TU Delft

INFLUENCES ON TECHNOLOGY ENTREPRENEURSHIP

A comparative analysis between The Netherlands and Japan

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Influences on Technology Entrepreneurship: A comparative analysis between The Netherlands and Japan

Master thesis submitted to Delft University of Technology

in partial fulfilment of the requirements for the degree of

MASTER OF SCIENCE

in **Management of Technology**

Faculty of Technology, Policy and Management

by

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To be defended in public on February 1st 2022

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ACKNOWLEDGEMENTS

With the completion of this Master thesis my time as a student at TU Delft will come to an end. I have learned and grown immensely, and I am sure I will look back on this period fondly. At the same time, I am looking forward to what the next chapter in my life holds with excitement.

Throughout the process of creating this thesis, many people helped and supported me along the way, and I would like to express my gratitude here.

I would like to thank my first supervisor Dr. Roland Ortt for his guidance, support, and words of wisdom. Our discussions were a great source of inspiration to me, and through them I have been able to learn much about myself. Secondly, I would like to express my thanks to my second supervisor Dr. Aleksandar Giga, the threat of your sharp mind never allowed for complacency. You both pushed me to create something that was better.

To Dr.ir. Bert Enserink, Dr.ir. Els van Daalen and Prof.Dr.ir. Shinichiro Haruyama, thank you for taking the time to have an interview with me. Your input was of great value to this work.

Lastly, but certainly not least, to my family and friends. Thank you for your patience, support, and feedback, it means the world to me. I am grateful to have people in my life I can truly count on.

Tondan Avé
Almere, January 2022

EXECUTIVE SUMMARY

This thesis explored the contrast between different types of entrepreneurship through a comparison of The Netherlands and Japan. The focus of this thesis is the contrast between the overarching category of entrepreneurship (from here on, "mainstream entrepreneurship" or ME) and the subset of technology entrepreneurship (TE). Many of the technological innovations part of everyday life have come through TE efforts (e.g., Google, Facebook, Apple, Uber, Netflix). Furthermore, a disproportionately large amount of the overall economy is generated by only a small number of technology firms (e.g., Amazon, Google), making not just ME, but TE in particular a source of innovation and contributor to the economy and job creation. According to data from the Global Entrepreneurship Monitor (GEM), which publishes worldwide annual entrepreneurship data, The Netherlands has much more ME than Japan, with the corresponding indicators confirming this. However, when looking at the subset TE specifically, a different picture seems to emerge. The paradox is that (virtually) every indicator points to Japan being, or having to be, lower on TE than The Netherlands, yet somehow Japan outperforms The Netherlands by almost 2:1 concerning TE. This could indicate that TE is not bound to the current frameworks of ME and is subject to different influencing variables, or the ratio of influence between the variables is different. This is however not established as such, showing a gap in focused research and knowledge on TE. Therefore, the variables that influence ME should be verified for applicability for TE and a framework of influencing variables should be created specifically for TE. This master thesis addresses this problem through the following research question: "What are the variables, on a national level, that affect TE differently than ME?" Three sub-questions guide the research, (i) "What is technology entrepreneurship and what are its differences with mainstream entrepreneurship?", (ii) "What variables influence mainstream entrepreneurship on a national level and what variables influence technology entrepreneurship on a national level?", and (iii) "How can I measure technology entrepreneurship on a national level in contrast to mainstream entrepreneurship, as well as the influencing variables?".

The first sub-question was answered through literature research, defining ME as "the activity of exploiting an opportunity for financial gain by starting a business, with the potential to be an instrument for change and wider economic growth". TE, a subset of ME, was defined as "a complex multi-actor phenomenon that is intricately linked to scientific and technological change and the exploitation thereof." The most important factor that distinguishes TE from ME was found to be its interdependence on scientific and technological change. The overall levels of ME and TE are influenced by a set of variables, therefore, to explain the differences in the overall levels of ME and TE between the Netherlands and Japan, it is important to measure these influencing variables as well.

One set of influencing variables for both ME and TE was created, consisting of *economic development, technological development, institutions, culture,* and *education.* ME was measured by using the Total Entrepreneurial Activity (TEA) index from the GEM dataset, which measures the percentage of the population (18-64 years old) engaged in entrepreneurship. Although there is no single indicator available that measures TE in a country, this thesis has operationalised TE for a best-fit approach. The TE index is created by the product of (i) usage of the latest technology (0-5 years), (ii) new product, (iii) high job creation, and lastly (iv) market impact. These are all found in the GEM dataset, and thus the TE subset is extracted from the TEA index through (different combinations of) these criteria.

The influencing variables themselves are difficult to measure and are often multi-dimensional, and no specific indices measuring these influencing variables were found. However, driving these influencing variables are underlying elements which are measurable. The measurements of these elements were used to draw conclusions about the influencing variables. Most elements were found in the GEM dataset, and where possible, combined with an additional source for verification (OECD, World Bank, IMF). The influencing variable e*conomic development* was measured through *GDP per capita.* For *technological development*, the elements were *R&D expenditure*, *Patent/GDP ratio, R&D transfer*, and *Broadband subscriptions*. Institutions were measured through *government policies: support and relevance, taxes and bureaucracy, government entrepreneurship programmes, commercial and legal infrastructure,* all from the GEM dataset. *Education* consisted of the percentage in a population having completed *tertiary education*, and the number of *universities offering technology majors*. Finally, culture consisted of the elements *cultural and social norms* from the GEM dataset, as well as the *Hofstede cultural dimensions*.

