refereed international publications 9%, number of other scientific publications 4%;
- Competed research funding: 9% (includes internationally competed funding 3%);
- PhD degrees awarded to foreign nationals 1%;
- International teaching and research personnel 2%.

All the numerical data, collected from Vipunen, was collected by Statistics Finland, the Ministry of Education and Culture and the Finnish National Agency for Education. In turn, these organisations collected the data, submitted by HEIs, educational providers, administrative registers and statistical data files ("Vipunen - Education Statistics Finland", 2019)

## **4. DATA ANALYSIS**

### **4.1 Research process**

The first step in this research process was the selection of the relevant data from the national educational statistics bank Vipunen. The selection was made accordingly with the criteria of the funding model. The data, which reflects the implementation of the funding model, was selected. Some background data, which helps to understand the results of the study in a clearer way, was studied.

The next step was calculating a mean of the output produced during several years. An average (also called a measure of central tendency) is a value that depicts a group of scores (Salkind 2016). In my case, I have the data for the years 2013 to 2016. I first calculated the results for each given year and after that

computed the measure of central tendency using the mean. The mean is a set of values calculated for each case and then divided by the total number of cases in a group (O'Leary 2004). In my case, I divided the sum of variables for the years 2013 to 2016 by the number of the years (4).

Following this, the findings were made visual with the help of charts. According to Salkind (2016), a visual representation of data is a highly effective method to describe the characteristics of any data set. After that, the charts were critically analysed based on the research literature and the way the funding model works. More information regarding the process of data analysis can be found below.

## **4.2 Data analysis**

This part presents the approaches to quantitative study and the analysis, used for this study.

Muijis (2011) describes quantitative analysis as the process of assembling numerical data, which is interpreted with the help of mathematically based techniques. Therefore, as this type of analysis deals with quantitative data only, the data used for this analysis has to be numerical (Mujis 2011).

I analysed the data using the method of descriptive statistics. Descriptive statistics method is chosen to manage and interpret the characteristics of a data set (Salkind 2016).

I chose to calculate a statistical overview in the software programme Excel. Excel is one of the most accessible and effective tools available today for calculating the basic statistics (Salkind 2016). In my case, as I do descriptive statistical analysis and not advanced statistical methods, Excel provides an opportunity to overview the statistics and to create charts. It helps to present the funding of this study in a clear and comprehensible manner and allows a wide category of the reader to understand the results of the calculations.

As this study uses a quantitative method, the data, used for this study, is numerical. In quantitative studies, there are three main concepts, which are validity, reliability and generalisability. Since this study comprises only

statistical overview and presentation of ratios and percentages, some of the subcategories of these three main concepts are not applicable for this study. We will look into each of these concepts and see how each of them is demonstrated in this study.

#### **4.2.1 Validity**

Validity is aimed at finding out whether a researcher measures what they would like to measure. Even though in many cases validity may seem to be an obvious thing, in educational research it is often not the case (Mujis 2011). For example, in this study case, there are a few latent variables, which cannot be measured directly. This is why it was necessary to create the right measurement instruments or to compare those latent variables indirectly to get credible results (Mujis 2011).

Content validity refers to whether a researcher uses the correct instruments to measure latent concepts. According to Mujis (2011), understanding of theory plays a crucial role in determining content validity. Therefore, all the theoretical frameworks, which are valid for this study and helpful for a better understanding of the study's context, were mentioned in the literature review.

With the help of content validity, one can see whether they are measuring what they are measuring latent variables in the right way. For example, if one wants to compare the number of Finns and foreigners, who are employed in universities for research in the Humanities and STEM fields, one cannot do it directly by comparing the number of researchers employed in both fields. In this case, comparing the numbers directly would indicate the different sizes of the fields and the difference in their scope. In this case, one should suggest a different instrument for comparing them, for example, by calculating a percentage of the employees of Finnish and non-Finnish origin in both fields.

One of the ways to achieve better content validity is to establish face validity (Mujis 2011). However, in this case, it is not possible, as the data I use concerns 'technical' data about universities, therefore, it is impossible to establish face

validity. In the case of this study, all latent variables were studied carefully to determine whether they could be compared directly or not. Every effort has been made to ensure that statistics are compared accurately.

Criterion validity describes how a measure might be related to other measures to anticipate a certain consequence (Mujis 2011). It focuses on measurement procedures. As this study takes official statistics, and I analyse it without using such instruments as, for example, surveys, this type of validity does not apply to this study.

Construct validity deals also deals with the internal design of the instrument, which is used for the measurement (Mujis 2011). If the concept, which is to be investigated, has more than one dimension, it is important to make sure that all the dimensions are taken into account when the concept is studied (Mujis 2011). In the case of this study, we are testing whether the funding model prioritises STEM fields over the Humanities. An official funding model is used to study this criterion, and it has five dimensions, which are the following: PhD degrees, PhD degrees awarded to foreign nationals, international teaching and research personnel, scientific publications and competed research funding. All of these dimensions were taken into account and analysed. The findings for each dimension are presented in the results section. Therefore, in this study, it is clear that the dimensions, taken for the investigation, are the right ones and they are all taken into account.

#### **4.2.2 Reliability**

Reliability is the second essential component, which can tell something about the quality of a measurement instrument in quantitative research (Mujis 2011). In quantitative research, it is highly important to that statistical measurement, used in the research, do not contain any errors. Reliability consists of three main elements, which are the following: true score, systematic score and random error (Mujis 2011). The true score refers to the score, which is free from any errors, the score which a researcher is interested in measuring. Systematic error is an error,

which repeats in all the measurements, done for the study, and is relatively easy to find and to eradicate. The random error varies between different measurements and is and is very unpredictable (Mujis 2011). Random error is what reliability mostly has to do with. For example, in this study, I might have made random calculation errors when calculating, for example, an average amount of funding, aimed at research and issued by the government, national and international funding bodies. These random mistakes might potentially lead to misleading results.

To avoid the calculation mistakes, I repeated all the calculations twice: in September 2018 and in February 2019, to ensure that all numbers are correct and error free. All the formulas used for the calculations and the numbers for each given year (2013-2016), together with averages, were rechecked.

There are two main types of reliability: repeated measurement and internal consistency. The former refers to the measurements' capability to measure the same thing at different times (Mujis 2011). As the data, used for this study, were collected jointly by the Ministry of Education and Culture of Finland and the Finnish National Agency for Education for official statistics report, and it deals with exact figures, this criterion does not apply to this study case.

Internal consistency reliability deals with the degree of homogeneity of the instruments' items and with items' ability to measure a single construct (Mujis 2011). In this study, the statistics were analysed, using the most basic quantitative techniques, such as mean and ratios. As this study mainly describes the official statistics, one can say that these techniques are enough for providing a general overview of statistics. Moreover, as it is mentioned before, all the items, used for the analysis, make part of the funding mechanism. Therefore, it leaves no doubt, whether these items are correct ones for measuring the functioning of the research-funding model.

### **4.2.3 Generalisability**

Generalisability is an extent to which the results of one study can be applied to other contexts (Mujis 2011). This concept is very important when there is a sample of the population, which the researcher investigates, and it is necessary to find out whether this sample can be applied to the population in general. However, in the case of this study generalisability might not be very applicable. The data, used for this study, includes the statistics, representing all the universities of Finland. Therefore, since the data was collected from all the Finnish universities, the findings apply to all the country. There is no need to generalise the results.

### **4.3. Ethical solutions**

Ethics is highly important to consider when conducting any research. According to Burgess (2005), in educational research, there are four key ethical issues to consider. The first is research sponsorship, which refers to the interference of sponsors in research activities (Ramrathan, Le Grange, & Shawa, 2017). As I did not have any sponsors for this research, this aspect does not apply to this study.

The second one is research relations, which deals with the relationship between the researcher and the researched (Ramrathan et al, 2017). In most cases, it refers to an educational researcher who takes care of confidentiality, secrecy and other ethical aspects when working with vulnerable groups in society (Ramrathan et al, 2017). In my case, the data I worked with was publicly accessible and provided by a national educational statistics database. Therefore, this aspect is also not applicable to this thesis.

The third one is informed consent, which is an individual's personal consent to participate in research (Ramrathan et al, 2017). As I worked with numerical data for this study, this concept is not applicable either.

The last one is data dissemination, which means that the data, gathered by the researcher, is disseminated and used in accordance with principles of confidentiality and anonymity (Ramrathan et al, 2017). As the data, which I used, is publicly available online this aspect is not applicable.



However, my study does have an ethical issue. Some parts of the literature, used for the review, do not exist in English. Therefore, a raw translation from Finnish to English was used, using the translation software online. However, the native Finnish speakers, who are fluent in English, checked all the documents' translations and necessary corrections were made based on their comments, to make sure that the sense is not lost.

## 5. RESULTS

As stated in the Ministry of Education and Culture's research-funding scheme from 2013 to 2016, 34% of overall funding for Universities is allocated to research activities. These 34 per cents are based on five different components, which were explained in detail in section 3.3.3. We will look into each one of these categories and present the findings for each category separately.

