Redefining the Role of Higher Education

The case of Third Mission practices of Icelandic universities

Verena Karlsdóttir

Thesis for the degree of Philosophiae Doctor

September 2023

School of Social Sciences

FACULTY OF BUSINESS

UNIVERSITY OF ICELAND

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Endurmat á hlutverki háskólastigsins

Greining á þriðja hlutverki háskóla á Íslandi

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Háskólaprent ehf.

Abstract

This study revolves around Third Mission (TM) activities in Iceland and the factors that influence the development of such activities within a small economy. In the context of higher education institutions, TM can be seen as a socio-economic mission of a university, which comes after the first mission of teaching and the second mission of research.

The objective of the study is to provide recommendations for universities on how to achieve the TM best practices that will foster the more traditional missions within academia by analysing collaboration patterns and socio-economic engagement. The data derive from a literature review, semi-structured interviews, and a population survey.

The findings reveal a general lack of TM activities caused by shortages of time, incentives, networks, and resources such as financial means, but a general optimism and willingness to participate more are also present. Overall, TM activities in the form of direct exploitation of research through contract research or commercialisation are very limited among academics in Iceland. There are hardly any differences between universities regarding the aforementioned results, but TM activities are influenced by the type of discipline, publication performance, work experience, and personality traits such as openness.

Based on these outcomes, the main recommendation drawn from this study is that TM activities – including those that have so far been less considered or recognised even though they often have the potential to yield societal impact in the long-term – be acknowledged more. Additionally, universities should adopt appropriate assessment and incentive systems to support TM, change recruitment guidelines so a more diverse academic staff can be hired, establish interdisciplinary networks, and incorporate TM into the first two missions of research and teaching. However, for this to work, greater financial resources are needed.

Ágrip

Þessi rannsókn fjallar um þriðja hlutverk háskóla á Íslandi og þá þætti sem hafa áhrif á slíkt hlutverk í litlu hagkerfi. Líta má á þriðja hlutverkið sem frumkvöðlastarfsemi háskóla, þegar fyrsta hlutverkið er kennsla og annað hlutverk eru rannsóknir.

Í rannsókninni er samstarfsmynstur háskóla, fyrirtækja og stofnana greint sem og félagsleg og efnahagsleg þátttaka háskólakennara. Stuðst er við hálf-stöðluð viðtöl, spurningalistakönnum og fræðilegt yfirlit. Niðurstöður eru notaðar til að veita háskólum ráð til að efla og styðja við þriðja hlutverkið.

Niðurstöður sýna almennt að þriðja hlutverk háskóla er mjög takmarkað meðal háskóla á Íslandi og stafar það af tímaskorti, lítilli hvatningu, takmörkuðu tengslaneti og skorti á fjármagni. Mjög lítill munur er á milli háskóla í þeim efnum, en nokkur munum er á milli fræðigreina, starfsheita í háskóla og persónuleikaeinkennum.

Á grundvelli þessara niðurstaðna eru mótaðar tillögur til háskóla um að efla þriðja hlutverkið sem svo aftur hefur möguleika á að efla samfélagsleg áhrif háskóla til lengra tíma litið. Að auki ættu háskólar að taka upp viðeigandi mats- og hvatakerfi til að styðja við þriðja hlutverkið, breyta ráðningarreglum til að ráða starfsfólk með ólíka hæfileika, koma á þverfaglegu tengslaneti og tengja þriðja hlutverkið við rannsóknir og kennslu. Til að svo megi verða þarf meira fjármagn til háskóla.

Að lokum er í doktorsritgerðinni lögð áhersla á mikilvægi virkrar félagslegrar- og efnahagslegrar þátttöku fræðimanna á öllum fræðasviðum. Þáttur í því er að gera þriðja hlutverkið sýnilegra innan og utan háskóla og taka tillit til slíkrar starfsemi í hvata- og matskerfi háskóla. Með því vekur rannsóknin athygli á mikilvægi þess að háskólar ræki frumkvöðlahlutverk sitt.

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List of Publications

The thesis is based on the following original publications, which are referred to in the text by their Roman numerals (I-IV).

Journal articles (published):

I. Schnurbus, V., & Edvardsson, I. R. (2020). The Third Mission Among Nordic Universities: A Systematic Literature Review. *Scandinavian Journal of Educational Research*, *66*(2), 238-260. https://doi.org/10.1080/00313831.2020.1816577

II. Karlsdottir, V., Edvardsson, I. R., & Heijstra, T. M. (2021). "Nothing happens in a vacuum here": university-industry collaboration in Iceland. *International Journal of Knowledge-Based Development, 12*(1), 35-56. https://doi.org/10.1504/IJKBD.2021.119049

III. Karlsdottir, V., Torfason, M. T., Edvardsson, I. R., & Heijstra, T. M. (2023). Assessing Academics' Third Mission Engagement by Individual and Organisational Predictors. *Administrative Sciences, 13*(1), 9. https://doi.org/10.3390/admsci13010009

IV. Karlsdottir, V., Torfason, M. Þ., Edvardsson, I. R., & Heijstra, T. M. (2023). Barriers to academic collaboration with industry and community: Individual and organisational factors. *Industry and Higher Education*. Advanced online publication. https://doi.org/10.1177/09504222231173953

List of other authored publications during the course of this research (not included in this thesis):

Verena Karlsdóttir, Magnús Þór Torfason, Ingi Rúnar Eðvarðsson, og Thamar M. Heijstra (2022). Þriðja hlutverk háskóla í íslensku samfélagi: Greining á umfangi og áherslum. *Tímarit um viðskipti og efnahagsmál*. *19*(1),1-26. https://doi.org/10.24122/tve.a.2022.19.1.1

Conference article:

Schnurbus, V. (2019). *University-Industry Collaboration in Iceland. Barriers and Drivers of Knowledge Transfer*. Research-in-Progress Article. 17th Interdisciplinary European Conference on Entrepreneurship Research (IECER), University of Utrecht, 2019.

1 Introduction

1.1 Research focus and structure of the thesis

1.1.1 Research focus

This research investigates the concept of an active university that purposely engages in various activities and initiatives beyond traditional teaching and research, such as community involvement, industry partnerships, and innovation. It thus emphasises a dynamic approach to education and research and aims to contribute to the broader society by addressing societal challenges and fostering economic development. This approach has emerged as a strong framework that highlights the significance of three main roles of the university: teaching, research, and socio-economic engagement. This thesis investigates the extent to which academics in Iceland follow the third of these missions by analysing the rationale behind academics Third Mission (TM) engagement and possible barriers to participation among academics. Hereby, with this thesis I intend to examine the available options for universities in Iceland to overcome these limitations and stimulate a discussion on the future direction of higher education.

It is necessary to study TM, as universities play an increasingly active role within society and the modern knowledge-based economy. Due to the growing interaction of industry and higher education, new forms of knowledge production develop, leading to new institutional formats with universities as change agents and catalysts of knowledge production. For a long time, universities were deemed to be ivory towers in society, detached from economic and social realities. With the shift towards a knowledge society, science is particularly used as an open source to spur economic growth and social welfare (Kutinlahti, 2005). In this context, the involvement of higher education institutions is crucial as they generate a skilled and educated workforce, foster innovation and entrepreneurship, and address societal challenges.

However, a dilemma arises when it comes to TM of universities, which is not as clearly defined as teaching and research, which are clear in their scale and scope, but the third mission is not (Bortagaray, 2009). This lack of clarity can pose challenges for both policymakers and university management as implementation and measurement of TM may lack clarity. Likewise, academics may find it unclear which aspects of their work duty (teaching, research, administration) encompasses TM activities.

The remaining sections of this introductory chapter will discuss among other things the key concepts of the thesis. Chapter 2 revolves around the methodology, while Chapter 3 is devoted to the range and definitions of TM in particular. As TM's conceptualisation is a rather complex one, and therefore needed substantial discussion, hence a separate chapter on the concept. The complexity of TM serves as a driving force for further exploration of the topic, leading to Chapters 4 to 6, where TM is examined across different units of analysis using both qualitative and quantitative methods. Consequently, this thesis comprises four papers encompassing the research project, which are presented in Chapters 3 to 6.

In this study I adopt the definition proposed by Molas-Gallart et al. (2002) whereas TM is "about the interactions between universities and the rest of society" (p. iv). Chapter 3 shows that a general definition of TM is not clearly articulated between different scholars which is a considerable problem when trying to implement and analyse TM in different universities or countries. However, the approach of this thesis is that the concept of TM involves the socio-economic engagement of academics and covers aspects such as community engagement, commercialisation of research, contribution to public policy, science communication, and lifelong-learning projects. As part of TM, university-industry collaboration (UIC) is an essential element and focus of this thesis since such collaborations facilitate the transfer of knowledge and expertise between academia and industry, it fosters innovation, contributes to regional development, and offers new opportunities for academics and students in the form of internships, joint (research) projects, or access to resources. The commercial aspect of TM has also been specified as an entrepreneurial mission (Zhao et al., 2020).

Until recently, higher education institutes seldom held the potential for new company creation, commercialisation of products or services, or direct regional development. This lack of potential is particularly noticeable among smaller universities or those situated in remote areas, which encounter challenges in establishing long-term partnerships due to limited resources and expertise. Iceland serves as a prime example, with its population of approximately 390.000 inhabitants and several smaller universities located in sparsely populated regions (Hagstofa Íslands, 2023).

Conducting this study in a country such as Iceland, which has a relatively brief history of higher education (Jóhannsdóttir & Jónasson, 2013), has revealed valuable insights into the motivations behind academics' engagement in TM and the potential barriers to their participation. This research is the first of its kind in Iceland, enabling meaningful comparisons with other countries and drawing insightful conclusions from such comparisons. Given that universities and businesses on (small) islands face more challenging market conditions and often

cater to consumers outside the region (Burnett & Danson, 2017), the findings underscore the significance of collaborations and strong institutional relationships in fostering innovation, particularly in terms of knowledge and technology transfer.

Due to Iceland's size, the country is largely dependent on imported expertise and resources, and is limited in technology and infrastructure, with mainly small and medium-sized enterprises (SMEs) in operation. With regard to higher education institutions in smaller countries or rural areas, it might be harder to receive competitive funding, as both national and international competition for funding is growing (Ranga et al., 2016). Further, as globalisation involves higher student and labour mobility, universities have to fight harder for talented students and academics (Henrekson & Rosenberg, 2001). Finally, for many universities, it is challenging to serve regional, national, and international needs at the same time (Altbach, 2004). One way for universities to be less dependent on public funding, withstand stronger competition, and be more attractive to future employees and students is to adapt to the principles of an entrepreneurial university by following TM (Clark, 1998; Etzkowitz, 2014; Guerrero et al., 2015). In this light, a strong interplay of industry, government, and regional universities is crucial to keeping up with international competitiveness. That is, universities as centres for knowledge production, need to align with industry needs. Likewise, flourishing industry lays the foundation for a well-functioning region, which will become a popular location for living, working, and receiving higher education. In this situation, consideration of possible pathways is important.

To get a better overview of the topic, after the introduction (Chapter 1) and methods and framework of analysis (Chapter 2) this thesis will continue with a literature review (Chapter 3) where a lack of a general understanding of TM and an overall discrepancy between conceptualisation and practical implementation of TM within universities is discussed. The literature analysis further uncovers that social aspects of TM are frequently overlooked or given less priority. Results likewise reveal a lack of comparative studies taking into account different scientific disciplines, and how academics can assimilate a third role into their range of responsibilities.