The main research question was answered through data analysis of a comparison between The Netherlands and Japan. The Netherlands showed high values for ME, but low values for TE, and Japan showed low values for ME, but high values for TE. The Netherlands had double the amount of ME on average. Several iterations of the TE index were used, and every iteration clearly showed Japan to have more TE, the difference ranging from twice the amount of TE to nearly four times the amount of TE. Thus, the results were consistent, whichever way TE was defined. These findings were also consistent throughout the analysed time-period (2013-2020) as well as consistent with the preliminary findings in earlier chapters. *Technological development,* and *Education* showed higher levels for Japan, whereas *Institutions* and *Culture* showed higher values for The Netherlands. These influencing variables therefore affect TE differently than ME and vice versa. More specifically, higher levels of *Technological development* and *Education* have a positive influence on the levels of TE in a country. *Institutions* was found to be more conducive to entrepreneurship in The Netherlands than in Japan, thus leading to the conclusion that a better institutional environment leads to more ME. The Netherlands was found to have a better cultural environment than Japan, as rated by the GEM data as well as through Hofstede's cultural dimensions, showing higher levels of *individualism.* This was in line with the literature that the *individualism* dimension was strongly linked to higher levels of ME. *Economic development* showed similar values and thus seemed to have little or no influence in the comparison between these two countries.

To check these results for generalisability, (a similar) analysis was performed on 44 additional countries. The first finding, after plotting the countries in a scatterplot based on their ME and TE values, was that The Netherlands and Japan were not exceptions and that the combination of high TE/low ME and low ME/high TE was a common phenomenon. The scatterplot was divided into four quadrants, with Q1 (low ME, high TE) being exclusively high-income economies, Q2 (high ME, high TE) and Q3 (low ME, low TE) both mixed with high- and low-income economies, Q3 (low ME, low TE), and Q4 (high ME, low TE) consisting of low-income economies, or developing countries. It also showed that TE and ME are unrelated, which was confirmed by a low correlation coefficient and corresponding p-value. We therefore conclude that the influencing variables for ME and TE must be different. Q1 (low ME, high TE) and Q4 (high ME, low TE) were compared to each other and showed that values for the influencing variables *Technological Development,* and *Education* are much higher in countries with high TE, as in the comparison between The Netherlands and Japan. Some of the elements clearly showed differing values, whereas others were more similar between the two quadrants. For *technological development,*

in Q1 (low ME, high TE) *R&D expenditure*, *Patents/GDP,* and *Mobile Broadband Subscriptions* were found to be much higher than in Q4 (high, ME, high TE). *Education* seems to be a major influencer for TE, as both elements (*tertiary education, universities offering technology majors)* showed significantly higher values in Q1 (low ME, high TE) than Q4 (high ME, low TE). *Economic Development* was also found to be higher in Q1 (low ME, high TE) than in Q4 (high ME, low TE) countries, which is consistent with prior literature research. Thus, The Netherlands was more of an outlier in that specific comparison. Therefore, the influencing variables that affect TE differently than ME are *Economic Development, Technological Development,* and *Education*. Higher values for these influencing variables will lead to higher levels of TE. *Institutions* showed little difference between the two analysed quadrants. For *Culture*, Q4 (high ME, low TE) was not found to have higher levels of *Individualism*. On the contrary, Q1 (low ME, high TE) was found to have more *Individualism*, and unexpectedly had higher levels of *long-term orientation*, possibly indicating an additional cultural precursor for high levels of TE.

Policy recommendations following the findings to increase national levels of TE concern education and technological development. Increasing the level of education, more specifically technical education to increase the available human capital for TE, is likely to increase TE levels. This can be done through increasing funding for universities of technology, paying special attention to technology in high schools, encouraging more women to study technology majors and decreasing the tuition fees for technology students. Providing a favourable regulatory and tax environment for TE lowers barriers, increases the appeal of TE and likely contributes to higher TE levels. Furthermore, funding for start-ups, specifically those at universities could be increased. In addition to increasing the levels of TE, policy should focus on increasing the quality and success rate of TE efforts.

Managerial recommendations following the findings include placing start-ups close to universities of technology and industrial areas with many technology companies, which would offer more opportunities to come into contact with people that have a high level of technical education and increase the chance for *knowledge spillover*. Becoming part of a start-up incubator or accelerator is likely to increase odds of success as well. Lastly, diversifying your team beyond technically skilled people to include those with financial and marketing knowledge is important to the success of the overall business, and is therefore recommended.

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1 | Problem Statement & Research Questions

This thesis will explore the contrast between different types of entrepreneurship through a comparison of The Netherlands and Japan.