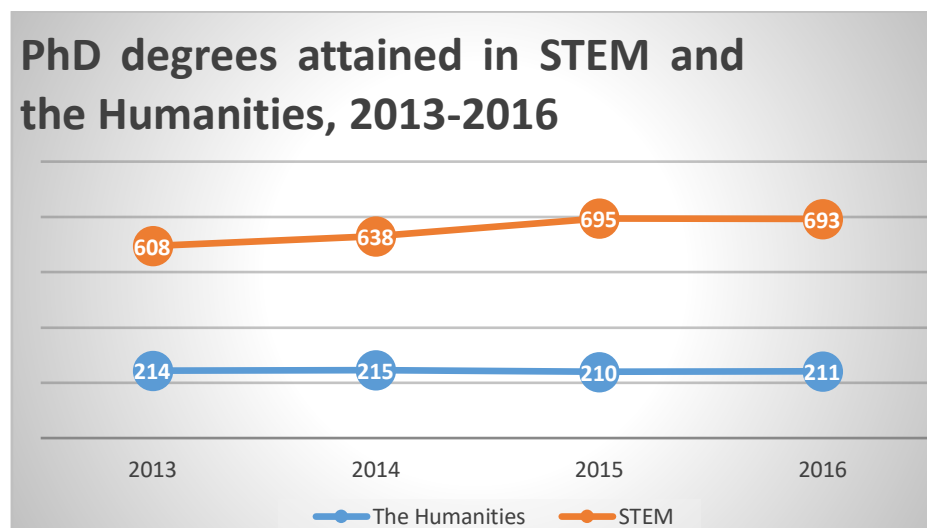
It is to note that in several cases it was impossible to retrieve statistics for each year between 2013 and 2016. For such category, as distribution of publication types in STEM and the Humanities and the data was available for the years 2014-2016 only. In the category 'percentages of Finns and foreigners employed in Finnish universities,' the data was available only for the years 2015 and 2016. Therefore, in these cases, a mean of the years 2014-2016 and 2015-2016 was calculated.

It must also be pointed out that in many cases it was impossible to compare the outputs of STEM and the Humanities directly. STEM is a larger field with many sub-specialisations and the Humanities is a smaller field. For example, if one compares the number of teaching and research staff in STEM and the Humanities, it is possible to see the difference in fields' sizes. While there were 7491 employees in teaching and research in STEM fields in 2016, the Humanities

had only 2603 teaching and research staff. This example illustrates that STEM field is much larger than the Humanities. Besides, the research in STEM often requires more elaborate infrastructure, while in the Humanities it is usually much cheaper and does not require complex infrastructure. Therefore, it would be pointless to compare the fields directly. However, it is possible to compare them indirectly, i.e., through comparing various characteristics inside both fields, calculating the proportions of various components inside the fields and comparing the ratios. In each section of the results, presented below, more information about comparing each component of the funding model can be found.

### 5.1 Number of PhD degrees, 9% of funding (the number of doctoral degrees completed at the University up to the target set for the contract period) (Finlex 2012)

**Figure 3.** A percentage of attained degrees in Finland at the doctoral level or equivalent, STEM fields and the Humanities, 2013-2016



This category refers to the number of attained degrees of doctoral level or equivalent. While it is rather pointless to compare two fields directly and as a result, observe the huge difference in the number of attained degrees, which

indicates the difference in the size of the fields, we can compare this indicator in two fields indirectly and see the dynamics. Figure three shows that while the number of attained PhDs in the Humanities remained unchanged, we can see a steady growth of PhD graduates in STEM fields. Though it is obvious that the size of these two fields is different and consequently, the need for PhD graduates is different, we can say that STEM fields are quite successful at attracting new PhD graduates, while the Humanities not that much. However, for the results of this study, we cannot directly utilise these findings because of the difference in the fields' sizes, it can serve as good background information for understanding how the fields are doing in general under the funding model 2013-2016.

## **5.2. Scientific publications**, 13 % of funding, which includes:

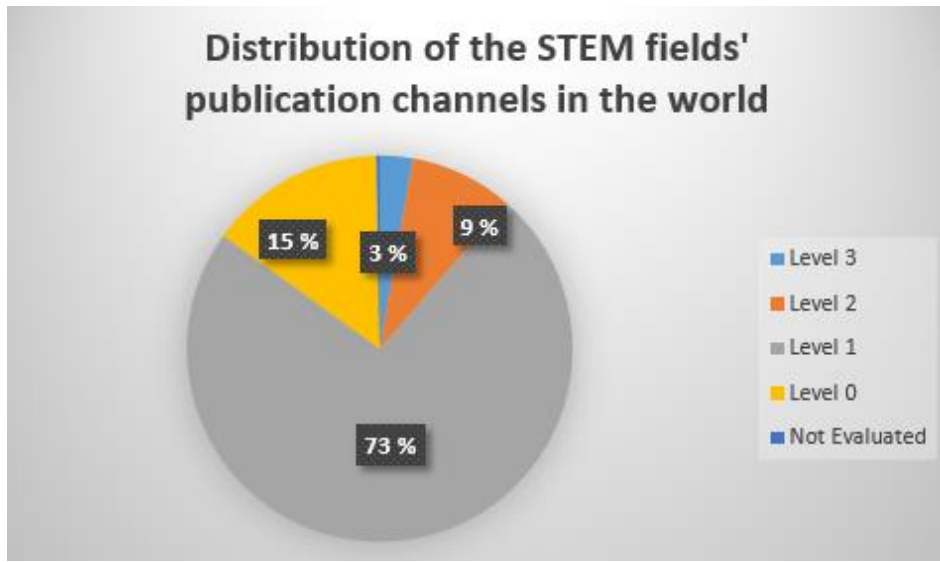
- refereed international publications 9%;
- other scientific publications 4%.

This category highlights the distribution of publication types, as it is set by the Finnish classification system for assessing the quality of research output, namely the Publication Forum. The criteria used for evaluating different levels of publications were explained in detail in section 3.3.2.2. Classifications that are more detailed can be found in Appendixes one and two.

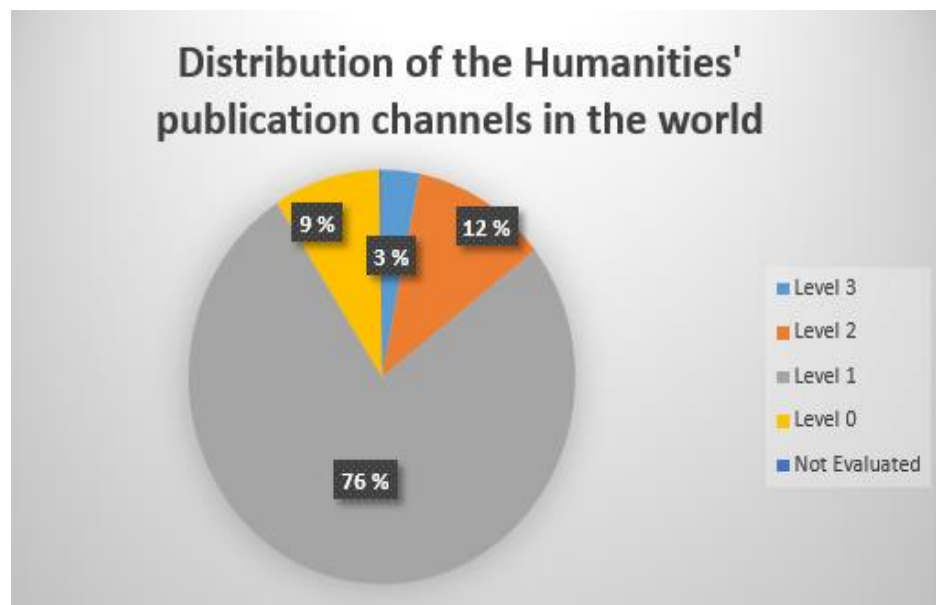
For this criterion, we will first investigate the distribution of the publication channels in the world in both STEM and the Humanities. This will help to understand the Humanities' research position in the world. After that, a similar type of information will be explained, which relates to the context of Finland. Following this, a mean of publication types' proportion in categories A to I in both fields for the years 2013-2016 is demonstrated. Lastly, a dynamic of ratio peer-reviewed versus non-peer-reviewed publication channels during the years 2014-2016 is presented and discussed.