From this backdrop evolve the four main objectives:

a) To ground the research, it is important to build on a clear understanding on what TM is and is not in the context that is being studied. In doing so, I develop a novel conceptualisation and classification framework for TM, encompassing both formal and informal or less visible TM efforts. By proposing a fresh perspective on TM, the study seeks to establish a clearer understanding of its scope and enhance its assessment and analysis. Further, the study aims to overcome the challenges posed by the broad interpretations of TM and enable

a more precise evaluation of TM activities in diverse contexts. Thereby, the research seeks to develop a new classification framework that captures and assesses the valuable contributions made through informal channels.

b) Enhancing knowledge on TM practices and strategies in a small economy like Iceland: Exploring how knowledge transfer and TM activities can effectively flourish in a small-scale economy such as Iceland. This objective involves identifying the unique challenges, opportunities, and strategies that contribute to the successful implementation and growth of TM activities in a limited economic context.
c) Examining the factors influencing the development of TM activities by relying on multiple data collections: Identifying and understanding the various factors that have an impact on the development and advancement of TM activities. This purpose involves investigating both internal and external factors that play a role in shaping the success and effectiveness of TM, including barriers to academic collaboration with industry and community.
d) Providing recommendations for university government and practitioners: The research has a practical purpose of informing policy and decision-making processes. The findings can be utilised by policymakers, government agencies, and other stakeholders to design and implement effective strategies, initiatives, and support systems that foster the growth and sustainability of TM activities in small economies like Iceland.

By exploring how TM activities can thrive in a small economy like Iceland, the research aims to provide insights and recommendations that are tailored to the specific challenges and opportunities presented in the context. To this end, the research has led to four articles, that together address these issues. Hereby, Chapter 3 (Article I) is examining existing research whereby it reveals a prevailing lack of a comprehensive understanding of TM and a notable disparity between the conceptualisation of TM and its practical implementation within universities. The analysis of the literature also highlights a tendency to overlook or assign less importance to the social aspects of TM. Furthermore, the findings indicate a scarcity of comparative studies that consider diverse scientific disciplines and investigate how academics can effectively integrate a third role into their existing range of responsibilities.

Results of Chapter 4 (Article II) show that prevalent modes of collaboration were informal and characterised by a focus on short-term goals and dependence on social connections due to the Icelandic business culture, funding structures, organisation size and location. The results highlight that smaller stakeholders are eager to participate in collaboration. However, their dependence on the government's critical role is even more pronounced in resource-based economies. This reliance stems from various factors, including their limited resources and

capacities. Smaller stakeholders face challenges due to their constraints in funding, infrastructure, and research capabilities. The government plays a significant role in regulating natural resources, which are often at the core of these economies. Its influence through policies and regulations greatly impacts the operating environment for smaller stakeholders. Additionally, the government's involvement in funding academic institutions and supporting research is vital. It provides the necessary resources and opportunities that smaller stakeholders lack on their own. Moreover, the government's role in creating market access and opportunities further accentuates the dependence of smaller stakeholders. Their ability to overcome challenges, access resources, and participate effectively in collaborative endeavours heavily relies on the government's support.

Collaboration with external actors is a crucial aspect of TM, but not sufficient in the socio-economic commitment of universities. In view of this, a first approach to conceptualise TM in a novel way is presented in Chapter 5 (Article III) by examination of multiple factors that influence different types of TM activities. The findings suggest that individual factors have a stronger influence on engagement in "soft" activities like community engagement and external teaching, while organisational factors have a stronger impact on engagement in "hard" activities like applied contract research and commercialisation. Academics are generally more inclined to participate in community-related activities where factors like openness to new experience, academic performance, and disciplines significantly affect TM participation.

Finally, Chapter 6 (Article IV) analyses the barriers to socio-economic engagement of academics in higher education which are mostly due to institutional aspects of universities such as the lack of resources within universities. However, also age and academic discipline significantly influence academics' perceptions of barriers to collaboration, particularly regarding teaching obligations.

An important contribution of the thesis is thereby to shed light on the situation in Iceland and its challenges as a small economy and to discuss the possible directions of higher education. As this is the first study of its kind in Iceland, a practical contribution which should also be considered in an overall national context is that this research is raising more awareness of the importance of TM and opportunities for universities, industry, and society. This research also involved a research publication in Icelandic, the national language (Karlsdóttir et al., 2022), which was an important step forward to open up space for further debates and research in this field.

As a result, the thesis provides recommendations for university and government practitioners regarding the implementation and measurement of TM to further foster the traditional university missions of research and teaching. Generally, academic

institutions possess the potential to play a more active role in promoting and facilitating TM activities beyond their current level of involvement. This can be achieved through sufficient funding and establishing incentive structures for academics, fostering a diverse and inclusive academic community, enhancing Triple Helix collaborations, and increasing the visibility of TM both within and outside academia.

Research outcomes can thus allow policymakers and university management to consider which organisational structures and incentives to promote and how to take conditions at the individual academic level into account. For instance, it is still not clear how TM is defined, and how universities should best implement and assess this mission and incorporate it into conventional academic responsibility (Bortagaray, 2009). Also, as much of the conducted research concentrates on measurable types of TM, such as company creation and patenting, the emphasis of this research is laid on a more diverse interpretation of TM, including a broader scale of TM activities that can be challenging to measure but have a strong, often indirect, impact on knowledge and technology transfer towards society. This includes the creation of networks and platforms, or the training of students (Nilsson et al., 2010; Trippl et al., 2015). By identifying key drivers and barriers that shape the development of TM activities, the research contributes to evidence-based decision-making. The insights gained will inform the design of strategies aimed at enhancing the effectiveness of and impact of such initiatives. Additionally, by examining these factors, the research illuminates the unique contextual dynamics at play and provide valuable guidance for the development of targeted interventions. This comprehensive approach has the ability to foster the growth and success of TM activities in Iceland, ensuring their positive and sustainable outcomes. Accordingly, the overall research questions of the thesis are as follows:

How can TM activities thrive in a small economy like that of Iceland?

What factors influence the development of such activities?

In this manner, the unit of analysis in this study focuses on Icelandic universities and their academics, recognizing their significant impact on various levels. To gain a comprehensive understanding, it is crucial to analyse multiple universities as they exhibit diversity in their approaches. Additionally, the role of individuals, particularly academics, shapes the university landscape, necessitating an examination at the individual level. This becomes especially important due to the varying levels of TM engagement among academics in different scientific fields (Perkmann et al., 2013; Tijssen, 2006). Therefore, to effectively support TM, the strategy must encompass the complex attributes of disciplines, institutional demands, and individual academic backgrounds. Consequently, the scope of analysis extends beyond national policymaking and the overall university

environment, encompassing single universities and their individual academics. By considering these multiple dimensions, a holistic perspective on TM activities can be achieved.

By answering the aforementioned research questions, the study adds several practical and theoretical aspects concerning academic entrepreneurship and regional development. First, this research is based on different universities in peripheral and urban regions. This is crucial, as both academics' organisational structures and their regional engagement differ, especially in small economies (Karlsen et al., 2017; Markuerkiaga et al., 2016). Second, as academic engagement is commonly influenced at an individual level, different personal and work-related background variables of university researchers who engage in TM activities are scrutinised (Huyghe & Knockaert, 2015). Third, in this context, it needs to be considered how intrinsic and extrinsic motivation influence researchers' entrepreneurial and social engagement (Fogelberg & Lundqvist, 2013).

1.1.2 Structure of the thesis

As discussed above, the thesis started with an introduction (Chapter 1), in which the relevance of the research topic, research objectives, and overall research questions were presented. Next, core concepts such as the entrepreneurial university and Triple Helix and recent developments in higher education regarding TM are discussed. As these key concepts are discussed, the development of universities in a European context is outlined with respect to the first, second, and third missions. Furthermore, as the study material was collected from Iceland, background information will be provided to deepen the understanding of the Icelandic university environment.

What follows in Chapter 2 is the analytical framework underlying this research and elaborating on the research methods which were applied in the four articles, including a summary of the main results.

The main part – Chapters 3 to 6, consists of the four articles that make up the thesis. Chapter 3 (Article I) analyses TM of universities in Nordic countries and universities approach to implementing the mission into their strategy. Chapter 4 (Article II) investigates university-industry collaboration in Iceland. Chapter 5 (Article III) and Chapter 6 (IV) are both based on a large-scale survey of academics in Iceland whereby first (Chapter 5), individual, and organisational factors that influence the propensity of academics to engage in different types of TM activities are investigated. Second (Chapter 6), findings on factors hindering academic employees from becoming involved in collaboration activities are presented.

The last chapter, Chapter 7, is a discussion of the main results, including recommendations, and future research directions.

1.2 The development of university roles and missions

A key component in the development of university roles is the emergence of three explicit missions: teaching, research, and socio-economic activities. These missions are important of the context of this thesis; thus, I provide a brief overview of them below.

In this framework, the *first mission* is understood as an educational or teaching mission, that is, to disseminate knowledge through academic education (Nabaho et al., 2022) and to train students for the labour market and for active participation in society.

The *second mission*, the research mission, was incorporated into the university model in the nineteenth century, in what is sometimes referred to as the *first academic revolution* (Etzkowitz, 2003b; Yusof & Jain, 2010). The second mission, however, is more than "just" a research mission. Although the concept of the university is many centuries old, it was not until the beginning of the nineteenth century that teaching was based on current research – free from ideology and religious or political influence. This Humboldtian model of higher education, which "stressed the mode of 'pure enquiry'" or 'Wissenschaft' associated with the spread of basic research to produce 'new knowledge'" (Cooper, 2009, p. 159) was the product of scholars and intellectuals of the Enlightenment.

The model consisted of three fundamental principles: first, the principle of the unity of research and teaching; second, the principle of academic freedom (consisting of "freedom to learn" and "freedom to teach"); and third, the principle that arts and sciences are equal in status to such subjects as law, theology, and medicine (Scott, 2006). Since then and up until now, nearly all universities define themselves mostly by the second mission – perhaps with the exception of polytechnical schools or universities of applied sciences, which focus more on the educational mission. A reason to concentrate mostly on the second mission or on research excellence is that an institution that does so is likely to gain a higher international reputation and more governmental funding. This becomes clear, as differentiation among universities is mostly based on research achievements and less on educational performance. It further means that the first mission, teaching, is an additional effort for academics and is seen as a time-consuming competition for research and less honourable.

With the rise of the knowledge society, the university had to adopt a new role. Since then, knowledge has been increasingly seen as a product or service, with new related facilities emerging and evolving, such as science parks, technology transfer offices (TTOs), science or fab labs, and lifelong education (Chatterton & Goddard, 2000; Etzkowitz & Leydesdorff, 1997). Therefore, a second shift,

sometimes also referred to as the *second academic revolution*, happened after the 1980s with the emergence of a *third mission*, wherein universities enter into collaborations or partnerships with industry and society to contribute to innovation-driven strategies that spur regional development (Compagnucci & Spigarelli, 2020; Etzkowitz, 1998).

In short, TM concerns entrepreneurial activities. Universities have been working with industry and the public for a long time; however, collaboration is mainly based on research activities and less on applicability or commercialisation (Valentín, 2000). For some, TM might be a "way of doing, or a mindset for accomplishing, the first two [missions]" (Mora et al., 2018, p. 515); others explain it as a mission of social engagement with diverse activities that are covered by neither research or teaching (Trencher et al., 2014).

The idea of TM in relation to entrepreneurial activities and resulting economic development was at first rather exotic and pursued by only a few early leaders, such as Stanford, Oxford and the Massachusetts Institute of Technology (Etzkowitz et al., 2000). Later, especially since the 2000s, the organisational design of many formerly rather traditional European universities has changed towards an open approach of contributing to societal and economic needs (Sánchez-Barrioluengo & Benneworth, 2019; Santos, 2016). Hereby, TM brought about fundamental changes in universities, especially regarding their objectives, funding structures and availability, and management (Bonaccorsi et al., 2014), which means concretely that managerialism was introduced into academia (Staniškis, 2016). Additionally, in the recent past, the funding model, which was mostly state funding for a long time, has gradually changed towards a mixture of public- and private funding (Muscio et al., 2013).