1.1 Introduction

ENTREPRENEURSHIP
/ˌɒNTRəPRəˈNɜːΣɪP/
NOUN
1. THE ACTIVITY OF MAKING MONEY BY STARTING OR RUNNING BUSINESSES, ESPECIALLY WHEN THIS INVOLVES TAKING FINANCIAL RISKS; THE ABILITY TO DO THIS

According to the Oxford English Dictionary entrepreneurship is defined as "the activity of making money by starting or running a business, especially when this involves taking financial risks". If you are willing to take on these risks, entrepreneurship can offer much in return: independence, responsibility, freedom to express yourself and financial return. People choose to engage in entrepreneurship for any number of these reasons. I have engaged in entrepreneurship myself, which was a period of great personal growth for me. There are many different types of entrepreneurship, which can take place across many industries. Entrepreneurship is an important contributor to the economy, job creation and a source of innovation. Chapter two will discuss the academic theories, definition and different types of entrepreneurship in detail. Related to innovation, within the overall umbrella term of entrepreneurship, one subset of entrepreneurship that is of particular interest both personally and within context of this Management of Technology MSc programme, is technology entrepreneurship (TE). The contrast between this subset (TE) and the overarching category of entrepreneurship (from here on, "mainstream entrepreneurship", or ME) will be the focus of this thesis. Many of the technological innovations we now enjoy as part of everyday life have come through technology entrepreneurship efforts. TE does not necessarily create the technology itself, as the principles behind these efforts often stem from, among others, scientific research; but TE envisions them in products with business models. TE is therefore responsible for the commercialization of the innovation and bringing innovative products to market (Ortt, 2021). Think of companies like Google, Facebook, Apple and more recently, Uber and Netflix, of which some have started small but have grown to become multinationals and have far-reaching impact. Many of these come from Silicon Valley in the United States of America, the famous tech hub and breeding ground of tech start-ups.

Annually, according to the Startup Genome (2020) over 305 million start-ups are founded. Within the global start-up economy (ME including TE), over 2.5 trillion euros comes from technology start-ups, highlighting the size and importance of TE. Furthermore, a disproportionately large amount of the overall economy is generated by only a small number of technology firms (e.g., Amazon, Google).

The Startup Genome (2020) predicts that the increasing globalization and decentralization of TE will lead to Silicon Valley no longer being the central hub of the start-up economy, but that the global start-up landscape will consist of multiple large hubs across the world. They foresee at least 30 global centres of TE that will be either regional or specialized; meaning Jakarta could be the central hub for Southeast Asia or Shenzhen the central hub for Robotics as a specialization. Thus, tech start-ups, being widely

recognized as an engine of social and economic growth (Acs and Audretsch, 2003), is increasingly present on the agenda of governments across many nations, developed and underdeveloped, to implement policies towards encouraging TE.

Although TE is of increasing importance to national governments around the world, there is a clear difference in the spread and speed of adoption of both ME and TE between countries. Data on entrepreneurship is published yearly in the Global Entrepreneurship Monitor (GEM) reports and differences among countries can be clearly seen.

Out of personal curiosity in both technological innovation and national culture I decided to compare The Netherlands to Japan. I've always seen Japan as a very technologically advanced country. Having visited a few times I'm always amazed by, and very much enjoy, the many innovations integrated into society and everyday life. In addition to that, Japan is culturally a vastly different country to The Netherlands, which I know both from the literature as well as first-hand experience. Furthermore, the literature is very clear on national culture being a strong influencer for engaging in ME.

The following figure, displaying data GEM report (2020) taken via a survey (2000+ participants), shows the percentage of the people in Japan and The Netherlands that see entrepreneurship as a good career choice. The percentage is displayed on the y-axis and the year in which the survey was taken on the x-axis.

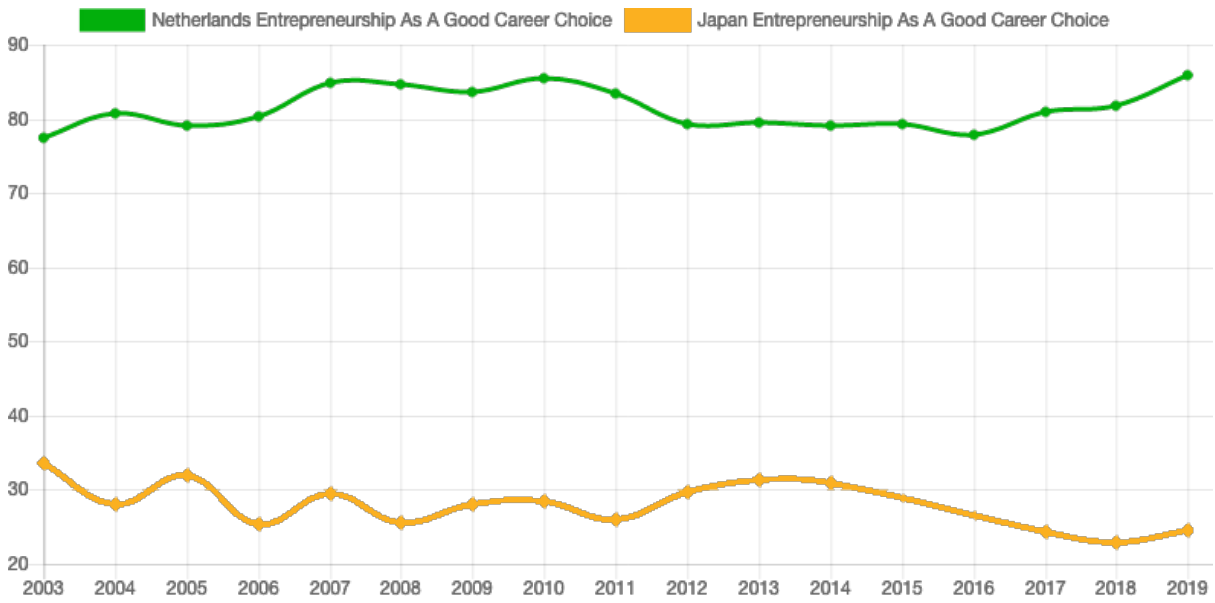


Figure 1.1 Percentage of the population that sees entrepreneurship as a good career choice (GEM Report 2020)