### **5.2.1 Publication types in the world**

**Figure 4.** Distribution of publication types in STEM fields in the world, Publication Forum's classification



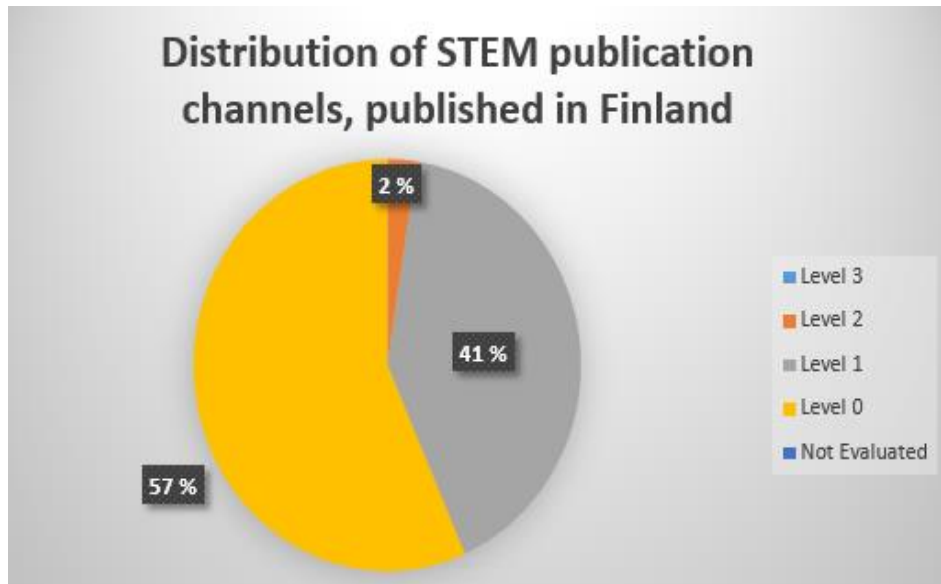
**Figure 5.** Distribution of publication types in the Humanities in the world, Publication Forum's classification



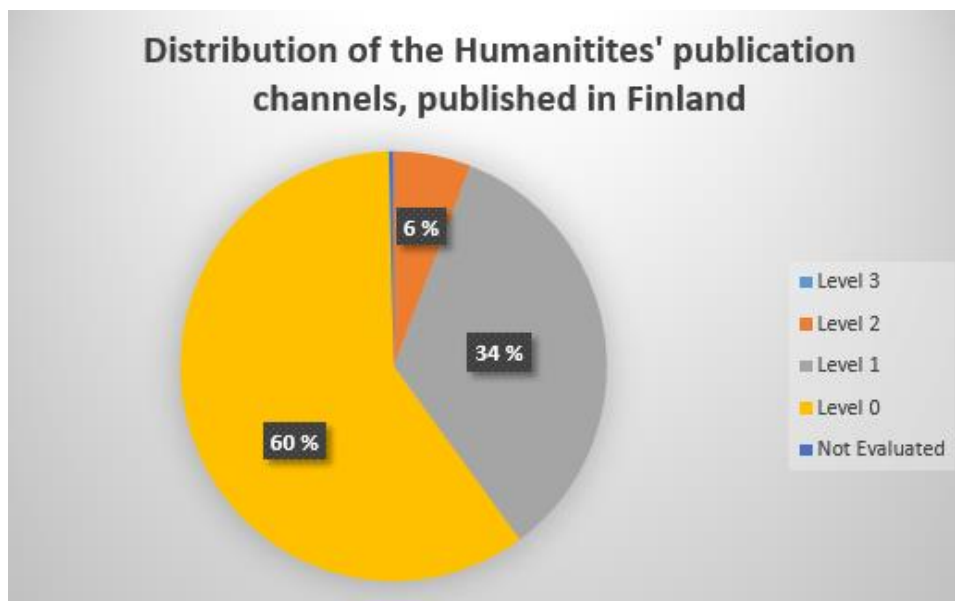
Figures four and five indicate that the publication channels' distribution for both STEM and the Humanities in the world is almost identical. Both fields have almost the same percentage of publication channels for level three and similar percentages of channels for levels two and zero. STEM fields have a slightly higher percentage of level one channels, 15 %, compared to 9 % in the Humanities. Overall, based on the distribution, we can see that both fields have equal opportunities for publishing at all four levels. It is important to note that the data, concerning the distribution of the publication channels, was taken as on the 13th of September 2018. It is impossible to retrieve the data, concerning the exact the number of publication channels in each level, which was in place during the years 2013 to 2016. However, as there were not any significant shifts in the classification system in the recent years, we suggest that the shares of the publication channels' distribution remained relatively stable over the course of the years 2013-2018. Therefore, even though the number of publication channels in each level might have slight changes, the overall proportion of the channels in each level remained more or less constant. This is why we can apply the results, obtained in September 2018, to the context of the years 2013-2016.

### **5.2.2 Publication types in Finland**

**Figure 6.** Distribution of publication channels in STEM fields published in Finland, Publication Forum's classification



**Figure 7.** Distribution of publication channels in the Humanities published in Finland, Publication Forum's classification



Based on the information presented in the pie charts six and seven, we can see that the distribution of the publication channels in Finland for both fields is very different from the distribution of the publication channels in the world. It is

possible to say that in both cases there are no publication channels for level three. It can be explained by the fact that only international publication channels of state-of-art research quality, which are mostly published in English, can be accepted for level three. However, as it is stated in the Publication Forum website, in the Humanities and Social Sciences level two channels also include Finnish and Swedish language forums. Perhaps this might explain the fact that the Humanities have a slightly bigger proportion of publication types in level two-six per cent against two per cent in STEM fields. The proportion of publication channels of level zero is almost identical in two fields, while STEM fields tend to have slightly more publication channels in category one: 41 % against 34 per cent in the Humanities. However, the difference is only four per cent. Therefore, it cannot indicate that the Humanities have a better position in this category. Overall, the opportunities for both fields in this category are equal. However, based on this criterion, we can see that one of the publication patterns in the Humanities- namely publishing in the national languages- is taken into account by the funding scheme. Publication channels of level two in the Humanities can be in Finnish and Swedish languages; therefore, it is an advantage for the field.

### **5.2.3 Distribution of publication types**

**Figure 8.** Distribution of the publication types, categories A to I in STEM fields in Finland, mean 2014-2016

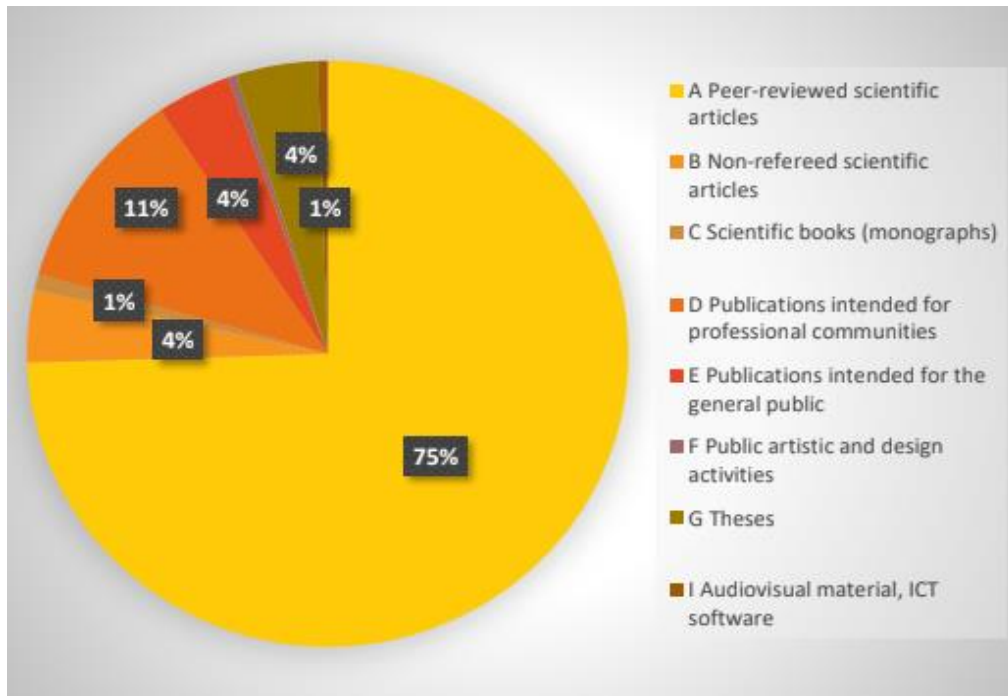
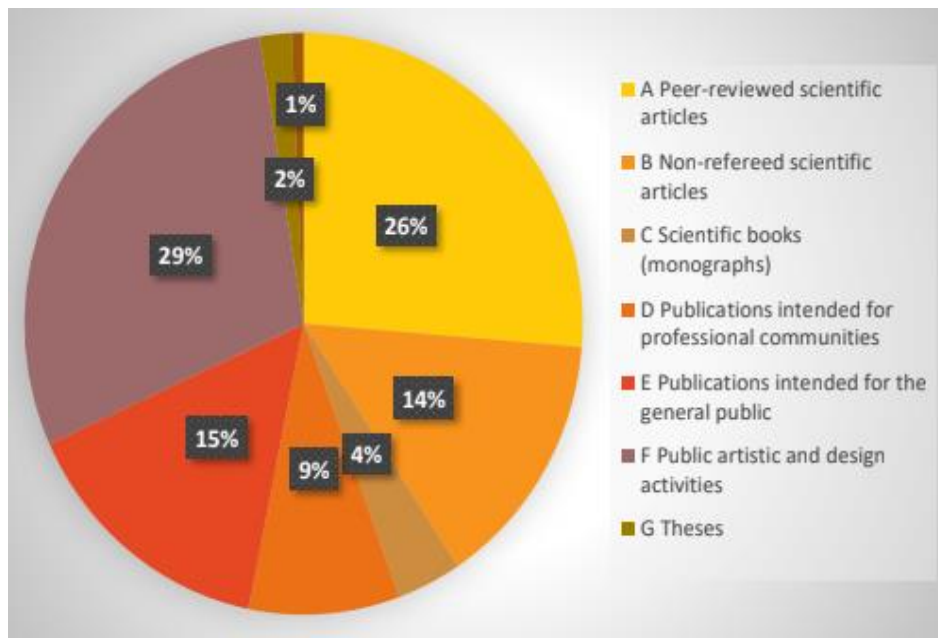


Figure eight clearly shows that peer-reviewed articles take almost 4/5 of all the publications in the field. This distribution might be explained by Becher's disciplinary differences theory. As Becher (1994) points out, most of the hard disciplines are 'competitive', 'accumulative' and have a high publication rate (Becher 1994, p.13). Since the main publication channel in STEM fields is peer-reviewed journals, it is logical that the publication rate in STEM fields is high, since it is easy to produce articles at a relatively high speed. As we could see from table two, level one publications are valued quite highly, especially if they are published in level three or two publication channels. Given that the proportion of peer-reviewed publication in STEM fields in Finland is quite high, one might suppose that they are weighted in the classification system also very high.