The common reasons for universities to follow TM are as follows:

- Diversification and better availability of funding (Ranga et al., 2016; Sánchez-Barrioluengo & Benneworth, 2019)
- Strategic partnerships of universities with non-academic institutions (Klofsten et al., 2019; Knudsen et al., 2019)
- Higher interdependency of government, academia, and industry, which leads to the formation of a Triple Helix (dependency of knowledge and technology transfer on behalf of industry and government, and dependency of finances and reputation on behalf of universities) (Cai & Liu, 2015; O'Kane, 2018)

- A greater embeddedness of universities in local and regional areas to strengthen overall economic development and potential supply of educated graduates (Edvardsson, 2014; Thomas et al., 2023)

- A greater shift of research from industry and government to universities, which again leads to an increase in information flow between institutions (Larivière et al., 2018)

- Political push, from, for example, the European Commission to create competitive European industries with universities as drivers in research, development, and innovation (Zomer & Benneworth, 2011)

- Neoliberalism and the marketisation of universities as the result of a growing conception of knowledge as capital (Laalo et al., 2019)

This being said, there are potential downsides to TM for universities and scientists. First, building up TM without including especially its academics might lead to a mission drift where priorities of universities and academics towards activities that generate commercial or economic benefits prevails at the expense of traditional missions such as fundamental research and teaching (Weerts & Sandmann, 2008). This can also be regarded as a "mission overload" (Benneworth et al., 2016; Jongbloed et al., 2008). Second, some academics might be afraid that academic freedom is impaired by requiring academics to align their research to goals and interests of industry or government which might lead to a conflict of interest between different stakeholders (Cohen, 2021; Hirsu et al., 2021; Ranga et al., 2016). One example is the focus on short-term goals of industry in contrary to often long-term research purposes within academia which might have an effect on overall research quality in the long term. Third, as TM is still mostly seen as a commercial or economic mission of universities, it might cause an unequal distribution of benefits among different stakeholders, especially between industry and universities, and different scientific disciplines (Pinheiro et al., 2015; Ranga et al., 2016). As such, industry might benefit more due to higher profit, and science, technology, engineering, and mathematics (STEM) fields might profit more than social sciences and humanities (SSH) as they are more involved in technology transfer (Compagnucci & Spigarelli, 2020; Rybnicek & Königsgruber, 2019).

According to my research, I found that academic freedom is often prioritised over collaboration with industries, aligning with previous studies. Additionally, the study highlighted the time constraints faced by academics, particularly those in lower ranks who have higher teaching obligations, due to the demanding nature of teaching. As a result, their ability to engage in TM activities is limited.

Furthermore, the research revealed that not all academics are equally involved or interested in TM. This lack of equal participation means that there is a dearth of

diversity within the academic community, resulting in missed opportunities for addressing societal and industrial needs. Consequently, the potential impact that academia can have on society is hindered.

As this study is performed in Iceland, a country with a young higher education history with dramatic and fast changes occurring in the last two decades (see Chapter 1.6) the development of TM might not be as smooth as previous examples from Stanford, Oxford and the Massachusetts Institute of Technology showed, but it gives more evidence of possible challenges regarding its understanding, implementation and acceptance.

Moreover, it was observed that in the universities examined here not all TM activities are adequately recognised or rewarded within the higher education system. This discrepancy contributes to an unequal level of involvement among academics.

1.3 The entrepreneurial university

With TM, universities take on a more active role in society through intensified knowledge transfer and extended stakeholder collaboration (Etzkowitz, 2016). They therefore stand at crossroads, as their traditional research and educational mission is being changed to an entrepreneurial mission which implies a greater participation in economic and social activities. An entrepreneurial university can therefore be defined as "combining a 'third mission' of economic and social development with teaching and research" (Etzkowitz, 2003a, p. 325). The first entrepreneurial university was said to be MIT, which was formed to support local industry (Etzkowitz, 2002). This development has since reached European universities (Taliento, 2022) and is a continuous process (Giuri et al., 2019) and related policies have been adopted in the European Union (de Saille, 2015). Characteristics of entrepreneurial universities are a combination of basic and applied research, the building of networks with industry and their regions, interdisciplinary curricular courses and research and opportunity-seeking and opportunity-exploiting behaviour (Audretsch, 2014; Pugh et al., 2018; Shane & Venkataraman, 2000; Stolze, 2021). Further, according to Gallagher (2000), the entrepreneurial university engages with its local community, takes account of the needs of the labour market, and emphasises entrepreneurial education throughout its curriculum and course offerings. It also implies a reorientation of education, which means promotion of an entrepreneurial mindset among its students and staff (Wong et al., 2007). Teaching based on an entrepreneurial mindset also involves teaching problem-solving, collaboration, and creativity using student-centred approaches (Harkema & Schout, 2008).

1.4 The Triple Helix concept

This thesis emphasises the importance of adopting a Triple Helix approach, as proposed by Etzkowitz and Leydesdorff (1997) to drive the development of entrepreneurial universities in smaller economies. Specifically, it recognizes the crucial role of government leadership, particularly in rural areas (as discussed in Chapter 4), in fostering this development. The Triple Helix model, depicted in Figure 1, highlights the interconnected relationship between the university, industry, and the state, with the aim of facilitating technology transfer and innovation. By embracing this collaborative framework, involving the combined efforts of universities, government, and industry, the development of entrepreneurial universities can be effectively realized in smaller economies. Here, government can play a crucial part in intensifying UIC through appropriate incentives, financial resources and support, policies (Albats et al., 2018; Kapetaniou & Lee, 2017), and creation of platforms and structures such as science parks or TTOs, which function as hybrid organisations (Zhou & Etzkowitz, 2021). Academia plays an increasingly prominent role in technology and knowledge production, that leads to industrial innovation. Industry thereby provides venture capital and infrastructure. A strong presence of certain industries has an impact on the creation of start-ups, which again facilitates knowledge exchange. In this model, boundaries are no longer fixed, but become blurred and individuals take on distinct roles such as intermediaries or entrepreneurs who together build connections.

Even though Figure 1 implies that organisations are involved in the process, the Triple Helix is based on the individual level, as there are individuals such as entrepreneurial scientists involved, so it is clear that it is an interaction model (Rajalo & Vadi, 2017). The Triple Helix is the result of interactions between members of several institutional domains, each of whom contributes from that domain's its unique resources, leading to the development of a novel organisational structure or hybrid format. In this way, each institutional sector thereby strengthens the contributions of the other members (Zhou & Etzkowitz, 2021). However, how much the individual members are involved varies, therefore, Figure 1 shows only one possibility for interaction – that is, equal contribution by all members, – which is, however, not always the case in reality.

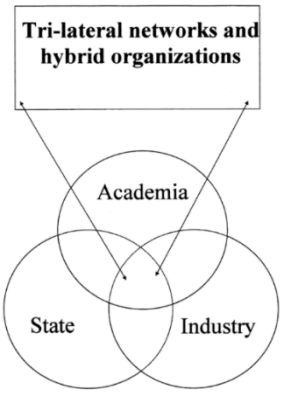

Figure 1. The Triple Helix Model of University-Industry-Government Relations (Etzkowitz & Leydesdorff, 2000)

While the Triple Helix model has been praised for its potential to foster economic development and to promote innovation, it has also faced criticism. This involves similar reasons as it has already been mentioned when discussing TM in Chapter 1.2 such as an overemphasis on commercialisation over social welfare, less emphasises on academic freedom or sustainability, and the risk of conflicts of interest, such as academics being incentivised to prioritise research that benefits their industry partners over producing objective and unbiased research (Philpott et al., 2011). This could raise concerns about the credibility and the integrity of the research output. A conflict of interest often emerges due to power imbalance of the involved actors as the model does not take resourcing into account (Bellgardt et al., 2014): as such, governments can exercise their power through regulations, policy implementations, and provision of financial resources and thus act as a key players in the relationship (Amir & Nugroho, 2013). Industry can exercise power as they often possess more resources and bargaining power than universities which consequently become subservient to industry interests.

This imbalance is further often reflected between the different university missions of teaching, research, and innovative activities or TM, and between different scientific disciplines (Ma, 2008; Unger & Polt, 2017). Another essential point of criticism is that the model does not take other actors outside the helix into account which might drive innovation and economic growth such as community or society (Amir & Nugroho, 2013). There has been the attempt in the last years to remodel the Triple Helix into a fourth and fifth or Quadruple and Quintuple Helix by including the public or society as a fourth subsystem and the natural environment as a fifth subsystem (Carayannis & Campbell, 2011, 2013; Marcovich & Shinn, 2011).

Society represents hereby citizens, communities, and non-profit organisations. In this way the model considers social responsibility, inclusive innovation, culture, and civic engagement. To go even further the Quintuple Helix underscores the role of the natural and societal environment (Zhou & Etzkowitz, 2021) which are aspects that have gained increasing relevance in light of the discourse on climate change (Rámháp et al., 2017).

Another important point of criticism of the Triple Helix in an international context is its limited applicability: The model was developed in the context of Western economies with its origin in the US. It might be problematic to transfer its usefulness to different national or cultural contexts, such as developing countries or industries that are less technology driven (Cooke, 2005; Pugh, 2017; Williams & Woodson, 2012). Many case studies have been published, however, their transferability to other contexts is often limited (Hellström et al., 2013) and a one size fits all approach does not directly apply (Clark, 2001; Philpott et al., 2011).

My research findings indicate that the Triple Helix model has limited applicability in the context of Iceland. This limitation primarily stems from the country's relatively small population and economy, which translates to a restricted number of industries and universities. As a result, the scope and scale of collaborative opportunities within the Triple Helix framework are constrained.

Furthermore, Iceland's economy heavily relies on specific industries such as fishing, renewable energy, and tourism. The focus on these particular sectors tends to restrict the diversity of collaboration opportunities and impede the exploration of new and emerging industries.

As a result, it is true, that the changing role of universities is a complex and multidimensional phenomenon and in means of that it is crucial to acknowledge that the changing dynamics of universities extend beyond a single theoretical framework. Alternative theoretical frameworks beyond the Triple Helix have been introduced such as Mode 2 theory of Knowledge Production (Gibbons, 2000; Gibbons et al., 1994) which emphasises the shift towards knowledge production that is more responsive to societal needs and the integration of different knowledge sources. Hereby, Mode 1 knowledge production focuses on knowledge generated within universities through specialised research following formal academic structures and a peer-reviewed publication system. Mode 2 is on the other hand addressing complex societal challenges and facilitating innovation. Interdisciplinary research, collaboration across different sectors, and the involvement of non-academic actors in knowledge creation and application. Mode 2 does here complement Mode 1 without completely replacing it. Mode 2 emphasises the active involvement of non-academic actors, such as industry partners, community, and policymakers, in the knowledge production process. Universities can thereby

benefit from engaging with external stakeholders, as it can lead to collaborative research projects, knowledge exchange, and the co-creation of solutions. It can enhance the university's reputation, foster research commercialisation, and facilitate technology transfer (Geuna & Muscio, 2009).

In structuring the research project, I build mainly on the Triple Helix model. However, in the discussion (Chapter 7), I consider potential interpretations of the result from the perspective of alternative models.

1.5 The Nordic university context

As this thesis examines TM in an Icelandic context, Chapter 3 scrutinises different approaches of universities in Nordic countries. Investigations of Nordic countries in general reveals that higher education policies share the values of broad access to education and high equality, for this reason, Nordic regions are technologically advanced with highly skilled and educated workers due to a highly developed and well-funded education system (Elken et al., 2016). Further, according to the European Innovation Scoreboard 2018, Sweden, Denmark, and Finland are innovation leaders within the European Union (European Commission, 2018). Norway and Iceland, which are not EU members, are also both strong innovators when compared to the EU.

For this reason, Nordic countries all have smaller-scale economies with more universities located in less populated areas than do other European neighbours. Higher-education participation in Scandinavia is among the highest in the world, ranging from 50% to 70% of the total population, with a large number of PhD student intakes yearly (Maassen, 2012). In this context, Nord (2002) suggests that in a "Nordic Model," in which universities create economic gains for the regional economy, especially through local employment, university spending, regional economic diversification, and regional links to the national and global market. Furthermore, the model proposes that universities should provide resources for social and cultural matters in the region to strengthen the community and its identity. This model gives thus a strong reason for Nordic countries to support and develop TM even further.