The GEM data shows clear and significant differences between The Netherlands and Japan in their attitude towards ME. Both are well developed economies, but Japan is much slower to adopt ME on a national level. Further GEM data shows Japan lagging, both on a regional level as well as among its economic peers.

However, when looking at the subset of TE specifically, a different picture seems to emerge compared to ME. As seen in a paper by Laplume et al (2014), who have defined a variable for TE and extracted the percentage of entrepreneurs engaging in TE from the GEM data: when it comes to the percentage of entrepreneurs using the latest technology, it was 10% (out of 220 respondents) in Japan and 5.83% (out

of 446 respondents) in The Netherlands. This indicates that, although there is a lower level of all-round entrepreneurship in Japan, the percentage of those engaging in TE is higher in Japan than in The Netherlands. The paradox here is that every other indicator points to Japan being, or having to be, lower on TE than The Netherlands. Japan scores significantly lower in virtually every other category measuring entrepreneurship, yet somehow, Japan outperforms The Netherlands by almost 2:1 concerning TE.

The paradox here is that every other indicator points to Japan being, or having to be, lower on TE than The Netherlands, yet outperforms the Netherlands by almost 2:1.

This could indicate that TE is not bound to the current frameworks of ME and is subject to different influencing variables, or the ratio of influence between the variables is different. However, much of the data and available literature is on ME and there is a gap when it comes to focused research on TE. Therefore, the variables that influence ME should be verified for applicability for TE and a framework should be created specifically for TE.

1.2 Research Question

To address this paradox and to take a first step to create a framework of influencing variables for TE, this master thesis has formulated the following research question:

What are the variables, on a national level, that affect technology entrepreneurship differently than mainstream entrepreneurship?

To guide the research, the following sub-questions must be answered in the process:

1. What is technology entrepreneurship and what are its differences with mainstream entrepreneurship?
2. What variables influence mainstream entrepreneurship on a national level and what variables influence technology entrepreneurship on a national level?
3. How can I measure technology entrepreneurship on a national level in contrast to mainstream entrepreneurship, as well as the influencing variables? (Operationalization and measurement)

First, TE must be defined, and defined as separate from ME. Then, the influencing variables for ME must be identified. The next step will be to do the same for TE. After that, the influencing variables for ME and TE will be taken to compare The Netherlands and Japan to each other to find an explanation for the difference in ME and TE levels between the two countries.

1.3 Theoretical perspective

To answer these questions the literature research will combine literature from several domains. Firstly, literature on mainstream entrepreneurship, then technology entrepreneurship specific literature. Additional literature to explain the individual variables will be added.

1.4 Relevance

It is apparent that TE does not conform to the frameworks established for ME, yet a framework of influencing variables that is specific to TE has not been created. It is important to establish a TE specific framework, because usage of ME frameworks for TE and basing assumptions on these frameworks does not lead to accurate results.

1.5 Practical contribution

Beyond adding to the existing academic literature and satisfying intellectual curiosity, the result of this thesis has practical implications as well. Because TE occupies an important place in society and the economy, the results of this thesis will be of special interest to governments and policymakers. If TE is influenced by a different set of variables than ME, different policies must be implemented that have differentiated TE from ME. These policies will trickle down to the operational level and affect incubators, accelerators, venture capitalists and investors, coaches and mentors, and not least of all, the entrepreneurs themselves in the national start-up ecosystem. Both those working within the borders of a country as well as those who work cross-country and cross-culturally will benefit, because understanding the environment they are operating in and the people they are working with, will allow them to adjust their strategy and programs accordingly.

1.6 Method

To answer the research questions, literature research will be performed that will combine information from different fields, namely ME and TE, supplemented with variable specific literature (e.g., Hofstede cultural dimensions if culture is found to be important). The necessary data for comparison purposes can be found in the GEM, OECD, IMF and World Bank datasets, where GEM provides more entrepreneurship specific data, OECD national data and IMF and World Bank economic data. Below is a table displaying the method per research question.