**Figure 9.** Distribution of the publication types, categories A to F in the Humanities in Finland, mean 2014-2016





What concerns the field of the Humanities, as figure nine shows, the distribution of publication types differs greatly from STEM fields. Becher (1994) highlights that the nature of knowledge in pure soft disciplines (to which the Humanities belong) is 'reiterative' and 'holistic'; the results of Humanities' research is often interpretative. Therefore, we can suppose that unlike in STEM fields, the publication pattern in the Humanities might be very different due to the nature of its knowledge. Indeed, as we can see from pie chart nine, the distribution of publication channels is different. Peer-reviewed articles take only a quarter of all publishing categories. Another quarter of publications takes public artistic and design activities. Other quite important parts of this distribution are publications of types B, D and E, which take respectively 14%, 9% 15% of all the publications. Since the Humanities research tends to be less 'strict' and more descriptive and pluralistic, only a relatively small part of them is published in the articles, which allows more freedom to express the findings in a way they need to be presented. It is to note that the proportion of articles published in non-peer-reviewed channels (category B) is significantly more in the Humanities than in STEM fields: 14 % against 4%.

However, concerning the funding system, the Humanities might not necessarily be in a very good position. As it is seen from table four, the publication categories apart from A and C are not valued highly by the research funding model. While the majority of publications in STEM are of level A and funded relatively generously, the typical publishing categories for the Humanities (B, D, E, F) are considered of much less importance and therefore, the funding system gives them fewer points. In this category, we can say that the Humanities are regarded as much less important as STEM fields, and the funding system does not take the different publication patterns of STEM and the Humanities into account.

#### 5.2.4 Ratio of peer-reviewed publications in STEM and the Humanities

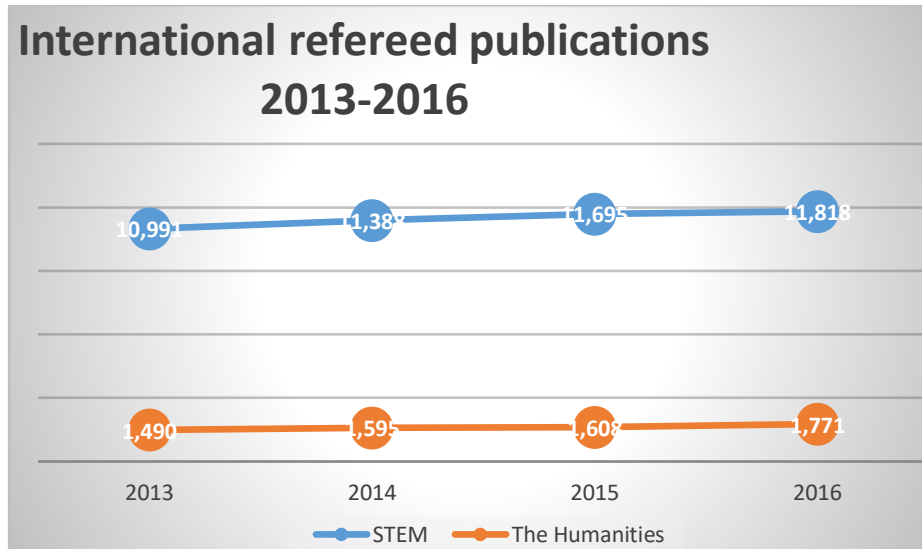
**Table 5.** The ratio of peer-reviewed vs non-peer reviewed publications in STEM and the Humanities, produced during years 2013-2016

	2013	2014	2015	2016
<b>STEM peer-reviewed vs non-peer-reviewed</b>	<u>10991:568</u>  (5,1% of publications are non-peer-reviewed)	<u>11388:439</u>  (3,8 % of publications are non-peer-reviewed)	<u>11695:342</u>  (2,9 % of publications are non-peer-reviewed)	<u>11818:331</u>  (2,7 % of publications are non-peer-reviewed)

<b>Humanities</b> peer-reviewed vs non-peer-reviewed	<u>1490:475</u>	<u>1595:472</u>	<u>1608:474</u>	<u>1771:426</u>
	(31,8 % of publications are non-peer-reviewed)	(29,5 % of publications are non-peer-reviewed)	(29,4 % of publications are non-peer-reviewed)	(27,5 % of publications are non-peer-reviewed)

Table five presents an important overview of the publications' ratios in the two fields. We can observe how the trend in the distribution of peer-reviewed versus non-peer-reviewed publications changed over a period of four years, from 2013 to 2016. Based on this table, we can see that the trend in the two fields is quite similar- that is, the number of non-peer-reviewed publications tends to lessen. However, the share of non-peer-reviewed publications in the two fields is vast. STEM fields reduced the percentage of non-refereed publications from 5, 1 % in 2013 to only 2, 7 % in 2016, which means that almost 98% of publications, produced by STEM fields, are refereed. The Humanities followed the same trend and reduced the number of non-refereed international publications from 31, 8 % in 2013 to 27, 5 % in 2016. This means that slightly more than 70% of publications, produced in the field of the Humanities, are non-peer-reviewed. This might mean that STEM fields have much bigger chances for better funding for publications than the Humanities.

**Figure 10.** The trend of international peer-reviewed publications in STEM and the Humanities, years 2013-2016



Based on figure ten, we can see that the share of international refereed publications increased in both fields. However, if the increase in the Humanities is hardly visible, the increase in the STEM fields is more evident. This means that even though the trend is similar for both fields, the share of international refereed publications grows faster in STEM fields than in the Humanities.

### 5.3 Competed research funding

The ministry of Finland describes this category in the following way: competed research funding 9%, internationally competed research funding 3 % and nationally competed funding and corporate funding 6%. To consider this criterion, I decided to split the criterion of competed research funding into three categories and see the outputs compared to one another for all three of them. The categories are the following: firstly, budgeted financing (Ministry of Education and Culture funding; that is, basic funding). Secondly, the national competed research funding, which comes from the following organisations: Academy of Finland, Business Finland, ministries, municipalities, Finnish trusts and foundations, Finnish companies and other public financings. Thirdly,

international competed research funding, which includes funding, available from foreign companies; EU programme framework funding; ERDF, ESF and other EU funding; foreign trusts and foundations; international organisations and other foreign financings.

To see the output of this category, a trend over the years 2013-2016 in competitive funding in STEM and the Humanities will be presented. After that, the proportions of the three main types of funding in both fields for the same years will be introduced.

### 5.3.1 Competitive funding trend in STEM and the Humanities

**Figure 11.** The trend of competed research funding in STEM subjects over the years 2013-2016

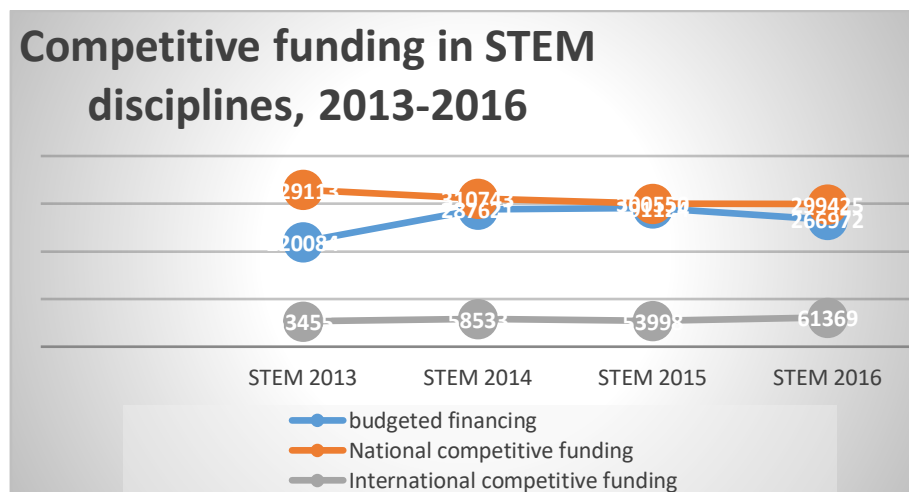
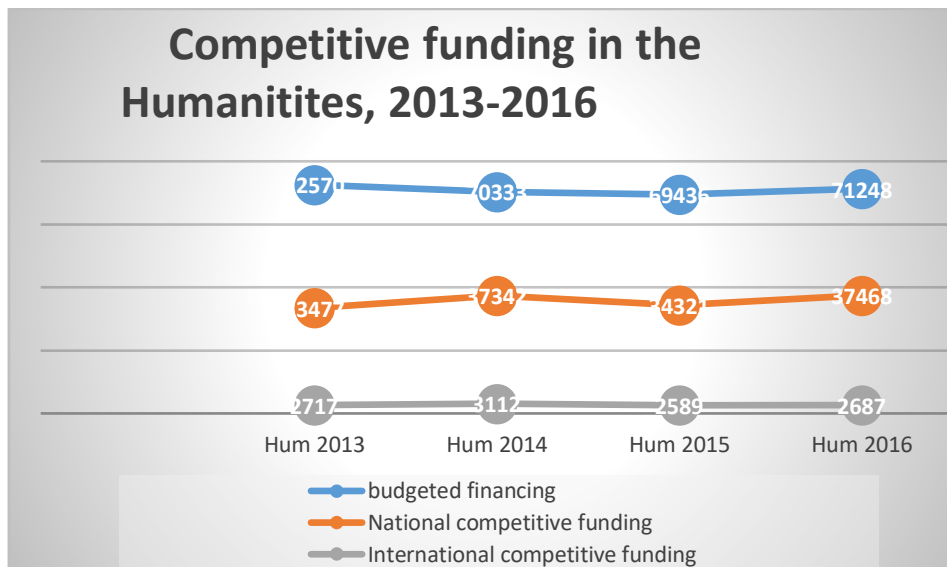