Frølich et al. (2018) give a comprehensive overview over academic career structures in Europe. Summarising, the Norwegian institutional landscape has undergone significant shifts due to mergers and the possibility for institutions to obtain university status. Universities and university colleges share a common career structure with research and teaching-oriented tracks. The career path typically progresses from PhD to postdoc to associate professor in universities, while university colleges follow a path from lecturer to senior lecturer. Research-only positions exist in both types of institutions. Also, Denmark's, Finland's, Sweden's

and Iceland's higher education systems are binary, consisting of research-oriented universities and more education-focused colleges. However, individual institutions exhibit variations in employment contracts and the balance between teaching and research tasks. The typical career path in universities spans from PhD to postdoc, adjunct position, lector position, and professorship. Research-only positions are available. Positions in Iceland range from PhD to postdoc, adjunct position, associate professor, assistant professor, and professorship.

The next chapter discusses the Icelandic higher education landscape in more detail.

1.6 Icelandic universities

This chapter provides a concise overview of the higher education landscape in Iceland, offering insights into the historical context and current status. Presently, Iceland is home to seven universities, catering to a population of approximately 390.000 inhabitants as of 2023 (Hagstofa Íslands, 2023). Notably, around two-thirds of the total population reside in the capital area. Four of the universities are state-run and belong under the Ministry of Higher Education, Science and Innovation, i.e., University of Iceland, University of Akureyri, Agricultural University Iceland, and Hólar University College. The remaining three universities follow a different operational structure yet maintain service contracts with the ministry. Additionally, private universities receive partial funding from the state. These institutions include Reykjavik University, Bifröst University, and Iceland University of Arts.

The University of Iceland, established in 1911, holds the distinction of being the oldest and largest university in the country. Presently, it enrols approximately 15.000 students, accounting for around 65% of the total student population in Iceland. Three universities are located in Reykjavik, the capital city: the University of Iceland, Reykjavik University, and Iceland University of Arts. In the northern region of Iceland, the University of Akureyri and Hólar University College serve as educational hubs. Additionally, in the western part of the country, about an hour away from the capital, one can find Agricultural University Iceland and Bifröst University.

Distance learning options are available at most universities, particularly those located outside the capital area. These programs typically involve online courses with occasional on-campus seminars and examinations throughout the semester. The prevalence of distance learning has increased across all universities since the onset of the COVID-19 pandemic in 2020. However, prior to the pandemic, distance learning was primarily offered by universities outside the capital area. For a comprehensive overview of the universities mentioned, please refer to Table 1.

Furthermore, the universities in Iceland host a number of research institutes, such as the Health Sciences Institute of the University of Akureyri (ice. Heilbrigðisvísindastofnun Háskólans á Akureyri), Tourism Research Center (ice. Rannsóknamiðstöð ferðamála), Fisheries Center of the University of Akureyri (Sjávarútvegsmiðstöð Háskólans á Akureyri), The institute of Earth Sciences (ice. Jarðvísindastofnun), the Science Institute – University of Iceland (ice. Raunvísindastofnun) and many more. Besides, Icelandic universities run numerous service organisations such as Lifelong learning (ice. Símenntun) or The School of Fisheries Science school for young people (Sjávarútvegsskólinn, Vísindaskóli unga fólksins).

Table 1 illustrates that a significant proportion of academics are affiliated with the University of Iceland. However, it is crucial to acknowledge that Icelandic universities have faced controversy due to their frequent employment of experts as sessional teachers for specific courses or as external examiners for final student theses. Over the years, efforts have been made to address this issue, resulting in a gradual decrease in the percentage of sessional teachers. In 1986, the ratio stood at one permanently employed academic for every two sessional teachers, with 215 academics and 400 sessional teachers responsible for teaching approximately half of all available courses during that time (OECD, 1987). By 2021, the ratio had improved to 3.77 sessional teachers for one permanently employed academic, or 3.2 permanently employed academics for one sessional teacher when accounting for the full-time equivalence of sessional positions (University of Iceland, 2020). Such a high reliance on sessional teachers may potentially impact the quality of teaching, as it is often less grounded in active research typically conducted by permanently employed academic staff. Additionally, it may lead to lower research output due to the limited number of permanently employed academics.

In the 1980s, opportunities for master's and doctoral studies were limited, and most students had to pursue their postgraduate studies abroad. During that time, postgraduate studies were primarily concentrated in the humanities, such as history, Icelandic language, and literature (Jónsdóttir et al., 2015). However, all seven universities now offer diverse postgraduate programs. Doctoral degrees can be obtained from the University of Iceland, Reykjavik University, Agricultural University Iceland, and the University of Akureyri. Notably, the University of Iceland has experienced a significant increase in its number of doctoral students, rising from 253 in 2008 to 705 in 2023, with the aim of promoting research and achieving higher international rankings (University of Iceland, 2023).

Until the 1990s, the Icelandic government exerted significant control over various aspects of university operations, including employment and salary matters. During this period, a financial framework was implemented, stipulating that universities

should be allocated a specific annual budget for which they would assume responsibility. This, coupled with the enactment of a new law governing university operations, marked a significant step towards enhancing the autonomy of universities. As a result, there was a proliferation of new universities, often arising from the merger of smaller institutions, and a notable expansion in the range of courses offered, particularly at the postgraduate level (Jónsdóttir et al., 2015).

The 1990s witnessed a rapid increase in student enrolment, leading to the establishment of five universities in Iceland by the year 2000. An important development during this period was the promotion of Akureyri, located in the north, as a regional hub for education and scientific pursuits, thereby diversifying educational opportunities beyond the capital area. The University of Akureyri, founded in 1987, initially focused primarily on nursing and industrial management courses. However, it subsequently expanded its offerings to encompass fisheries and teacher education, aiming to better cater to the specific needs of the region. Notably, the University of Akureyri was at the forefront of distance education initiatives among Icelandic universities.

Currently, a major challenge revolves around the funding structure for universities, which is tied to the annual number of students participating in final examinations and research performance-based funding. This system poses several issues. Firstly, many departments struggle to meet their obligations or have exceeded the agreed maximum number of students, as there are limited enrolment restrictions in Iceland. This is primarily due to a high demand for postgraduate and diploma degrees. Secondly, the evaluation of research outcomes within universities is slow and fragmented, making it difficult to establish a direct link between budgets and performance (Jónsdóttir et al., 2015). Moreover, assessing the broader societal impact and effectiveness of academic engagement presents another challenge. This includes evaluating the influence of universities at the local, regional, and national levels, as well as their contributions to knowledge and technology exchange, stakeholder engagement (including government, industry, community, and the general public), and societal impact. Establishing a connection between budgets and performance becomes crucial for ensuring accountability in resource allocation for research and TM activities. It also aids in aligning financial resources with strategic objectives. By allocating resources based on performance indicators such as research collaborations, knowledge transfer, and community engagement, universities can incentivise and reward endeavours that positively contribute to society.

Table 1. Icelandic universities sorted by founding year (Numbers are based on the years 2021/2022)

University	Governance (private/public)	Founding year	Number of staff (full-time position equivalence)	Number of teachers (not included are sessional teachers)	Number of students	Location	Disciplines/Faculties	Degrees
University of Iceland (UI)	public	1911	1797 (1444)	816 (3.073 sessional teachers equivalent to 254 full-time positions)	15.000	Reykjavik	Faculties of: Social Sciences, Health Sciences, Humanities, Education, Engineering and Natural Sciences	Diploma, BA, BS, MA, MS, MPH, MAS, MBA, PhD
University of Akureyri (UNAK)	public	1987	236	127	2500	Akureyri	Faculty of Humanties and Social Sciences, Faculty of Health, Business and Science	Diploma, BA, BS, MA, MS, MBA, PhD
Bifröst University	private	1918 (1988: university status)	47 (42)	16 (and 83 sessional teachers equivalent to 16 full-time positions)	850	Bifröst	Faculty of Social Sciences and Law, Faculty of Business	Diploma, BS, BA, MS, MA
Reykjavik University (RU)	private	1998	287 (273)	94 (professors, associate professors, assistant professors)	3.300	Reykjavik	Faculties of: Law, Engineering, Computer Science, Industrial and Technical Sciences, Psychology, Sports, and Business	Diploma, BA, BS, MS, MBA, PhD
Iceland University of Arts	private	1999	137 (102)	66 (500 sessional teachers equivalent to 37 full-time positions)	650	Reykjavik	Departments of: Art, design and architecture, art education, music department, performing arts, film	Diploma, BA, MA
Agricultural University Iceland	public	2005	92 (85)	35	600	Hvanneyri	Department of Natural Resources, Environment Department, Department of Vocational and Continuing Education	BS, BA, MS, MA, ML, PhD
Hólar University College	public	2007	51 (50)	23	200	Hólar	Department of Tourism, Department of Aquaculture and Fish Biology, Department of Equine Science	Diploma, BS, BA,MA

1.1.1 Third Mission in Icelandic universities

As the previous chapter illustrates, until recently, the quality of teaching in Iceland has been given a higher priority in universities than focusing and supporting research endeavours (Steinthorsdottir et al., 2016). However, since the last decade, Icelandic universities have been trying to establish greater focus on research and innovation, by, for example, incorporating doctoral studies and focusing more on the importance of international ranking systems. The University of Iceland (UI), for example, aimed to enter the group of top 100 universities in the Times Higher Education ranking and had already achieved a rank among the best 201–250 universities in the overall World University Rankings from 2016 to 2018. Since then, however, it has declined and now (2023) ranks among the best 501 and 600 (Times Higher Education, 2023).

A big problem for Icelandic universities is the frequent threat of cuts to research funding (Arnmundsson, 2018; Rúnarsson, 2023). This is an issue as universities are dependent on a secure and steady financial flow. However, the total public expenditure for Icelandic universities is less than in other Scandinavian countries and lower than the OECD average (OECD, 2019). Public universities are dominant in Iceland, do not charge tuition fees and are funded in small part privately, but mostly publicly, up to 89%, compared to the OECD average of 67% (OECD, 2019). University funding is therefore mostly based on the number of students (Taxell et al., 2009).
When looking specifically at the science-society relationship, Iceland is classified as a country where science is disregarded. According to Mejlgaard (2018) science has little influence in policymaking, science communication is in its developmental stages, and public participation in science governance is highly involved but not formalised. Subsequently, these results imply that science does not yet play a key role in society and the interconnection of the Triple Helix is lacking.

What is more, the trend in scientific publications based on UIC in Iceland in the years 2004–2014 shows a general lack of publications in comparison to other Nordic and Baltic states (Murashova & Loginova, 2017). This indicates that UIC has not been researched in Iceland and that interest in this topic is deficient.

In consideration of the strategies of the universities in Iceland, very little is stated on the intention to diversify income sources or to form substantial collaboration bonds in which the university "plays a key role in promoting university education, research, development and innovation" (University of Akureyri, 2018, p. 8). An increased focus has been placed on research, but only recently has the strategy of taking an active part in society (and industry) been explicitly stated (University of Iceland, 2016).

Yet, one optimistic example of a novel organisational structure that supports the Triple Helix approach is the establishment of the University of Iceland Science Park (UISP) which is intended to create "a community bringing together the academic world, knowledge-based companies and research institutions" (Vísindagarðar, n.d., para. 3) The science park is still in its preliminary stages, but it is already connected to a few local companies, that mainly operate in biotechnology or medical sciences. Another example was the establishment of the University of Akureyri in 1987 with the aim of regional development in a rural area far away from its thriving capital, Reykjavik. However, due to a lack of industry interest in research activities, the Triple Helix development in this region is behind expectations (Yigitcanlar et al., 2017).

Nevertheless, to foster possibilities for additional funds and expertise, facilities within universities need to be used more efficiently through purposeful collaboration with institutions outside of academia.

2 Methods and framework of analysis

My research approach is practice-oriented and based on a pragmatic paradigm (Morgan, 2007) with the main goal of creating scientific knowledge of practical value in university management. This further involves the changing circumstances in university management and the environment academics work in.
Another important aspect is that pragmatic researchers are often characterised by their flexibility to modify their research questions and overall research approach based on current information that emerges during the research process, rather than adhering rigidly to a predetermined research plan (Kelly & Cordeiro, 2020). As in my case, the research plan changed as the main purpose in my doctoral studies was initially to analyse solely UIC in Iceland. However, I noticed that there is a lack of data, as I realised that many collaborations are based on informal relationships (see further Chapter 4). Further, I recognised that it is not only UIC which is important for socio-economic development, but that there are many more aspects – many of them even hidden – and that this important development goes beyond UIC. It further involves all scientific disciplines which however place different emphasis on how they realise their contribution towards TM.