Research question	*Method*
What are the variables, on a national level, that affect technology entrepreneurship differently than mainstream entrepreneurship?	Combination of list below
What is technology entrepreneurship and what are its differences with mainstream entrepreneurship?	Literature research
What variables influence mainstream entrepreneurship on a national level and what variables influence technology entrepreneurship on a national level?	Literature research, data analysis
How can I measure technology entrepreneurship on a national level in contrast to mainstream entrepreneurship, as well as the influencing variables? (Operationalization and measurement)	Literature research, data analysis

Table 1.1 Methods used to answer research questions

1.7 STRUCTURE

Chapter two – Literature Research - starts with reviewing the current levels of analysis for entrepreneurship. One level will be chosen to focus the rest of the literature research. Then, the literature research will aim to provide the definition, importance and influencing variables of first ME and then TE. The influencing variables for ME and TE will then be compared, and a final selection will be made for data gathering, to compare The Netherlands to Japan. One model with influencing variables to be used throughout the rest of the thesis will be presented. The third chapter will cover operationalisation and measurement, where the relevant datasets will be reviewed, and the measurement of the chosen influencing variables will be defined. Chapter four – Results - will cover the results and compare The Netherlands to Japan with the gathered data. Chapter five – Generalisability - will aim to perform the same analysis and comparison of the influencing variables with different countries, to see if the results from chapter four are generalisable. Chapter six - Conclusion and Discussion - will cover the answers to the research questions, the scientific discussion, managerial and policy recommendations, and finally future research. The following table (1.3) shows the structure of the following chapters in this thesis and which research questions are answered in the chapters.

Chapter	*Sections*	*Research Question(s)*
2. Literature research	2.1 Levels of Analysis 2.2 Mainstream Entrepreneurship 2.3 Technology Entrepreneurship 2.4 Comparison of the influencing variables for ME and TE 2.5 Chapter conclusion	1. What is technology entrepreneurship and what are its differences with mainstream entrepreneurship? 2. What variables influence mainstream entrepreneurship on a national level and what variables influence technology entrepreneurship on a national level?
3. Operationalisation & Measurement	3.1 Measuring ME 3.2 Measuring TE 3.3 Influencing variables 3.4 Chapter conclusion	3. How can I measure technology entrepreneurship on a national level in contrast to mainstream entrepreneurship, as well as the influencing variables?
4. Results	4.1 Mainstream entrepreneurship 4.2 Technology entrepreneurship 4.3 Influencing variables 4.4 Chapter conclusion	What are the variables, on a national level, that affect technology entrepreneurship differently than mainstream entrepreneurship?
5. Generalisability	5.1 ME and TE levels of additional countries 5.2 Analysis of the influencing variables 5.3 Chapter conclusion	What are the variables, on a national level, that affect technology entrepreneurship differently than mainstream entrepreneurship?
6. Discussion & Conclusion	6.1 Answer to the research questions 6.2 Scientific discussion 6.3 Managerial and policy recommendations 6.4 Future research	All

Table 1.2 Structure of the thesis displaying which research question is covered in which chapter

The following figure (1.2) displays the structure of the main research (chapters 2-5) in more detail, showing the logic of the chapters, their interconnectivity, and methods and questions that guide the research. This chapter structures are repeated at the start of each respective chapter.