Figure eleven shows that in STEM fields the trends for three types of funding are slightly different. While the amount of internationally competed funding remained unchanged over the course of four years, national competed funding slowly went down over these years. The government funding increased a tiny bit and then started to decline again, hitting in 2016 the level, which is somewhat higher than in 2013. It has to be noted that the amount of national competed funding is slightly higher than that of government funding. However, the

amount of international competed funding is considerably lower than the other two types of funding.

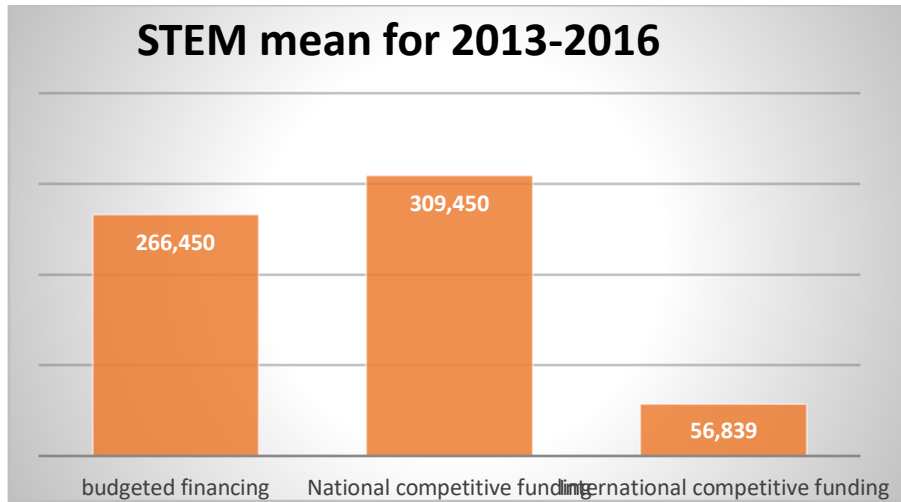
**Figure 12.** The trend of competed research funding in the Humanities over the years 2013-2016



As we can see from figure twelve, the situation with the competed funding in the Humanities is different from the one in STEM fields. All three types of funding remained stable over the course of four years. The only exception was the national competed funding, which had minor fluctuations. The share of government funding is much higher than the amount of national competed funding. In turn, the latter is significantly higher than the amount of international competitive funding.

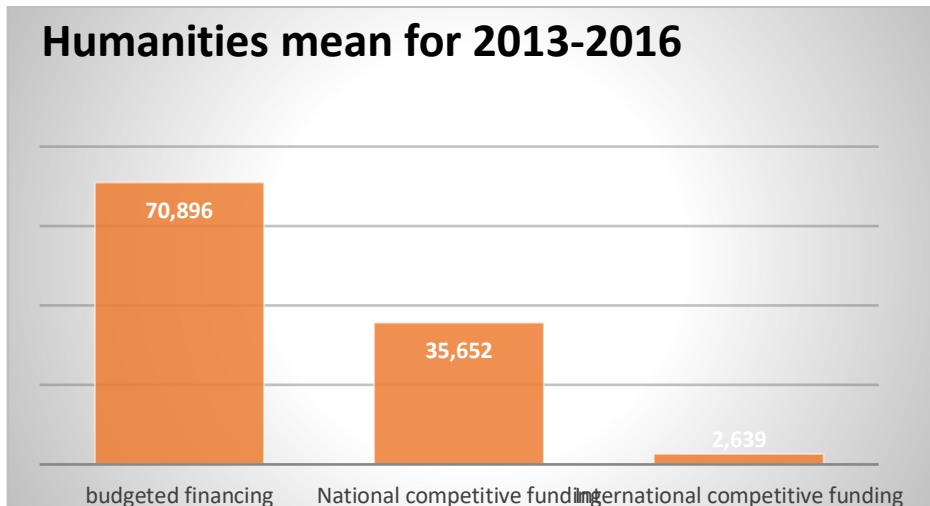
### 5.3.2 Three types of competed funding distribution in STEM and the Humanities

**Figure 13.** The mean of three types of competed funding for the STEM fields, years 2013-2016



Based on figure thirteen, we can see that approximately half of STEM fields funding comes from national competitive funding. Other 42% comes from the state budget and only about 9% of competed funding is gained internationally.

**Figure 14.** The mean of three types of competed funding for the Humanities, years 2013-2016



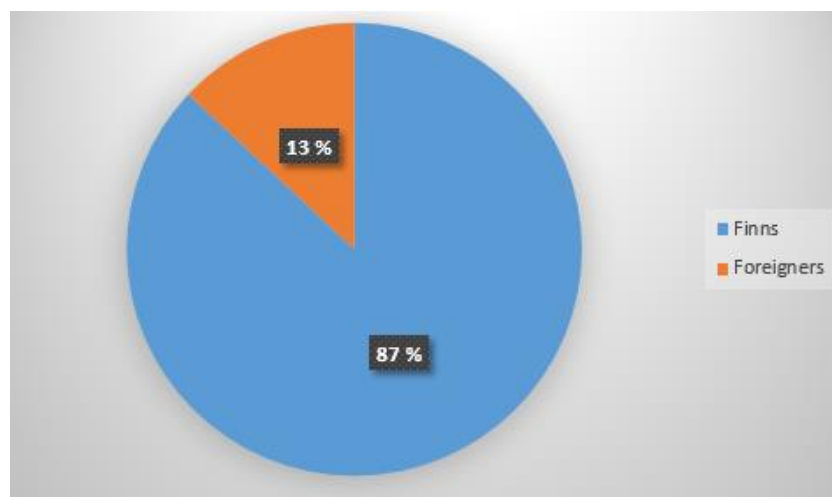
When it comes to the Humanities, the distribution of research funding is different from STEM fields. Figure fourteen indicates that 65 % of the Humanities' research funding comes from the Ministry of Education and Culture. Unlike in the case of

STEM fields, budgeted funding is the main funding source for research in the Humanities. National competed funding takes about 33% overall research funding for the Humanities and international competed funding is only about 2%.

As we know from the funding model, it takes into account nationally competed research funding (6 %) of research funding and internationally competed funding (3%). Based on figures thirteen and fourteen, we might suggest that STEM fields might have a somewhat higher chance to get a larger proportion of nationally competed funding. This category of funding is the largest one in STEM and takes up about 50% of overall funding, while in the Humanities nationally competed research funding account for only 33% of overall funding. The same can be applied for the proportion of internationally competed funding, as it constitutes 9% in STEM and only 2% in the Humanities. Even though internationally competed research funding accounts for only 3% and the numbers for both fields are not high in this criterion, we could still theoretically suppose that STEM might have a slightly better chance to succeed than the Humanities.

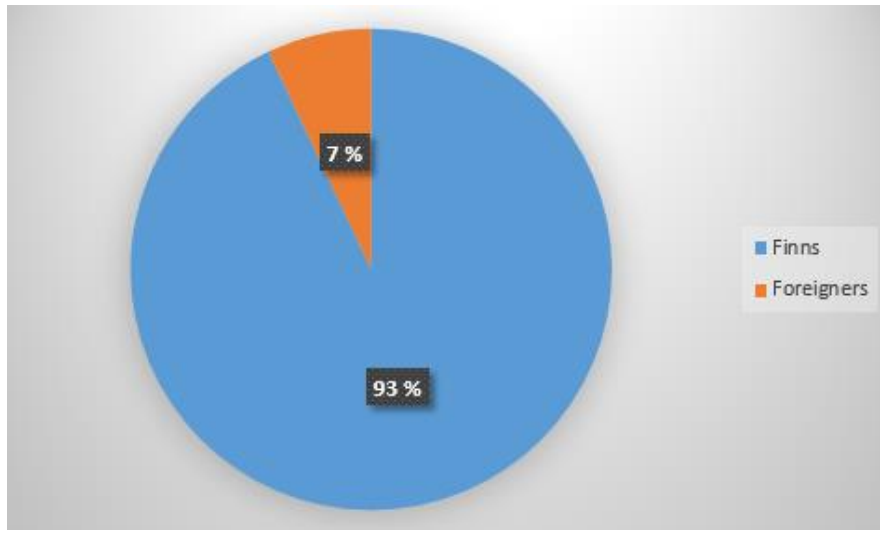
#### 5.4 International teaching and research personnel, 2 %

**Figure 15.** Percentage of Finns and foreigners employed at universities in STEM fields, 2014-2015 average





**Figure 16.** Percentage of Finns and foreigners employed at universities in the Humanities, 2014-2015 average



As it was the case in some of the categories as mentioned above, in this case, we cannot compare the number of persons, employed for research in two fields directly. The results would not be valid because they would show a difference in the sizes of the fields and would not say anything about the two fields, compared to one another. This is why we compare them indirectly, looking into the percentages of Finns versus foreigners in each field. The percentage of funding distribution for this category is relatively small (only 2%). In this case, 'foreigners' refers to the persons, who were born outside Finland.