As this thesis is addressing practical problems in university management towards socio-economic activities of academics it seeks to integrate different research methods and perspectives to achieve this goal. Hereby, the pragmatic paradigm is often associated with mixed methods design, which combines both quantitative and qualitative research methods to provide a more comprehensive understanding of the research problem, and it addresses research questions from multiple perspectives (Creswell, 2009). By mixed methods, I refer to the definition of Creswell and Plano Clark (2011): "Mixed methods [...] focus on collecting, analysing, and mixing both quantitative and qualitative data in a single study or series of studies. Its central premise is that the use of quantitative and qualitative approaches, in combination, provides a better understanding of research problems than either approach alone" (Creswell & Plano Clark, 2011, p. 5). This implies that the research topic focuses on the current problems of universities in each local setting with the aim of using its outcome as a tool for action and possible change of the current situation in Iceland and similar cases. The scientific contribution is both local (for universities and governments in Iceland) and general. The study includes not only qualitative and quantitative aspects, but also wide-ranging perspectives from individuals in academia, the public sector, industry, and society. This involves research methods built on a literature review, interviews, and surveys to derive knowledge from experience.

The mixed methods approach follows an exploratory sequential design (Creswell & Plano Clark, 2011). The first phase of the study involved a qualitative approach. Here, data was collected through qualitative methods, such as semi-structured interviews, a literature review, and document analysis. In the second phase, quantitative methods were followed that built on the findings of the qualitative data, with the aim of further examining and validating qualitative results. By these means, a questionnaire was sent to academics of all faculties within all seven Icelandic universities. The exploratory sequential design was chosen to develop an instrument in the form of a survey and to generalise qualitative findings to a larger sample. Therefore, qualitative, and quantitative data were collected at separate times. The reason for this choice of approach was that little was known about TM at Icelandic universities, especially regarding the extent of TM activities and the participation of distinct types of academics. Furthermore, appropriate instruments to quantify and measure TM have not been developed or were incomplete. In most cases, informal parts of TM were left out.

Academic research often aims to verify or falsify research hypotheses. In my study, I take a mixed-methods approach to offer a thorough understanding of TM within university settings by integrating quantitative and qualitative data. This approach goes beyond the narrow scope of mere verification or falsification, as qualitative research adds depth and richness to the findings. By incorporating qualitative insights, this research seeks a more holistic comprehension of the topic, delving into the complexities of TM and exploring its nuances. It strives to interpret the multifaceted nature of TM and provide a comprehensive exploration of the subject matter.

2.1 The analytical framework

The unit of analysis in this dissertation is the Icelandic higher education environment, which encompasses multiple universities and the individuals within them. While the focus is on this level, it is crucial to acknowledge that the environment is shaped by the academics within each university. Therefore, the analysis extends beyond the scope of national-level policymaking or the examination of a single university. To comprehensively address the research questions, it is imperative to consider not only policy documents or overall university management but also the intentions and behaviours of academics.

Thus, this study adopts a holistic perspective by focusing on Icelandic academics, acknowledging their significant impact within the higher education system. To obtain a comprehensive understanding, it is essential to examine multiple universities, considering their diverse approaches influenced by institutional factors. At the same time, it is crucial to recognize the role of individual academics

in shaping the university landscape, necessitating an examination at the individual level. In addition to context specific models relating specifically to higher education, such as the Triple Helix model, this research draws on three broader theoretical perspectives. These three perspectives, each of which is described in more detail in the sections below, are institutional theory (or more precisely, the new institutionalism), the theory of planned behaviour, and the Big Five personality model.

1.1.2 Institutional theory

To begin with, the thesis links to institutional theory as it scrutinises the extent to which academics follow TM alongside the other two missions and how this is affected by the institutional environment. This is done by the identification of specific organisational-level factors compared to individual factors. According to institutional theory, individual behaviour is strongly affected by organisational context (Scott, 2013). In research on universities, several other studies have applied institutional theory to academic entrepreneurship, especially regarding university-industry research (e.g. Colyvas, 2007; Guerrero & Urbano, 2012; Huyghe & Knockaert, 2015; Lam, 2010; Zhao et al., 2020).

In line with the new (or neo-) institutionalism, organisations shape individuals' behaviour and attitudes through norms, rules, structures, and values and it examines how institutions – such as universities – are shaped by and conform to various institutional logics (DiMaggio & Powell, 1991; DiMaggio & Powell, 1983). A key concern in the literature is how performance and legitimacy influence the adoption of certain structures in organisations. Organisations copy the practices of others and, as a result, gain social support as legitimacy is granted by a network of other actors. As universities compete to secure funding for research excellence while also seeking legitimacy as socially important organisations, they may become isomorphic and convergent institutions (DiMaggio & Powell, 1983; Pinheiro et al., 2012), which implies that they will adopt similar practices and become more homogeneous over time. Universities are under pressure to adopt similar practices despite their institutional diversity and organisational differences, sometimes strengthening imitation drifts (Teichler, 2004).

In relation to the research topic, TM represents a shift in the institutional logic of universities, expanding their traditional focus on teaching and research to include a stronger emphasis on societal engagement and impact. New institutionalism can help explaining the process through which this shift occurs and how it becomes institutionalised within universities (Sapir, 2022). Thereby, the organisational context plays a crucial role in shaping TM of universities. Hereby, the leadership of a university plays a pivotal role in setting the vision, values, and priorities of the

institution. If leaders prioritise and actively support TM activities, it creates a favourable context for engagement. Leaders can provide resources, incentives, and infrastructure to facilitate and encourage societal outreach and engagement (Huyghe & Knockaert, 2015). Additionally, the governance structures and policies within a university can shape the institutional support and incentives for TM. Clear guidelines, allocation of resources, and formal recognition mechanisms can provide a supportive framework for academics to engage in societal outreach (Meoli et al., 2019). Policies related to promotion and tenure can also impact the extent to which TM activities are valued in career progression (Amara et al., 2019; Göktepe-Hultén & Mahagaonkar, 2010). Also, the prevailing culture within a university can influence the extent to which TM activities are valued and supported. A culture that recognises and rewards societal engagement fosters an environment where academics are encouraged and motivated to participate in activities that contribute to the public good. An organisational culture that promotes collaboration, innovation, and societal impact can inspire and enable academics to engage in TM initiatives (Hellström, 2007; Huyghe & Knockaert, 2015).

The organisational context can further facilitate or hinder collaborations and partnerships with external stakeholders. Universities that actively foster relationships with industry, community organisations, government agencies, and other societal actors create opportunities for impactful collaborations. Adequate allocation of resources and the availability of supportive infrastructure are critical for the successful implementation of TM. Financial resources, research facilities, community engagement centres, and communication platforms are examples of the resources and infrastructure that can enable academics to effectively engage with external stakeholders and carry out impactful initiatives (Perkmann et al., 2013). What is more, universities with a strong reputation for societal impact and community engagement are more likely to attract academics and students who share these values (Friedman & Silberman, 2003; Ranga et al., 2016). The reputation and legitimacy of the university can also influence the perception of external stakeholders, which can in turn facilitate collaborations and resource mobilization for TM (Li et al., 2021; Taliento, 2022).

1.1.3 Theory of planned behaviour

It is not only the external or institutional environment which influences TM, but as TM and its realisation is accomplished by academics also individual factors need to be considered to allow for a comprehensive understanding of the motivations, behaviour, and decision-making process of academics. Individual factors provide insights into the motivations and intentions of academics regarding their engagement in TM activities. Exploring individual perspectives allows for a deeper understanding of why academics choose to participate in such activities, what

drives their decision-making, and how their personal values and beliefs influence their engagement. This is crucial for informing policy development and interventions aimed at promoting and supporting TM activities. By identifying the barriers and facilitators at the individual level, policymakers and institutions can tailor strategies that address specific needs, motivations, and preferences of academics, thereby enhancing their engagement in TM activities.

Individuals play a crucial role in shaping the behaviour and decision-making processes within universities. However, until now, the expanding body of literature on TM, particularly UIC, has largely overlooked the significance of individuals (Göktepe-Hultén, 2008). By examining individual factors, such as attitudes, subjective norms, and perceived behavioural control, through theories like the theory of planned behaviour, researchers and policymakers can gain insights into the factors that influence academics' choices regarding TM engagement.

Thereby, the theory of planned behaviour (Ajzen, 1991), assumes that individuals have purposeful control over their actions and behaviours, which are, again, determined by attitudes, subjective norms, and perceived behavioural control. An individual's degree of control over a behaviour, as well as how well perceived behavioural control is an accurate measure of actual behavioural control determines whether external factors can directly force or prevent behaviours, regardless of motivation.

In this thesis, Chapter 6 (Article IV) examines barriers to academic collaboration, where individual academics face varying risks and benefits in engaging in TM. In the context of academics' TM engagement, the theory of planned behaviour suggests that their intentions and subsequent actions to participate in activities related to TM are shaped by their attitudes towards these activities (e.g., valuing societal impact and knowledge transfer), subjective norms (e.g., perceptions of support or encouragement from peers and institutions), and perceived behavioural control (e.g., perceived barriers or facilitators that affect their ability to engage in TM activities).

By understanding these psychological factors through the lens of the theory of planned behaviour, researchers and policymakers can gain insights into the determinants of academics' intentions and behaviours concerning their involvement in TM. This knowledge can help in developing interventions, policies, and support systems that promote and enhance academics' engagement in activities related to TM, such as knowledge transfer, societal impact, and entrepreneurial endeavours.

1.1.4 Big Five personality model

The inclusion of individual factors helps to contextualise and explain variations in TM engagement across different academics, disciplines, and institutions. Individuals bring their unique backgrounds, experiences, and personality traits that can influence their attitudes and behaviours towards TM activities. By considering individual perspectives, researchers can better understand the diversity of engagement patterns and the factors that contribute to them.

In line of this, the thesis work was inspired by the Big Five personality model, which was used as a predictor for academics' TM participation in Chapter 5 (Article III). The theory was initially based on Tupes and Christal (1958), but it was further developed by Goldberg (1993), who identified five factors that measure personality: conscientiousness, agreeableness, openness to experience, emotional stability or neuroticism, and extraversion.

Integrating the Big Five Personality Model into the analysis helps explain why academics may differ in their attitudes, intentions, and engagement levels based on their personality profiles.

The model has already been used in previous academic entrepreneurship research, in which personality traits were analysed in relation to entrepreneurial intention, with the result that people with higher levels of conscientiousness, extraversion, and openness to experience and lower levels of agreeableness and neuroticism had stronger academic intentions to become entrepreneurs (Kolb & Wagner, 2015; Obschonka et al., 2010). As a consequence, individuals high in openness to experience may be more inclined to explore new avenues for societal impact, while those high in conscientiousness may demonstrate greater dedication and discipline in pursuing TM activities. Higher scores in neuroticism, on the other hand, may present potential barriers or challenges for engagement due to higher levels of anxiety or stress.

This PhD thesis uses the same measurement scale as Kolb and Wagner (2015), which was originally based on Gosling et al. (2003). In this way, it was possible to look for factors that determine TM participation. Given that personality traits are relatively stable over a person's lifespan (Cobb-Clark & Schurer, 2012; Roccas et al., 2002), this model is good for understanding the socio-economic engagement of academics.

Previous research points out that personal attributes of academics, as well as researchers as role models, and reputational and intrinsic reasons exert a more significant influence compared to the attributes of their departments or universities (D'Este & Patel, 2007; Göktepe-Hultén, 2008; Lam, 2011). This can be based on theories of motivation in social psychology, particularly the self-determination theory

(Deci & Ryan, 2000; Ryan & Deci, 2000), which suggests that individual motivations for behaviour and their reactions to various rewards are affected by the alignment between their personal values and the underlying principles of the activity. It needs to be acknowledged however, that the influence of individual factors might be mediated by the characteristics of university and departments to which academics are affiliated (D'Este & Patel, 2007).