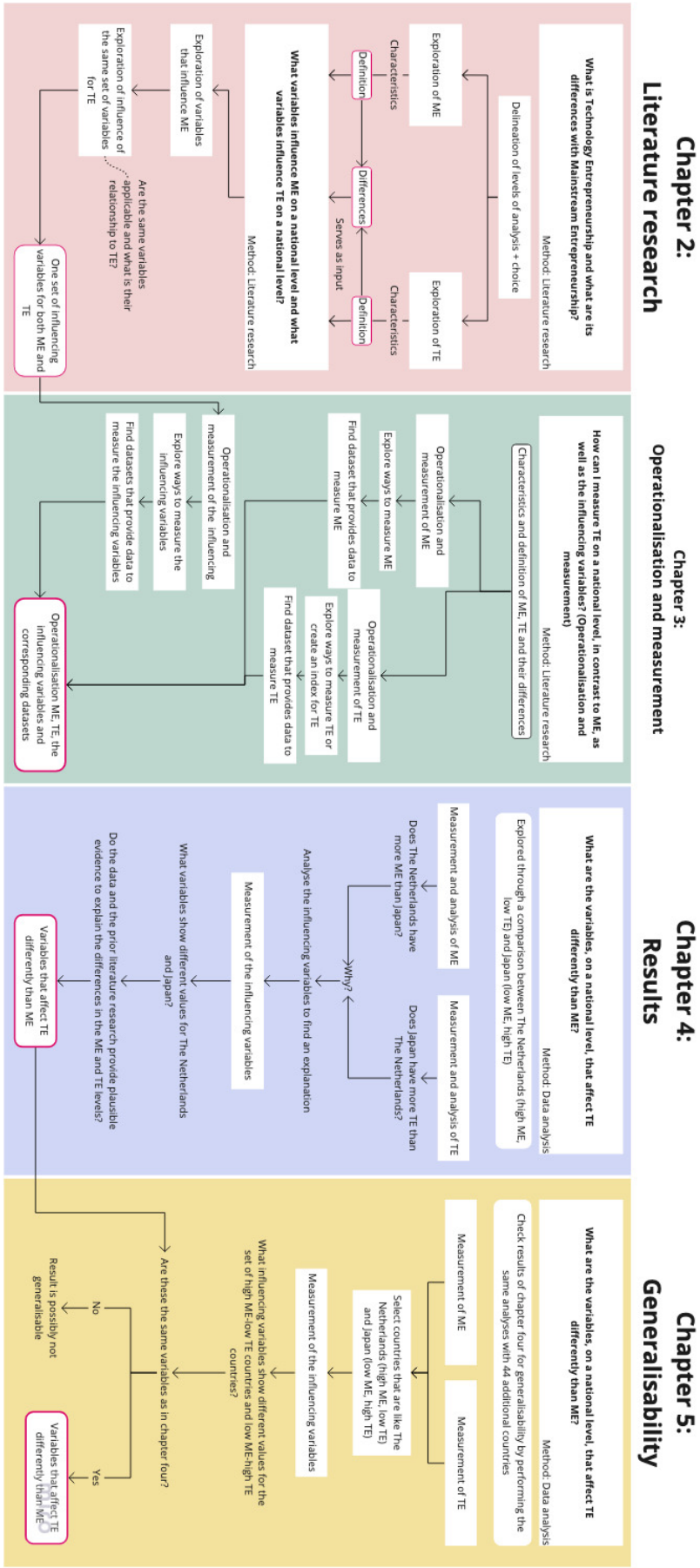
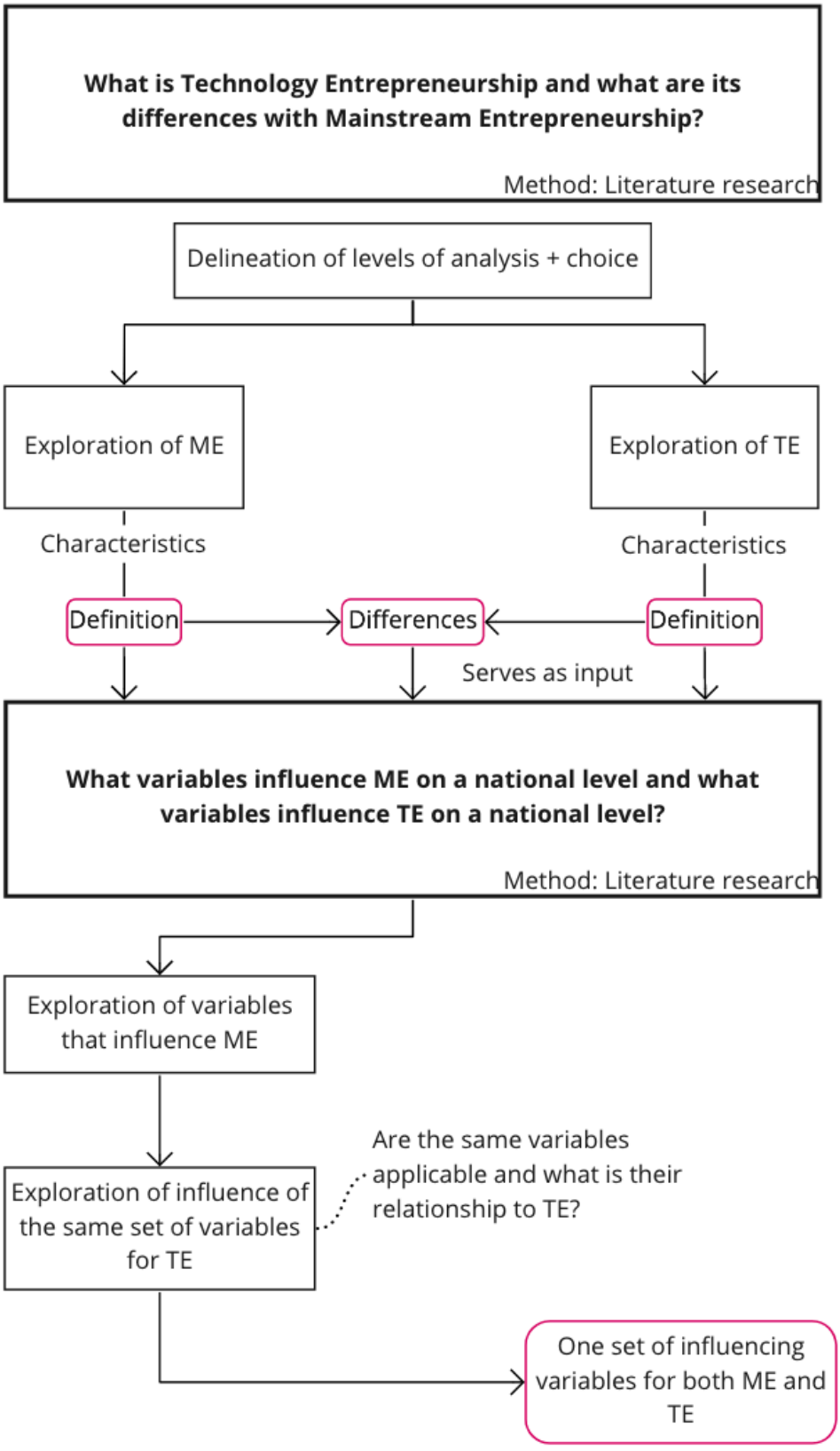


Figure 1.2 Structure of the main body of the researc

Chapter 2:
Literature research



2 | LITERATURE RESEARCH

In this chapter relevant literature will be explored to answer the first two sub-questions of this master thesis, "What is technology entrepreneurship (TE) and what are its differences with mainstream entrepreneurship (ME)?" and "What variables influence ME on a national level and what variables influence TE on a national level?". To answer this, a delineation of the levels of analysis and a choice for one level will be made in the first section of this chapter. As one of the aims of this chapter is to separate TE from ME, the chapter is divided as such. After the choice for the level of analysis, the second section of this chapter will discuss ME. It will start with a brief historical overview and discussion of ME's place in society. The following subsection will review the literature discussing the definition, importance, and the influencing variables for ME. The third section of this chapter will discuss TE along a similar structure; first the definition, importance, as well as a TE-specific addition to the levels of analysis will be discussed, after which the influencing variables for TE will be reviewed. The chapter will end with a single model containing influencing variables for both ME and TE, which will be used in the rest of this master thesis.