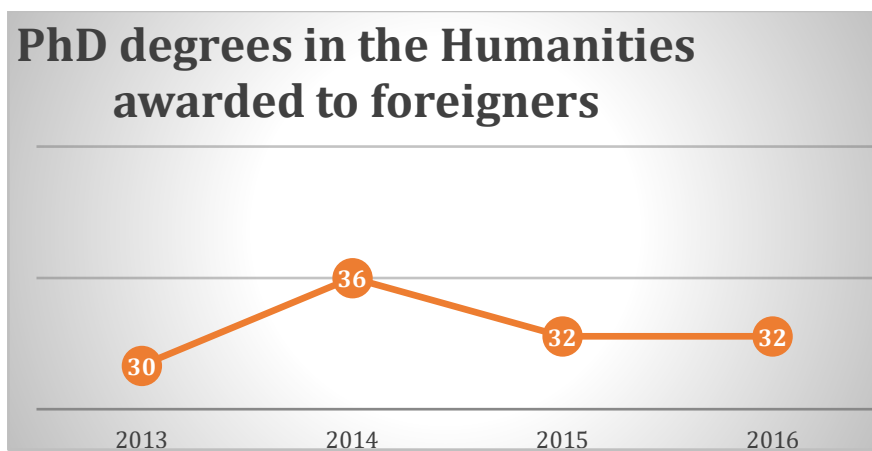
We can see from figures fifteen and sixteen that the percentage of foreigners, involved in research in both fields, is not very high: 13% in STEM versus 7% in the Humanities. Therefore, as the share of this criterion in the research-funding model is small and the difference between the percentages in the fields is not very significant either, we cannot say anything about one of the fields having better chances for funding than another one, based on this criterion.

### **5.5 The number of PhD degrees awarded to foreign nationals, 1%**

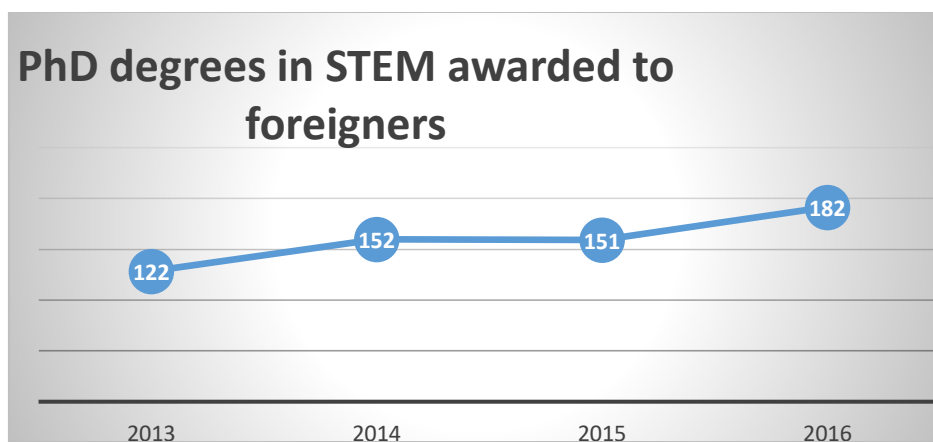
Even though this category takes up only one per cent in the funding model, we will nevertheless study it as part of background information.

As in some of the previous categories, it is rather pointless to compare the absolute numbers of the degrees earned in both fields, since the fields are very different in size. Instead, we are looking into the trend of degrees distribution over the course of four years, to see in what way the trends changed under the funding model 2013-2016.

**Figure 17.** The number of PhD degrees, awarded to foreign nationals in the Humanities, years 2013-2016



**Figure 18.** The number of PhD degrees, awarded to foreign nationals in the STEM fields, years 2013-2016



As we can see from the figures seventeen and eighteen, the trends of awarding PhD degrees to foreign nationals in both fields is rather different. The number of degrees, granted to foreigners in the Humanities remained relatively stable, with only one rather significant fluctuation in 2014. On the contrary, the number of PhD degrees awarded in STEM fields grew slowly but steadily over the course of four years, when the funding model 2013-2016 was in place. Even though the results of this category comprise only one per cent in the funding model and cannot speak anything about the position of two disciplines on the funding scheme, these trends might tell something about how the two fields felt under this funding scheme. Besides, this piece of information might potentially say something about the general attractiveness of pursuing a PhD in two mentioned fields. However, these kinds of questions are rather different from the ones, used for this study and will not be studied in detail in this thesis.

## **6. DISCUSSION**

### **6.1 Findings**

The primary aim of this study was to comprehend whether the Finnish research-funding model for the years 2013-2016 favoured STEM disciplines rather than the Humanities and whether the specific features of the two fields - namely disciplinary differences- were taken into account in this funding model. The analysis of the funding model's output for all the five categories, which comprise the funding model, was carried out to reach a goal of this study in the best manner possible. Besides, background information, such as the distribution of publication channels in the world in STEM fields and the Humanities, was introduced to present the results of the study more accurately.

As it was mentioned in chapter five, it was impossible to compare STEM fields and the Humanities directly. The fields of the sizes differ greatly; research in STEM fields is much more expensive than research in the Humanities due to

the complex equipment, often needed for STEM research. Besides, the forms, in which research findings come in STEM and the Humanities is quite different. However, every attempt has been made to compare these two very different fields indirectly, by comparing various indicators inside each field rather than contrasting two fields one against the other.

The results of this study turned out to be largely complex. The only criteria, producing data, which would unambiguously say something about the position of STEM fields and the Humanities, were the share of publications in both fields, the distribution of publication types, and the ratio of peer-reviewed versus non-peer-reviewed publication channels in both fields. The rest of the criteria could not contribute to the results of this study in a direct way. However, it did provide very good background information about the position of the two fields in general. This type of information will be discussed later in this part. Besides, most of these criteria constituted only a small percentage of the funding model. Therefore, they did not play a determinative role in the funding distribution.

Based on the data, which deals with the share of publication types, we could say that the funding model might unintentionally prioritise STEM fields. This field has a huge share of type A publications, which are the most highly rated peer-reviewed articles. Besides, these publications generate a generous amount of points for publishing on the scale of the Publication Forum. As we can see from the funding model classification, publication types A are regarded as very important ones. According to Becher's (1989) theory of disciplinary differences, hard pure and hard-applied fields (to which STEM fields belong) tend to produce many articles, which fall under the category A. Since they also tend to publish at quite a high speed, STEM fields have very good chances to succeed in producing this type of publications. As we can see from table five, over the course of three years the amount of non-peer-reviewed publications in STEM fields gradually continues to reduce. In 2016, only four per cent of all publications in STEM fields were non-peer-reviewed. Therefore, they had a good chance to be generously rewarded by producing the publications, which are highly valued by the Publication Forum. Besides, type A publications are published at a much higher

speed than, for example, those of type C. Therefore, STEM fields tend to publish relatively a lot in the most highly rated journals. The funding system 2013-2016 highlighted the importance of 'international referred' publications, by allocating them 9 % of funding. This is almost one-third of all funding, which goes to research. Since the share of this type of funding is very significant in STEM fields, we can claim that the funding model does give priorities in publications to STEM fields by stressing the importance of the publications' types, which typical for STEM fields.

The Humanities, on the other hand, do not seem to be placed in an excellent position by the funding model. However, the Humanities do get some incentives when it comes to publications. For example, some of the Finnish and Swedish-speaking journals belong to publication type 2, even though for the other fields the journals, belonging to this category, are international and in most cases are published in English. This is apparently an incentive, which could have been made to promote the publications in Finland's national languages in the Humanities. Despite this, we could say that the funding model does not pay much attention to the peculiarity of the publication pattern of the Humanities, which is rather different from the one in STEM fields. According to Becher's (1989) theory of disciplinary differences, soft pure disciplines, such as the Humanities, tend to produce publications at a relatively slow pace. Besides, the share of type A publications in the Humanities is relatively low, due to its publication patterns, which are very different from STEM fields. As we can see it from figure nine, refereed publications take up only 26% of all publications in the field (while in STEM fields they take up 75%). At the same time, other significant publication types in the Humanities (which are publication categories D, E and F) are not considered as very important by the funding model, since the amount of points, given for these publications by the Publication Forum model, is relatively low. Therefore, the Humanities get fewer opportunities to generate points from the government and, consequently, less funding. Table five indicates that when the funding model was active, the percentage of non-peer-reviewed publications in the Humanities decreased from almost 32% to 27,5 %. These

numbers show that the position of the Humanities in research is becoming better, but at quite a slow pace. Overall, concerning the scientific publications, the Humanities did not perform as well as STEM fields did.