Summarising, institutional theory provides the broader context and institutional pressures that set the stage for engagement. The Theory of Planned Behaviour examines the individual-level factors that mediate the impact of these institutional pressures on intentions and behaviour. The Big Five Personality Model adds another layer of analysis by considering the inherent characteristics of individuals and how they interact with their motivations and behaviours. By combining these theories, researchers can explore how institutional factors, individual decision-making processes, and personality traits influence and interact with each other. For example, the institutional context may shape attitudes and subjective norms regarding TM activities, while personality traits can moderate the strength of these relationships or influence perceived behavioural control.

This integration allows for a comprehensive understanding of why academics engage in TM activities, considering both the external and internal factors that shape their intentions and behaviours. It offers a holistic perspective that considers the dynamic interactions between institutional, individual, and personality-level factors.

2.2 Research methods and summary of results

The research methods used in this dissertation encompassed a combination of qualitative and quantitative approaches. The first step involved conducting a literature review, which is presented in Chapter 3 (Article I), to examine universities' TM within Nordic countries and their strategies for its implementation. The purpose was to get a first overview of research conducted in Nordic countries, to find similarities and differences and to obtain different definitions and understandings of the term *third mission*. The literature review followed specific criteria, including the analysis of articles published between 2000 and 2019 in the Scopus, WOS (Web of Science), and ProQuest databases, focusing on the university context in Scandinavian countries. The review identified similarities and differences in TM definitions and understandings, focusing on research conducted in Scandinavian countries between 2000 and 2019. For the literature review, 35 articles were extracted, most of which were conducted in Sweden, whereas the main research method was a qualitative approach with 28 articles (Table 1).

Table 2. Research method and origin of research

Synthesis	**Number of articles**
Qualitative methods	28
Quantitative methods	7
Mixed methods	3 (years 2010, 2015, 2017)
Country/Region	
Sweden	20
Denmark	6
Finland	5
Norway	6
Iceland	1
Northern Europe	1

The articles were published in a wide range of journals, with an emphasis on (higher) education, technology transfer, and policy. An overview of the journals with most publications related to TM can be found in Table 2.

Table 3. Journals

Journal	**Number of articles**
European Journal of Education	2
European Planning Studies	2
Higher Education Policy	6
Industry and Higher Education	2
Journal of Management Development	2
Journal of Technology Transfer	6
Science and Public Policy	6
Triple Helix	2
Other	10

Most research has concentrated on TM as a commercial and entrepreneurial mission of universities, without considering aspects which might benefit academia indirectly – and society directly – such as science communication, policymaking, curriculum development, and lifelong-learning activities. Further, most research concentrates on "hard" sciences, such as engineering disciplines, biotechnology, or medicine, where university-industry connections are usually strong and commercialisation outputs higher than in other scientific disciplines.

To further explore the topic, interviews were conducted with academics, staff from research institutes, and industry representatives in Iceland – this study is presented in Chapter 4 (Article II). The aim was to investigate university-industry collaboration (UIC) and explore the motives for and barriers to collaboration from different perspectives. Semi-structured interviews were chosen as the research method, allowing for open-ended questions and follow-up inquiries. The interviews targeted employees from various industries, including energy production, biotechnology, food processing, and nutrition science, which are significant contributors to Iceland's economy. The participants were randomly selected from lists obtained from industry databases and research institutes. In total, 15 people were contacted, and nine agreed to participate in interviews. The interviews took place at the participants' workplaces, shortly after the initial contact, and lasted between 45 and 60 minutes. Ethical considerations were emphasized throughout the research process. Confidentiality and anonymity were prioritized, given the small size of Iceland and the familiarity among its inhabitants. Participants were assured that their information and identities would remain protected, and all interview records were deleted after transcription. The research also adhered to the principles of respect for autonomy, nonmaleficence, beneficence, and justice in social research. Thematic analysis was applied to analyse the interview data and identify patterns and themes. Initial codes were generated through open coding of interview notes and transcripts, which were then grouped into categories. The analysis focused on the forms of UIC, motivational factors, and barriers to collaboration. The primary objective was to uncover meaningful and significant findings that emerged from the data, allowing for a comprehensive exploration of UIC. While theory generation is a valuable outcome of qualitative research, my focus was more on the interpretive nature of thematic analysis, emphasising the understanding and interpretation of the data rather than the explicit development of theoretical frameworks.

The results of the interviews reveal that personal formal and informal relationships are in the foreground. The most common forms of collaboration are applications for grants for e.g., student projects, internships for university students, and use of research facilities. The motivational factors to collaborate are mostly voluntary and based on reciprocity, which involves an exchange of information and equipment, common saving of costs and material, and common financing in the form of research grants. Other factors are quality assurance and better access to (international) networks, which again facilitate higher knowledge and resource transfer.

In a next step, shortcomings that were emerging from the literature review were taken into account for the continuous process of the research, which tried to consider TM in a broader context by laying an emphasis on social engagement and expanding the research to disciplines such as the social sciences and humanities.

This led to the studies presented in Chapter 5 (Article III) and Chapter 6 (Article IV). In this part of the research project, the qualitative results were used to develop survey questions in order to make an inference of a larger sample of academics in Iceland and thus to evaluate and explain qualitative results statistically. For this research, contact details for university researchers were obtained from university webpages. A survey was set up on the survey platform *QuestionPro*, and emails containing the link were sent out to all academics at Icelandic universities in March 2021. Two reminders were sent out within the following two weeks. The survey was sent to all permanently employed university researchers in Iceland at the beginning of 2021. The survey aimed to investigate the influence of individual and organisational factors on academics' engagement in TM activities and their perception of barriers to collaboration. This quantitative research approach in TM research is unique, as the sample size encompasses the total population of permanently employed university researchers in Iceland.

Survey questions inquired about employment status at the university (seniority, position, employment contract, faculty), employment status outside of academia, the amount of government or nongovernment funding received and teaching and publication activities. (The questions were based on Bekkers & Freitas, 2008; Boardman & Ponomariov, 2009; Bourelos et al., 2012; D'Este & Patel, 2007; Goduscheit & Knudsen, 2015; Klofsten & Jones-Evans, 2000; Schmoch, 1997). The questionnaire is enclosed in the appendices. Descriptive statistics, principal component analysis, and multiple regression analysis were used to analyse the survey data.

Chapter 5 (Article III) examines the characteristics of university researchers involved in technology transfer (TM) activities, revealing distinct types of TM and their enhancement factors. "Soft" TM activities, such as community engagement, science communication, and external teaching, are primarily influenced by individual factors like personality traits. On the other hand, "hard" TM activities like applied contract research and commercialization are better predicted by organizational factors such as discipline or work experience outside academia.

In Chapter 6 (Article IV), a similar approach is taken to analyse different perspectives on why academics are not involved in collaboration activities. Five fundamental barriers are identified, including individual-level factors (academic freedom and teaching obligations), internal academic factors (university resources), and external environmental factors (partner resources and interest). The barriers perceived by academics are most significant at the internal level.

These findings provide a basis for Icelandic universities to establish a focused agenda for developing, managing, and governing TM. This will allow for better utilization of academic expertise beyond traditional teaching and research,

potentially improving higher education financing and exploring new opportunities through successful TM implementation. Additionally, a strategic emphasis on socio-economic engagement enhances universities' role in society and contributes to the establishment of a competitive regional innovation system. This involves leveraging structural capital (intellectual assets, technological infrastructure, innovation, and patents) to create academic spin-off companies, as well as human capital (skills, talent, and know-how) through regional education. Furthermore, relational capital is built by establishing networks with local industry and municipalities, while regional growth is facilitated through infrastructure investment, attracting new companies. The example of the University of Akureyri illustrates these dynamics (Edvardsson, 2014). The results of this study can assist the Icelandic government and university administration in adjusting policies to facilitate focused TM and UIC.

Nevertheless, this study is not without limitations. It was a PhD study conducted with limited resources, so there are methodological limitations to this research. This means foremost that, due to the limited time and resources available for the study, only a limited number of aspects were investigated. This applies to the restriction of data from Icelandic universities only. Additionally, the data was gathered from only a limited number of participants. This relates to interviews conducted and survey participation. That is, extending the interview sample to more researchers and other industries would have given the study more perspectives and guiding principles. Due to the low response rate, single disciplines could not be analysed separately, but it was decided to create two groups, one comprising STEM and health sciences and the other comprising all other disciplines. Certainly, there are significant differences in research activity and TM participation between all disciplines. Possible reasons for the low response rate are the survey length, survey fatigue (Olson, 2014) and a general lack of participation in TM and collaboration activities in Iceland. Although Roscoe (1975) and Hair et al. (2019) argue that the rate is acceptable for further analysis, I am aware of the limitations this provides with respect to data reliability and generalisability, and I think the low response rate might also be indicative of the low level of interest and/or engagement in the subject.

What is more, as this is a retrospective study, participants were asked to reflect on past TM activities and identify collaboration barriers. However, it is important to consider the potential for recall bias as participants rely on their memory, which can be distorted or inaccurate. Recall bias may be influenced by factors like time, individual memory capacity, and intervening experiences (Eisenhower et al., 2004). Although completely resolving recall bias is challenging, previous research, including the work of Berney and Blane (1997) has demonstrated the value and reliability of retrospective data for research purposes, even over extended periods.

Additionally, reverse causality can be a concern when examining the relationship between barriers and activities. It is possible that the presence of barriers may influence individuals' perceptions or memory of their past activities, leading to potential biases in the reported data. Reverse causality issues are inherent in observational studies (Hernán & Robins, 2020). However, the issue can be addressed in a number of ways, such as when the research question involves less mutable characteristics (such as gender and age) impacting more mutable actions (such as TM activities). Furthermore, the patterns uncovered in observational studies can be studied in follow up studies that use experimental methods to get a cleaner causal picture.

Another limitation of this study is the slightly skewed results, as participants do not completely reflect the real population in relation to gender, position, or discipline. As pointed out by both Dohse et al. (2021) and Salminen et al. (2014), TM activities are still controversial, with academics in general having little to no interest in entrepreneurship. Many academics might also have elected not to contribute because they felt they had little to say on the topic. More energetic data gathering – such as directly calling academics or visiting them during office times or offering incentives – would possibly have had an influence on the participation rate, and what is more, it could have led to better administration and less skewed results. Nevertheless, this study is the first of its kind in Iceland – considering the total population of academics, including disciplines such as social sciences and humanities, which have often been neglected in previous research – which makes it a valuable contribution to the theory of academic entrepreneurship.

Finally, it is worth noting that approaching TM is still a complex undertaking, as practitioners are still divided by its meaning, its organisation or composition and its benefit to academia and society. Thus, to the extent that a framework of TM can be developed, it must be acknowledged that it is just a model of one feasible option and not a one-size-fits-all approach. Nevertheless, the approach can be extended to examine further aspects of TM, which will be discussed in the following chapter.

3 Article I: The Third Mission Among Nordic Universities: A Systematic Literature Review

4 Article II: “Nothing happens in a vacuum here”: university–industry collaboration in Iceland

5 Article III: Assessing Academics' Third Mission Engagement by Individual and Organisational Predictors

6 Article IV: Barriers to academic collaboration with industry and community: Individual and organisational factors

7 Discussion and conclusion

The major intentions of this study were to enhance knowledge on TM practices and strategies in a small economy like Iceland, to examine the factors influencing the development of TM activities by relying on multiple data collections and giving recommendations for university government and practitioners.

The research encompassed a diverse array of universities and academics in both peripheral and urban regions. This is essential, given the distinctive organisational structures and regional engagement patterns in different regions. By examining academics working in universities with different background, this study accounts for the nuances and complexities that arise due to differing conditions. Furthermore, the study acknowledges that academic engagement often hinges on individual motivations and behaviours. As such, the study scrutinises the individual and work-related background variables of academics engaged in TM.

The research questions that guided this study were as follows:

How can TM activities thrive in a small economy like that of Iceland?

What factors influence the development of such activities?

These research questions served as the backbone of this study, enabling a comprehensive exploration of the dynamics of TM within the unique context of a small economy. Through an in-depth analysis and interpretation of the research findings, this discussion aims to provide valuable insights and contribute to the existing body of knowledge in this field.