2.1 LEVELS OF ANALYSIS

Because of the complex and multi-dimensional nature of both ME and TE (Phan & Foo, 2004), a clear delineation of the levels of analysis is necessary. The literature proposes three levels of analysis for ME: *the individual level*, *organizational level* and *country level* (Acs et al, 2014, 2016), with the same categorization repeated in the TE literature (Autio et al, 2014; Busenitz et al, 2000, 2014; Mosey et al, 2017; Phan & Foo, 2004; Spiegel & Marxt, 2011; Urbano et al, 2018), thus enabling analysis of both ME and TE in a similar fashion. A clear overview of all three levels is found in Phan & Foo (2004), which is given below, with a few additions from other authors.

Individual level

The analysis on the individual level, also known as the micro level, is concerned with the individuals, i.e. entrepreneurs, researchers, scientists, innovators, their contributions, as well as their motivation and factors that influence them on a personal level to become a (technology) entrepreneur (Shane & Venkataraman, 2000).

Organizational level

The analysis on the organizational level, also known as the meso level, zooms out one level further to focus on teams, firm and interfirm relations, organizations, structures, and processes that influence value creation.

Country level

The country level, also referred to as the macro, environmental or sometimes as systems level, is concerned with the analysis of resource exchange at a national level. This level includes "governing factors such as government technology and competition policy, industry standards, and the economics of geographical locations" (Spiegel & Marxt, 2011).

Because this thesis is interested in influences on a national level, it will take a country level approach and will look at how the technology-based firms are embedded in the environment and which variables

influence the interest in ME and TE. It seems a reasonable approach, as the existing literature suggests that environmental factors "strongly influence variations in entrepreneurial activity across countries" (Shane & Venkataraman, 2003; Acs & Armington, 2006; Aidis et al, 2008; Minniti & Lévesque, 2010; Acs et al, 2014; Brown & Mason, 2014; Laplume et al, 2014) with some countries having more conducive environments and others penalizing entrepreneurial behaviour (Arenius & Minniti, 2005).

However, it should be noted that the levels do not exist in a vacuum. They are related and connected to each other and what happens at one level can influence the other level. Processes at the individual and organizational level can have an aggregated effect at the country level and vice versa. Even though the focus of this thesis will be at the country level, to fully understand entrepreneurship at the country level, at times it is necessary to take a holistic view of all levels and consider the influence that comes from a lower level. This will be a repeating theme throughout the rest of this thesis, and will immediately become apparent in the following sections, as even the academic discussion of the definition of entrepreneurship itself speaks of individual entrepreneurs (*individual level*) having a direct (aggregated) effect on national economies (*country level*).

2.2 Mainstream Entrepreneurship

This section will discuss the definition, importance and influencing variables for mainstream entrepreneurship.

2.2.1 Definition and importance of mainstream entrepreneurship

In the academic literature, there is no single definition of entrepreneurship, as both the models and indicators change according to the needs of the era and geography. Terms that have been consistently used in relation to the behaviour found in entrepreneurship are 'innovative', 'holistic', 'risk-taking' and 'coordinating' (Bull and Willard, 1993; Lumpkin and Dess, 1996; OECD, 1998; Van Praag, 1999; Morrison, 2000; Wennekers et al., 2002).

Definitions of entrepreneurs found in the literature are "an alert individual discovering an existing opportunity" (Shane, 2003), "an innovative individual who shakes the economy out of its previous equilibrium" (Schumpeter, 1939), "an experienced individual making judgments about an unknowable future" (Foss and Klein, 2005), and "an individual who believes she has lower information costs than others" (Casson and Wadeson, 2007).

Morrison (2000) underlines the importance of entrepreneurship by describing it is an instrument for change. It has been harnessed by societies to solve dilemmas and transition from one state to the other. Examples of this are state-controlled economies to free-market, and traditional to modern. Entrepreneurs therefore have great potential to challenge the status quo, from the individual- to even the country-level. A new entrepreneurial orientation can break with cultural tradition, change the culture of an era, and steer a country in different directions.

Perhaps the most famous theory on entrepreneurship in modern economics comes from the political economist Joseph Schumpeter, who, along with Von Thünen (Hébert and Link, 1989) is responsible for the German, or Schumpeterian, tradition of entrepreneurship theory. In this tradition, capitalist economies are constantly in the process of change and disequilibrium, where entrepreneurs are the catalysts of economic change and transformation through a process called '*creative destruction'*, which

is the destruction of the old by creating the new. The entrepreneur disturbs economic equilibrium by innovating and creating profit-making opportunities, forcing incumbents to react to these emerging threats. In short, entrepreneurs initiate increased productivity, resulting in increased economic growth (Schumpeter, 1934, 1947; Levie & Autio, 2008). Therefore, in the Schumpeterian view, economies are self-transforming systems, with the entrepreneurs indispensably at the centre of economic development (Schumpeter, 1934; Witt, 2004; Levie & Autio, 2008). Several authors (Leibenstein, 1968; Baumol, 2002; Acs et al., 2004; Romer, 1990) have added to this theory and have designated the entrepreneur as the actor that converts knowledge into economic knowledge, once more painting the entrepreneur as a crucial contributor to economic growth.