Even though a few components of the funding model were taken and explained only as a piece of background information for this study, these components might also tell something about the position of STEM fields and the Humanities in the funding model 2013-2016. For example, points 5.1 and 5.5 might potentially say something about the interest of Finnish and foreign PhD students in researching STEM and the Humanities in Finland. Even though these two components deal with slightly different criteria (5.1 speaks about the number of PhD degrees attained in two fields in general, point 5.5 elaborates on the dynamics of PhD degrees, attained by foreign PhD candidates), the trend in the results for both categories is quite similar. While the number of PhD graduates (both Finns and foreigners) remained constant in the Humanities over the course of the years 2013-2016, the number of PhD graduates in STEM (also both Finns and foreigners) continued to rise steadily. The number of PhD degrees, which are to be attained in each field, are subject to the target set for the contract period, and the universities are not very much interested in producing more than that since they do not get any reward for that. However, it is clear while a number of attained PhD degrees in STEM fields steadily rose, the same indicator remained stable in the Humanities. Perhaps this criterion might potentially say something about the funding opportunities for doing research in both fields and how promising is the opportunity of doing a PhD in both fields for students. However, other types of studies are needed to answer these questions. Therefore, in this thesis, they will not be taken into consideration. Moreover, PhD students, who graduated when the funding model 2013-2016 was in place, started doing their degrees when previous funding models were active. Therefore, this criterion might indicate the information, which is more applicable to the previous funding models than the one, used in this study.

Point 5.3 elaborates on the differences in the funding sources between STEM fields and the Humanities. Again, while this sort of information cannot

give us straightforward answers to the research questions, it gives a very good overview of the funding situation in both fields. The most extensive part of the funding in the Humanities comes from the government, and the amount of funding from national companies is significantly lower than in STEM. On the one hand, this dynamic might be explained by the fact that through funding STEM fields it is possible to get the research results, which can afterwards be used in creating new products. In this perspective, it is rather logical that the companies are quite interested in financing STEM fields. Besides, the possibilities of investing in the Humanities' research, which afterwards would be able to create products that could be widely sold in the market, are quite scarce. In this respect, it is quite evident why STEM fields are widely financed by the national companies and the Humanities are not so much. However, the fact that the Humanities seldom produce the research results, which can immediately be turned into financial benefits, can lead us to another discussion. That is the relevance of the Humanities in today's technologically developed world. Since this is a whole other story- and a whole other study, it is not investigated in this thesis.

## **6.2 Limitations**

As it is the case in every research, this research has its limitations, too.

Firstly, some data, required for the study, was impossible to retrieve. As the data were analysed under the funding model 2013-2016, it would be right to analyse all data for these four years in all the components of the funding model to present a complete picture. However, as some data was absent from the statistics database, the numerical data for some components were analysed for the years 2014-2016. In one case for the years 2015-2016. While the complete statistics would probably not have changed the results in a significant manner, it would make the results of this study clearer and more precise.

Secondly, the scope of research was conceivably not big enough. A few categories, included in this study, were used only for background information only. While they did contribute to the clearer understanding of the position of STEM fields and the Humanities under the funding model, these categories did not themselves give any answers to the research questions. The main category, used in this study to answer the research questions, was the share of publication channels in each of two fields and the ratio of peer-reviewed versus non-peer-reviewed publications. While these categories produced clear and reliable results, to see the position of the two fields in a more precise way, research that is more extensive is needed. The study of the same phenomenon over the course of more years and under different funding model would provide a better overview of how the funding models treat STEM fields versus the Humanities. Besides, several interviews with the policymakers and researchers in both fields would provide more in-depth results of how the two fields are regarded by the government. Lastly, an extensive overview of policies and the ways they treat both fields would help to build results that are more comprehensive.

### **6.3 Future research**

Even though some of the points, mentioned in limitations, might already indicate some ideas for future research, there are also a few further suggestions. It would be a good idea to make the same study for the next funding model, which is functioning from 2017 onwards along with the policies, on which this model is based, and the statistical data for the years from 2017 onwards, available now. It would give an insight into whether the same policy priorities would continue to dominate the position in the research of the two fields. Moreover, as the core-funding model for the universities, starting from 2021 onwards is now available, an overview of that new funding model and the policies, on which it is based, might be highly relevant. It would provide a way to predict whether the funding model would continue to prioritise STEM fields through its funding model or whether the situation would change in the future.



Besides, to get more comprehensive results of this study, it is possible to analyse the part of the research-funding scheme, which deals with university education. One could do a comparison of such components as the proportion of Bachelor's and Master's students, their dynamics over the time when the funding model was in place, number of students who gained at least 55 credits during an academic year and other points of the funding plan for STEM fields and the Humanities. This type of information would not provide exact answers to the question 'Whether the funding model prioritises STEM fields rather than the Humanities', but it would give some useful knowledge about the interest of students and their motivation in studies in these two fields. This kind of data would, in turn, provide some background information about the position of each field and their ability to attract students. However, as it was the case in this study, it would not be possible to compare those criteria directly. This type of research can be done both for the funding model 2013-2016 and for previous models. This would help to see the context of both fields' performance in the past and the dynamics of change. It is also possible to do a similar investigation for the funding model, which is functioning now. This would allow seeing whether the past trends in both fields continue or not.

## **Afterword on the value of the Humanities**

*"In the end, the humanities can only be defended by stressing how indispensable they are; and this means insisting on their vital role in the whole business of academic learning, rather than protesting that, like some poor relation, they don't cost much to be housed."*

Terry Eagleton (literary theorist, critic and public intellectual), 2010

At this stage, when the study is completed and the findings are presented, I would like to come back to the aspect, which primarily served as a starting point to conduct this study. Namely, I would like to offer some reflections on why the

Humanities are significant in the first place and why they are still relevant even nowadays, in the era of KE. I hope that the results of this study, as well as this reflection, will convince the reader that the Humanities are still important and worth studying and advancing in academia and outside of it.

Sometimes the results of academics' work do not produce immediately visible results and thus they go unnoticed at first sight. In the society, which rests on technological and scientific advancements, this is especially true for the Humanities ('It's the Humanities, stupid!', 2016). Meanwhile, it is argued that the Humanities are not less important for economic development and innovation than STEM fields. Holm et al. (2014) claim that even though societies invest all the resources in STEM fields to achieve market growth, but they forget about generators of ideas and innovations and systems for producing that, which are most often originate in the Humanities. Indeed, it is hard to underestimate the value of the Humanities, which is itself a rather complicated issue. The following categories of expressing the value of the Humanities are mentioned in the World Humanities report: "intrinsic value, informing social policy, understanding cultural heritage, promoting economic value, contributing to other academic disciplines, feeding through to undergraduate education and promoting critical thinking and innovation"(Holm at al., 2014). Each of these categories is sophisticated and includes many points, however, the list is incomplete as is it nearly impossible to list all existing values of the humanities. What concerns the social functions of the Humanities, they include facilitating the coexistence of fundamentally different human beings, promotion the understanding of other cultures and thus allowing peaceful coexistence and conflicts' resolution without violence and transforming information into knowledge, there are also many other examples ('It's the Humanities, stupid!', 2016). The benefits of the Humanities to the society include preservation and making distinction between different types of understanding; assistance in preservation and understanding of culture; a large contribution to individual and collective happiness; providing a significant input into sustenance and promotion of democracy and democratic values; and the humanities' intrinsic value, to name only a few (Small 2013).