The theoretical contribution of this study in the field of TM research is by considering a broader perspective of academic engagement and barriers to collaboration. While previous studies have examined single aspects of TM activities, my research stands out by integrating three key aspects into a comprehensive model. While individual aspects have been explored in other studies, this study is the first to bring them together in a unified framework.

Furthermore, the theoretical contribution of this study extends beyond the integration of these aspects. It introduces a novel approach to narrow down the conceptualisation of TM and offers a classification system that allows for the assessment of informal or less visible engagement efforts. By developing this classification system, the study addresses a gap in the existing literature and

provides a valuable tool for understanding and evaluating a broader range of TM activities.

Hereinafter the four main objectives which were formulated in the introduction of this thesis are discussed, and a future outlook provided.

1.2 Novel conceptualisation and classification framework of TM

To ground this research project in a clear understanding of what TM is and is not in the context that is being studied, I reviewed existing definitions and conceptualisations of TM. This led to a novel conceptualisation and classification framework for TM, encompassing both formal and informal or less visible TM efforts. The first purpose of this study was to conceptualise TM in a novel way. As the topic of TM is diverse and definitions can be many, this novel approach provided a way to narrow down the term and find a new way of classifying TM activities which can help in assessing also informal or less visible TM efforts. This contribution was first accomplished by a literature review in Chapter 3 (Article I), where TM and its implementation in Nordic universities were analysed, followed by a more profound quantitative analysis of TM activities.

As the literature review suggests, much of the conducted research concentrates on measurable types of TM, such as company creation or patenting. Therefore, the emphasis of this research was laid on a more diverse interpretation of TM, including a broader scale of TM activities which can be hard to assess but has a strong impact on knowledge and technology transfer towards society (Nilsson et al., 2010; Trippl et al., 2015). One possibility is to take up measurements compared to the measurements of societal impact of research[1]. Societal impact can be used as a broad term to describe different types of impact, and is defined of the University of Iceland as "anything that affects sustainable development, economic prosperity, or the welfare of individuals" (University of Iceland, 2022, para. 1). Academic research can thus have an impact when someone outside of academia makes use of research results or when the results lead to a change in various aspects of life, such as education, politics, culture, health, and environment. Often, the impact can take many years to occur and become visible in society. Academic research can increase the chances of creating impact by e.g., collaboration with outside-academia institutions or people, making their research more visible, and increasing

[1] The first step of the University of Iceland was to launch a webpage for societal impact of research (https://sar.hi.is/en/sar/), with examples of impact measurement. As a side project during my doctoral studies, I had the opportunity to work on this content, as well as a handbook on the societal impact of universities.

student participation in their projects. Technological impact can be measured through patents or spin-offs, or trade data; social impact through e.g., comparison with control group using propensity score analysis; organisational impact by e.g., employee productivity or satisfaction measurements; health impact through hospital admissions, mortality rates, and more; environmental impact by e.g., ecological footprint or cost-benefit analysis. The toolkit by the Research Excellence Framework (REF) is one good example of planning for impact (Tilley et al., 2018).

Building on these outcomes, the thesis provides a revised definition of TM, which takes a broader approach to the term than many previous definitions:

> *The third mission, as a concept that bridges academia and society, is closely intertwined with the primary functions of universities, namely teaching and research in all academic disciplines. This vertical integration involves the active participation of faculty, administrative staff, and students. The overarching objective of the third mission is to enhance the value derived from knowledge exchange for academia, industry, and society. This is achieved through a diverse range of activities, both formal and informal, including community engagement, commercialisation efforts, applied contract research, science communication, and teaching and training initiatives.*

One key element in the definition is vertical integration, which refers to the seamless integration and alignment of the concept within the existing structures and activities of universities' first and second missions, which are teaching and research, respectively. It suggests that TM is not a standalone or isolated concept but is interconnected with and extends from the core functions of universities. The vertical integration occurs through the involvement and participation of different stakeholders within the university community. This includes faculty members, administrative staff, and students who collectively contribute to the implementation and realisation of TM. By involving these various actors, TM becomes an integral part of the overall functioning and mission of the university. The ultimate goal of TM, as mentioned in the definition, is to generate value in terms of knowledge exchange for academia, industry, and society.

The study made it clear that it is necessary to extend the term of TM and approach the concept as a compromise of satisfying the diverse needs of society, industry, and academia. In this development, universities can take advantages of TM to fulfil their existential role of contributing to society. Industry thereby makes more use of knowledge and technology transfer, mutual use of resources such as equipment, but also human resources, which again influences their overall innovative capacities and competitiveness. In this way, collaboration can further strengthen regional

development, as the example of Akureyri and its surrounding region, Eyjafjörður, shows (Edvardsson, 2014).

TM brings significant benefits to society by enabling the direct utilisation of new knowledge and technology, including infrastructure development, ongoing education opportunities, and social innovation. This engagement with society allows for targeted research efforts to address critical societal needs, such as addressing social imbalances in an unequal society and tackling social and sustainable challenges (Carl & Menter, 2021). As a result, TM emphasises more applied studies that have practical relevance to society rather than being predominantly theoretical in nature.

While the pressure to publish research in prestigious journals targeted at a limited scientific community remains high, there is a growing demand for open access communication of research from both companies and society (Gregersen et al., 2009; Meissner & Shmatko, 2017). This shift aims to make research more accessible to broader audiences (Miettinen et al., 2015), which involves using diverse channels such as news media, workshops, collaboration with schools, newsletters, and social media platforms to effectively communicate research to wider society (Robinson-Garcia et al., 2018).

Another important aspect is that through the dissemination process, the impact of research is determined and developed with regards to the intersection of science and society (Holmberg et al., 2019). By appropriate dissemination of research results, research itself can influence, change, or benefit economic prosperity, sustainable development, and the welfare of individuals. In this manner, universities adopt a role of economic and societal change agents (Soetanto & van Geenhuizen, 2019). As such, it has even been proposed that the term *Third Mission* be replaced by *societal impact* (Miettinen et al., 2015; Robinson-Garcia et al., 2018). Consequently, dissemination of research does not only include publication of research articles but also involves taking part in debates and discussions while opening dialogues with stakeholders and policymakers.

However, suppose we were to think of TM as a first mission, which entails that research and teaching are developed out of the standpoint of socio-economic engagement. What would happen, and how would it change the academic landscape? It would certainly spur further collaboration and an entrepreneurial mindset among its staff and students and provide a guiding compass for teaching and research. Thus, universities should view the entire higher education system through the lens of TM.

1.3 TM practices and strategies in a small economy like Iceland

The second objective was enhancing knowledge on TM practices and strategies in a small economy like Iceland.

This study made it clear that TM remains an additional responsibility of academics and is still underdeveloped in Iceland compared to its Nordic neighbours. TM has its spot in mission statements but is poorly funded, specific commitments on behalf of universities and goals are missing, and it needs to be put more vigorously into operation. What is more, TM still lacks the recognition and reputation of the first and second missions of teaching and research. Further, academics need to be better informed and educated on the issue and to be given the resources to invest in TM activities.

One key purpose of this thesis was to analyse the development of different universities when it comes to socio-economic engagement, i.e., differences between universities located in rural areas and those located in the capital area of Reykjavik. However, hardly any differences could be found in terms of TM development. Though I expected academics working at universities in rural areas to participate more in "soft" TM activities or educational and community activities due to the lack of other local research organisations, in comparison to their colleagues working at universities located in the capital (Carl & Menter, 2021; Salomaa, 2019), this was not the case. One reasons may be the isomorphism of Icelandic universities, as first, most national policies and regulations, and funding from the government to public universities, are similar. Second, Icelandic universities are still competing on a national basis for well-educated staff (academics) and students, as their financial budget received from the government is based on student number, but less on other outputs, such as research or their socio-economic engagement. Due to isomorphism, universities follow similar principles, and differentiation between them is not high (Teichler, 2004). It is certainly easy to follow a one-size-fits-all approach, but this does not support universities in their specialisation, specific community engagement, and international competitiveness.

Further, as there are seven universities in Iceland, but only one dominant university – the University of Iceland, with around 15.000 students – which also offers most types of degrees in various disciplines, it seems plausible that other, smaller universities align themselves to this university despite their location and imitate their behaviour and entrepreneurial approach. This is even more underlined as the smaller universities have even less manpower and financial support than the University of Iceland, which means that it might be easier for them to imitate that university instead of building their own identity and approach to the three missions.

Smaller universities outside the capital area used to have a stronger regional focus. However, due to their increasing emphasis on international publications, these universities have experienced a shift towards a more globally oriented perspective, potentially impacting their previous regional engagement.

Considering these factors, it becomes evident that alternative models or frameworks may be more suitable for Iceland, given its status as a small economy. The limitations of the Triple Helix approach and the government's influential role in shaping the operational landscape emphasise the need for innovative approaches that can accommodate Iceland's specific context and challenges. Exploring and adopting other models or frameworks that foster collaboration, (natural and financial) resource management, and regional development may better align with Iceland's unique circumstances and enhance its overall economic and societal progress.

One example is the Quadruple Helix model (Carayannis & Campbell, 2011, 2013; Marcovich & Shinn, 2011). The Quadruple Helix model extends the Triple Helix by including the community as the fourth helix. In Iceland, where community engagement is highly valued, incorporating public organisations, non-governmental entities, and local communities into collaborative efforts could provide a more comprehensive approach. As Iceland's natural resources, such as fisheries and renewable energy, play a crucial role in its economy the Quadruple Helix model would enable the inclusion of local communities and non-governmental organisations in resource management decisions, fostering sustainable practices that align with societal values and ensure long-term benefits for the community. Further, as tourism is another significant industry in Iceland, the Quadruple Helix model allows for the active involvement of local communities and public organisations in tourism development initiatives. This collaborative approach ensures that tourism growth is carried out in a responsible, sustainable, and community-oriented manner, considering environmental, cultural, and social sustainability. Another reason to promote the Quadruple Helix is rural and regional development. Here, the Quadruple Helix model provides a platform for engaging local communities, non-governmental organisations, and relevant stakeholders in the development of these regions. By tapping into local knowledge and resources, innovative solutions can be identified and implemented, addressing regional disparities, and promoting inclusive growth.

Another model which could be suitable for Iceland is the Smart Specialization approach which focuses on identifying a country or region's unique strengths and competitive advantages and directing resources and collaborative efforts towards those areas (Kempton et al., 2014). For Iceland, this approach could involve a strategic assessment of its research expertise, industrial capabilities, and societal

needs. By aligning collaborative initiatives with these identified areas of specialization, stakeholders can work together more effectively towards common goals, leveraging the country's distinctive strengths.

What is more, given Iceland's specific industries, a cluster-based collaboration approach may be effective. This approach involves bringing together a network of related academic institutions, industry players, government bodies, and other relevant stakeholders within specific sectors or geographic regions. By focusing on clusters related to fishing, renewable energy, or tourism, for example, collaboration can be tailored to the unique needs and characteristics of each industry, fostering specialisation, knowledge sharing, and joint problem-solving. Many initiatives or clusters have already successfully been developed in Iceland such as micro-clusters in tourism (Sigurðardóttir & Steinthorsson, 2018), fisheries, the Icelandic geothermal cluster, the Iceland ocean cluster, and the Iceland health tech cluster (Steinþórsson, 2020).

1.4 Factors influencing the development of TM activities

The third objective was examining factors influencing the development of TM activities by relying on multiple data collections. Generally, this study represents a novel way of examining, with a mixed methods approach, multiple factors that influence TM, and not just one. Accordingly, this research is a pioneer study that investigates both individual and organisational factors which influence academic TM participation. Thereby, the smallness of Iceland and its academic structure made it possible to study the total population of academics and their TM engagement. A valuable contribution to the theory of TM is also the consideration of disciplines such as the social sciences and humanities, which have often been neglected in previous research.

What becomes clear, is that each university, each discipline, and each academic contribute to TM in a unique way, where some actions are more visible than others, and some projects might take longer to have a societal impact. Bonaccorsi et al. (2014), for example, states that little participation from humanities and social sciences might be explained simply by isomorphism and inertia, as academics stick more to traditional forms of university tasks and missions. This can be problematic when universities, for example, mostly only value contract research or commercial activities such as patenting. It further means that there is no one-size-fits-all solution for different disciplines. As this research showed, social sciences and humanities are more active than academics from STEM or health sciences when it comes to science dissemination, which is, however, currently less valued. Consequently, it is therefore necessary to distinguish between different activities, as all disciplines

participate in TM but might emphasise different aspects. This calls for diverse reward systems for different disciplines.

Taking up TM often involves additional tasks for academics. These are, however, tasks which often go beyond researcher's ability, interest, and especially time, as the first two missions of research and teaching are already very time-consuming, and innovation and commercialisation training is lacking. Taking exploitation of research as an example, it involves utilising and leveraging research outcomes, knowledge, and discoveries to generate economic, social, or practical value. It encompasses activities that go beyond the initial creation of knowledge and focuses on realising the full potential and impact of research. Some key elements involved in the exploitation of research include innovation, or the transformation of research findings into new or improved products, processes, or services that offer novel solutions or benefits. It often also involves identification and protection of valuable intellectual property through patents, copyrights, or trademarks to secure exclusive rights and enable commercialisation. Exploitation further involves taking research outputs to market by developing business models, securing funding, or establishing partnerships, and by introducing and promoting the research-based products or solutions to target audiences, effectively positioning them in the marketplace, and addressing customer needs (Siegel et al., 2004).

Furthermore, an examination of the barriers to academics' engagement in TM reveals that the organisational structure of universities plays a significant role in impeding their participation. Within this structure, various factors such as incentive mechanisms, work evaluation systems, salary structures, and career development pathways within academia contribute to the limited involvement in TM activities.

Notably, younger academics and those occupying lower ranks face a critical dilemma in balancing their dedication to TM with the pursuit of career advancement. The prevailing emphasis on increasing publication rates as a measure of academic success, particularly for tenure and salary considerations, often leads them to prioritise research output over collaboration with external partners. The prevailing belief that high publication rates are paramount for career development reinforces this focus, creating a strong incentive for academics to channel their efforts solely into traditional research activities.

The current academic incentive and career systems, therefore, necessitate an overhaul to better align with the changing landscape of university-industry interactions and societal engagement. Revising the incentive structure to acknowledge and reward TM engagement, beyond publications, would encourage academics to actively participate in collaborative initiatives with industry and other external stakeholders. Likewise, implementing a comprehensive work evaluation system that recognises the value of TM contributions would enable academics to

allocate time and resources towards engagement activities without compromising their career prospects.

Moreover, a revision of the salary structure to reflect the importance of TM involvement would provide further extrinsic motivation for academics to embrace these activities. This could include incorporating performance-based components that assess both research outcomes and TM contributions, thereby fostering a balanced and holistic approach to career development within academia.

This study yielded interesting results, as no significant gender differences were found in TM activities or barriers to collaboration. There could be various factors contributing to this outcome, such as the evolving dynamics of gender roles and increasing gender equality. It is worth considering the impact of universities' policies that now place greater emphasis on gender and family issues, such as the University of Iceland (University of Iceland, 2021). While it cannot be definitively stated whether these policies directly influenced the findings, they provide a tangible context to explain the absence of gender differences. This suggests that both men and women are equally motivated and interested in participating in TM initiatives and utilising their academic expertise for the betterment of society.

Accordingly, the changes that TM brings about also bear challenges, and, consequently, universities stand today at crossroads where they must create new organisational models to find a balance between exploring and exploiting research and teaching but also to make better use of their physical resources and the expertise of their staff without violating scientific ethics. This can be challenging, as especially research collaboration increases the risk that universities will focus mostly on applied research and skip the traditional roles of universities' fundamental research; teaching and research roles are therefore in danger (Brooks & Randazzese, 1999; Perkmann & Walsh, 2008). This development can be disadvantageous, as a need exists to educate people adequately and to acquire new knowledge from fundamental research. Increasing short-term research on behalf of industry can result in neglecting fundamental research, which is less attractive for the private sector, but a necessity for further development of science and therefore of importance for society (Larsen, 2011). Such a development can challenge the independence of research institutes, especially universities and their role in society. When academics collaborate with the private sector, the ethics and values of the university are often not in the foreground but clash with commercial values from the private sector. Research for a public purpose with the intention of commercialising can result in privatisation of the "scientific commons" (Nelson, 2004).

1.5 Recommendations for university government and practitioners

As the research has a clear practical purpose, the last objective of the study is to provide recommendations for university government and practitioners. Here, especially, when regarding the practical contributions of this study, it becomes evident that solely individual or organisational incentives are not sufficient to promote TM participation. The new framework of TM can support practitioners such as policymakers and university management in distinguishing between different TM activities and set clear goals. It can further help in the development of assessment or incentive systems. In addition, it gives them a better understanding of potential barriers to socio-economic engagement, which is crucial when universities want to take a more vigorous step in promoting TM among their academics. Knowledge about these aspects is important especially for university management and policy regulation to strengthen researchers' entrepreneurial potential at the individual level but also give evidence on organisational aspects.

The outcomes of this thesis lead to the formulation of nine main recommendations for policy- and decision-makers in higher education. These are as follows:

- Classification of TM in a broader context (and not solely focusing on "hard" activities) using TM categorisation, as proposed in the study. This also involves the incorporation of less recognised TM contributions by considering academic engagement that yield long-term societal impact.
- Customise evaluation and assessment structures of long- and short-term TM outputs across different academic disciplines.
- Adjusting incentive and reward systems accordingly with different emphasis between academic fields in order to avoid disadvantaging certain disciplines – also with the purpose of overcoming barriers, as mentioned in this study.
- Establishing a unique but diversified academic community which involves hiring academics based on different work-related and personal attributes, while at the same time changing criteria for academic work, with less emphasis on publication quantity and history but more priority/putting more weight on socio-economic engagement and societal impact. The feasibility of such a transformation relies on strong institutional backing and leadership commitment. It requires universities to actively promote and incentivises socio-economic engagement and societal impact, potentially through updated promotion and tenure criteria or alternative career pathways. Shifting the academic culture to value diverse attributes and

prioritise impact over traditional measures may encounter resistance or scepticism. Changing mindsets and fostering a supportive environment that encourages innovation, collaboration, and societal engagement would be crucial. Developing robust evaluation frameworks and methods to assess socio-economic engagement and societal impact becomes essential. This includes defining relevant indicators, establishing clear benchmarks, and creating mechanisms to fairly evaluate and recognise these contributions.

- Making TM more visible in and outside of academia, while at the same time raising awareness of it, e.g., by making entrepreneurship education a priority across disciplines and by educating and advising academics on the wide-reaching impact of TM and entrepreneurship facilities ensuring that academic institutions provide comprehensive training and resources to nurture entrepreneurial skills and mindsets among students and academics. This includes integrating entrepreneurship modules or courses into various academic programs and creating opportunities for hands-on experience in innovation and commercialisation. Moreover, educating and advising academics on the broader implications and potential impact of TM and entrepreneurship facilities can help bridge the gap between research and practical application.
- In connection to the aforementioned point: Vertically integrating TM into the whole university, which also includes connecting TM with research and teaching, i.e., building up a knowledge triangle of research, education, and innovation. To integrate the third mission into teaching, universities can incorporate service-learning components into their curricula. Service-learning involves students applying their knowledge and skills to address community needs through practical projects. By integrating service-learning opportunities into various disciplines, students gain valuable hands-on experience while contributing to the community. Vertically integrating TM requires interdisciplinary and collaborative research that addresses societal challenges. Universities can encourage academics from different disciplines to work together on projects that have real-world applications and impact. This can involve establishing research centres or institutes focused on specific societal issues, such as sustainability, public health, or social inequality.
- Strengthening Triple and Quadruple Helix facilities, e.g., by providing better platforms, expanding facilities, funding interdisciplinary research, and providing interdisciplinary courses and positions within and outside

academia, such as intermediaries that better facilitate collaboration and bridge discrepancies between academia and industry.

- Setting incentives for universities to compete more on an international basis, instead of nationally with other Icelandic universities, through more collaboration on a national level.
- Icelandic universities should further emphasise their specialisation, especially if the university is not a "generalist" but founded under the premise of specific conditions or in a certain region, to spur regional education and development. By focusing on areas where the university has a competitive advantage or unique resources, they can attract faculty, researchers, and students who are specifically interested in those areas. This concentration of expertise can contribute to regional development by fostering innovation, attracting investment, and addressing local challenges.

Summarising, university leaders would be well advised to make more efficient use of academic expertise and facilities through e.g., TM activities to foster possibilities for additional funds. Industry collaborations enhance study and research facilities and higher knowledge and technology transfer (Ankrah & Al-Tabbaa, 2015). Thereby, a purposeful organisational structure within universities needs to be established with key facilitators, funding, and resources that bridge the gap between research, invention, innovation, and commercialisation. Further, incentive structures within universities, especially on the individual level, are crucial and need to be intensified over all academic disciplines.

Universities can encourage the establishment of specific organisational structures with a purposeful specialisation, with different product development levels, and with key actors which help in the build-up of TM. By dividing these processes within the university, the chance of reaching a balance in research performance and resource utilisation is more likely. Researchers or research groups are accountable for the preliminary stage.

Compared to many other European universities, universities in Iceland have few students and employees and, due to their location, are more isolated than other universities in the world. These aspects can be transformed into strengths by successfully implementing a Quadruple Helix in the form of regional collaboration between higher education, companies, community, and the government to keep up with challenges rooted in globalisation and growing competition in international markets.

1.6 Future directions

This study identified TM activities of academics and barriers to collaboration. While the research presented a broad theoretical base and an original approach to TM, there are more areas where future research can contribute to enhance the results of this study.

First, after this study, there is a need to follow up with an explanatory sequential design. Here, the purpose is to use a qualitative approach to explain previous quantitative results, e.g., non-significant results of TM such as gender, rank, or teaching, to gather more information from specific disciplines regarding their attitude towards TM, and to try to reach out to academics that did not participate in the survey. As the population in Iceland is small, research should also be expanded, i.e., considering a comparison of different universities in peripheral and urban regions, especially in small economies, as their organisational structures and regional engagement differ from each other (Karlsen et al., 2017; Markuerkiaga et al., 2016). As this research showed that academic engagement is usually influenced from an individual level, more educational and social background variables of university researchers who engage in TM activities should be scrutinised more than they have been in this study (Huyghe & Knockaert, 2015). Further, it needs to be considered how intrinsic and extrinsic motivation influence entrepreneurial engagement (Fogelberg & Lundqvist, 2013) and especially entrepreneurial intention as a predictor for TM participation. Organisational culture within the university and different disciplines should be considered (Fogelberg & Lundqvist, 2013; Klofsten & Jones-Evans, 2000).

What is more, as universities are highly integrated into society, it is of greatest importance to research public acceptance of university engagement, as well as the overall institutional context and value of TM for academia and society. Philpott et al. (2011) remarked that little research has considered the economic impact and importance of "softer" TM activities and their outputs. This is unfortunate, as incentive structures tend to reward for-profit structures and activities, thereby neglecting the pursuit of societal and regional university missions. Consequently, the concept of the TM and entrepreneurial university is misunderstood, and resources are allocated inappropriately.

Another notion that I found while studying TM in depth is that research should be extended to more emerging topics, such as sustainability of universities, which can even be seen as the "fourth mission" of universities (Trencher et al., 2014), and how academics approach this topic in research and teaching. The fourth mission is defined by Trencher et al. (2013, p. 40) as "co-creation for sustainability." My approach would be to start with a literature review of universities' sustainability approach then use case study research to examine how universities are

incorporating the "fourth mission" into their concept, especially into teaching and research.

In conclusion, TM has the capacity to substantially influence not only our research culture but also our society as a whole. As academics, our ongoing task is to improve our understanding of "soft" TM activities and to communicate their inherent value beyond immediate economic gains. As we journey further into this research area, we also face the timely issue of sustainability, a critical factor that presents a potential "fourth mission" for universities. By integrating these considerations into our future research, we open doors to an academia that is not only rigorous and relevant but also forward-thinking and socially responsible.

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Appendix I – Questionnaire in English

Appendix II – Questionnaire in Icelandic