**APPENDIX 1.** Publication type classification (directly reproduced from the Ministry of Education and Culture, 2016)

<p><b>A Peer-reviewed scientific articles</b></p> <ul style="list-style-type: none"> <li>- Fulfil the definition of a scientific publication;</li> <li>- Fulfil the definition of peer review;</li> <li>- The journal/series publishing the article has an ISSN identifier, and research books have an ISBN identifier.</li> <li>- If the article is an introduction to a book or a journal, the author must provide a research contribution to it;</li> </ul>	
<p><b>A1 Journal article – refereed</b></p>	<ul style="list-style-type: none"> <li>- An article in a scientific journal, series or yearbook;</li> <li>- Mainly includes unpublished material;</li> </ul>
<p><b>A2 Review article in a scientific journal</b></p>	<ul style="list-style-type: none"> <li>- A review article (e.g. review, systematic review, meta-analysis) in a scientific journal, series or yearbook;</li> <li>- Fulfils the definition of a scientific publication with the exception of the requirement to generate new information;</li> <li>- Is based on key original article material on the subject;</li> </ul>
<p><b>A3 Book chapter</b></p>	<ul style="list-style-type: none"> <li>- An article, an introduction or a preface in a published scientific research book consisting of articles by various authors;</li> </ul>
<p><b>A4 Article in conference proceedings</b></p>	<ul style="list-style-type: none"> <li>- Published regularly in the printed or otherwise publicly available publication of a scientific conference;</li> <li>- A complete written version of a conference presentation (full paper);</li> <li>- Conference publications are typical in the fields of IT sciences. In other fields, conference articles are mainly research books or special issues of journals;</li> <li>- The refereed articles in research books consisting of one-off conferences are entered under category A3 and the refereed articles of special issues in journals under categories A1 to A2.</li> </ul>

<p><b>B Non-refereed scientific articles</b></p> <ul style="list-style-type: none"> <li>- Fulfil the definition of a scientific publication;</li> <li>- The journal/series publishing the article has an ISSN identifier, and research books have an ISBN identifier.</li> <li>- If the article is an introduction to a book or a journal, the author must provide a research contribution to it;</li> </ul>	
<b>B1 Journal article</b>	<ul style="list-style-type: none"> <li>- Non-refereed articles in scientific journals, such as articles, brief case reports, brief review articles, editorials, book reviews, discussions, letters or comments</li> </ul>
<b>B2 Book chapter</b>	<ul style="list-style-type: none"> <li>- An article, an introduction or a preface in a published scientific research book consisting of articles by various authors</li> </ul>
<b>B3 Article in conference proceedings</b>	<ul style="list-style-type: none"> <li>- Published regularly in the printed or otherwise publicly available publication of a scientific conference;</li> <li>- A complete written version of a conference presentation (full paper);</li> <li>- Conference publications are typical in the IT field. In other fields, conference articles are mainly published in research books or special issues of journals;</li> <li>- The non-refereed articles in research books consisting of one-off conferences are entered under category B2 and the non-refereed articles of special issues in journals under category B1;</li> </ul>
<p><b>C Scientific books (monographs)</b></p> <ul style="list-style-type: none"> <li>- Fulfil the definition of a scientific publication;</li> <li>- Fulfil the definition of peer review;</li> <li>- The book has an ISBN number.</li> </ul>	
<b>C1 Scientific book</b>	<ul style="list-style-type: none"> <li>- The entire book was written by its author(s);</li> <li>- A new edition of the book may be reported on if the book has been modified sufficiently compared to the previous edition.</li> </ul> <p>(Note. Non-refereed monographs are entered under category D4, D5 or E2)</p>

<b>C2 Edited book</b>	<ul style="list-style-type: none"> <li>- Edited scientific book or special issue of journals consisting of various articles by different authors;</li> <li>- The authors have been in charge of editing the book, and their names are indicated among the editors.</li> </ul> <p>(Note. Non-refereed edited books are entered under category D6 or E3)</p>
<b>D Publications intended for professional communities</b> <ul style="list-style-type: none"> <li>- Fulfil the definition of a professional publication;</li> <li>- These also include publications in journals with no ISSN identifier or scientific books with no ISBN identifier</li> <li>- If the article is an introduction to a book or a journal, the author must provide a research contribution to it;</li> </ul>	
<b>D1 Article in a trade journal</b>	<ul style="list-style-type: none"> <li>- An article in a journal for the professional public;</li> <li>- An article in a scientific journal with no ISSN identifier.</li> </ul>
<b>D2 Article in a professional research book (incl. editor's introduction)</b>	<ul style="list-style-type: none"> <li>- An article in a professional manual or guide, information system or research book, text book material or short articles in an encyclopaedia.</li> <li>- Note. The introduction or preface must have research contribution</li> </ul>
<b>D3 Professional conference proceedings</b>	<ul style="list-style-type: none"> <li>- Published regularly in the printed or otherwise publicly available publication of a scientific conference;</li> <li>- A complete written version of a conference presentation (full paper)</li> </ul>
<b>D4 Published development or research report or study</b>	<ul style="list-style-type: none"> <li>- A published development or research report or study based on research or expert work</li> <li>- The publisher is generally a non-scientific publisher, usually a public party such as a ministry, a financier, a higher education institution or research institution.</li> </ul>

<b>D5 Text book, professional manual or guide or a dictionary</b>	<ul style="list-style-type: none"> <li>- A published professional book, text book, a professional manual or guide or a dictionary.</li> <li>- The book has an ISBN number.</li> <li>- (The category does not include handouts, online or other similar material created solely for a single course)</li> </ul>
<b>D6 Edited professional book</b>	<ul style="list-style-type: none"> <li>- An edited, published professional research book consisting of articles by various authors;</li> <li>- The authors have been in charge of editing the book, and their names are indicated among the editors.</li> </ul>
<b>E Publications intended for the general public</b> <ul style="list-style-type: none"> <li>- Fulfil the definition of a popular publication</li> </ul>	
<b>E1 Popularised article, newspaper article</b>	<ul style="list-style-type: none"> <li>- An article, review or editorial in a journal, series, research book or online platform for the general public (e.g. alusta.uta.fi).</li> <li>- The category does not include brief comments or letters to the editor. Long addresses in which the individual often uses the name of the home organisation will be taken into account in the data collection procedure (e.g. expert articles in Helsingin Sanomat, the Tebatti addresses in Talouselämä magazine).</li> <li>- Articles written by the author while working for the newspaper or magazine are not included in the category.</li> </ul>
<b>E2 Popularised monograph</b>	<ul style="list-style-type: none"> <li>- A published non-scientific, popular book</li> </ul>
<b>E3 Edited popular book</b>	<ul style="list-style-type: none"> <li>- An edited, published popular research book consisting of articles by various authors;</li> <li>- The authors have been in charge of editing the book, and their names are indicated among the editors.</li> </ul>
<b>F Public artistic and design activities</b> <ul style="list-style-type: none"> <li>- Fulfil the definition of an artistic publication, see the definitions in the Ministry of Education and Culture data collection manual.</li> </ul>	

<b>F1 Published independent work of art</b>	- An independent art publication that is not part of another work of art or does not contain elements that can be considered independent artistic publications.
<b>F2 Public partial realisation of a work of art</b>	<ul style="list-style-type: none"> <li>- An art publication can have a close, inseparable relationship with a co-publication, but it can still be valued as a separate work as per field-specific practice (for example, the staging of a play, a painting in a co-exhibition, a chamber musician's part in a concert, an actor's performance).</li> <li>- The compilation work for a publication is also entered under this category, i.e. the selection of parts, defining general artistic policies and working on the partial publications with the authors to make them fit within the publication (for example, directing a dramatic work, artistic directing/production of concerts).</li> </ul>
<b>F3 Artistic part of a non-artistic publication</b>	- An artistic part of a publication that is not primarily artistic but is valued as art within the art community (for example, the design of a product in the market, a demanding composition for an advertisement).
<b>G Theses</b>	
<b>G1 Polytechnic thesis, Bachelor's thesis</b>	
<b>G2 Master's thesis, polytechnic Master's thesis</b>	
<b>G3 Licentiate thesis</b>	- Note: If the work consists of articles, the articles will be entered separately under categories A to E;
<b>G4 Doctoral dissertation (monograph)</b>	- A doctoral dissertation (monograph) published in a university or institutional series, a published doctoral dissertation (monograph) or privately printed doctoral dissertation (monograph);
<b>G5 Doctoral dissertation (articles)</b>	- Note: If the work consists of articles, the articles will be entered separately under categories A to E;
<b>H Patents and innovation announcements</b> Definitions in the Ministry of Education and Culture data collection manual.	
<b>H1 Granted patent</b>	

<b>H2 Invention announcement</b>	
<b>I Audiovisual material, ICT applications</b>	
- Fulfil the definition of audiovisual material and ICT applications, see the definitions in the data collection manual of the Ministry of Education and Culture.	
<b>I1 Audiovisual material</b>	<ul style="list-style-type: none"> <li>- Published audiovisual material that does not fall within any of the other categories based on its content.</li> <li>- The author is usually the editor or the producer of the material.</li> <li>- Series comprised of several episodes or with a continuous plot are reported only once.</li> </ul>
<b>I2 ICT software</b>	- ICT software released as a commercial software or freeware.

**APPENDIX 2.** The Publication Forum ratings (Retrieved on April 17, 2019; directly reproduced from the Publication Forum, 2015).

**Level 1** includes foreign and domestic channels specialised in the publication of scientific research results. The minimum requirements include an editorial board constituted by experts of the discipline as well as regular peer-review focusing on the entire manuscript. A local peer-reviewed publication channel (such as university-specific series) will not be admitted to Level 1 if they are mostly acting as the organisation's own researcher forum (over half of the authors come from the same organisation).

**Level 2** includes scientific publications channels extensively appreciated and followed by the expert audience in the discipline or research area, with the researchers seeking to publish their best work in these publications. Level 2 is mainly awarded to international scientific publications channels, with the editors, authors and readers representing various nationalities. In humanities and social sciences, Level 2 also includes the leading Finnish or Swedish-language publication channels that cover the research in the special features of



the Finnish society, culture and history in the particular field as widely as possible.

**Level 3** is a subgroup of Level 2. It includes the most comprehensive international publication channels in discipline or research area in question with a very high impact (e.g., as measured through citation indicators). The editorial boards are constituted by the leading researchers in the field, and publication in these channels is highly appreciated among the international research community of the field.

**Level 0** includes all evaluated publication channels not rated as Level 1.

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