The second major tradition in entrepreneurship theory comes from Kirzner (1997b), Von Mises (1949) and Hayek (1945, 1978), among others. In contrast to Schumpeter's *creative destruction*, where entrepreneurs are disturbers of equilibrium, here entrepreneurs are actors that are always moving the economy towards equilibrium (Baumol, 2003). Entrepreneurship is seen as inherently human and they believe that "in any real and living economy every actor is always an entrepreneur" (Mises, 1949; Kirzner, 1997b; Acs et al, 2014). Entrepreneurship then becomes merely a market process and entrepreneurs are discoverers of arbitrage opportunities - where entrepreneurs find market disequilibria (e.g., under-valued resources or unmet needs) and seek to exploit their discoveries for economic gain - generating economic growth and moving the market towards equilibrium (Baumol, 2003).

In contrast to Schumpeter's creative destruction, where entrepreneurs are disturbers of equilibrium, Kirzner's entrepreneurs are always moving towards equilibrium

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However, the views of Schumpeter and Kirzner are not necessarily contradictory. Several authors (Baumol, 2003; Shane, 2003) have suggested that the Schumpeterian and Kirznerian entrepreneur can co-exist, and the theories are thus complementary. To have both these entrepreneurs exist in the economy and be contributors to economic growth, the distinction is made between high impact and low impact entrepreneurs. Thus, the Schumpeterian entrepreneur becomes the rare innovator that has a small chance to have a high impact on economic growth, and the Kirznerian entrepreneur is the 'replicative arbitrageur' (Levie & Autio, 2008) that provides low impact economic growth. This is not to say that the Kirznerian entrepreneur has insignificant impact, because Kirznerian entrepreneurs exist at a much a higher number than Schumpeterian entrepreneurs, and their combined impact can be considerable. Nooteboom (1993) provides further perspective by noting that "the creation of potential may be seen as Schumpeterian and its realization as Austrian".

For this thesis, considering the literature described here, as well as the Oxford definition at the start of chapter one, the working definition of ME becomes, "the activity of exploiting an opportunity for financial gain by starting a business, with the potential to be an instrument for change and wider economic growth." This definition encompasses all types of entrepreneurship, including TE.

Mainstream Entrepreneurship is the activity of exploiting an opportunity for financial gain by starting a business, with the potential to be an instrument for change and wider economic growth

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2.2.2 SELECTION OF INFLUENCING VARIABLES FOR MAINSTREAM ENTREPRENEURSHIP

Now that the definition of ME and its place in society are established, this section will discuss the variables most commonly mentioned in the literature that influence ME on a country level.

Wennekers et al (2002) identify five variables that influence the rate at which people engage in ME: economic development, demography, culture, institutions, and technology. Morrison (2000) mentions formal education system, regional history and characteristics, and the dominant societal construct of policy as influencing variables. Baumol (1990) mentions the degree to which the rule of law is respected in a country as well as a supportive legal environment for financial returns for entrepreneurs as important variables. The following table (2.1) shows the influencing variables mentioned per author. The variables that were deemed (somewhat) similar, by name or description were placed in the same row.

Wennekers et al. (2002)	*Morrison (2000)*	*Baumol (1990)*	*Chosen country level variables*
Economic development			Economic development
Demography			Demography
Culture	Regional history and characteristics		Culture
Institutions (includes family, educational, economic and political systems and legislation Encompass both general institutions and specific government policies)	Dominant societal construct of policy	Supportive legal environment for financial returns and respect for rule of law	Institutions
Technology			Technological development
	Formal education system		Education

Table 2.1 Influencing variables found in the literature

It seems that the list provided by Wennekers et al. (2002) is quite exhaustive, as the variables found in Morrison (2000) and Baumol (1990) create overlap rather than addition of new variables, with the exception of *formal education system*. Additionally, the table shows the breadth of the definition of the *institutions* variable with Wennekers et al deciding to group many elements into one single variable. Reynolds et al. (2000) give an alternative list of institutions, including capital markets, labour markets, competition and establishment, legislation, the tax system, social security, educational systems, and public and commercial support organizations. That definition of the institutional variable is, in my opinion, far too broad; I would argue that capital and labour markets, family, educational institutions and government policies are different things and should not be taken as a single variable. Capital, labour markets, competition and establishment, and commercial support organizations are deemed to be economic indicators or organizational level indicators. Family is deemed to be a micro level variable and will therefore not be taken into consideration, and education will be taken as a separate variable. Institutions will therefore be equal to government and its influence through its laws and policies.

Though the authors use slightly different names for the variables, the variables can therefore be put into six categories: *economic development, technological development, demography, institutions, culture,* and *education.* The following sections will review the literature for these influencing variables for both ME and TE, after which a final selection will be made (for a model to be used throughout the rest of this thesis).

2.2.3 EXPLORATION OF THE INFLUENCING VARIABLES FOR ME

To steer the literature research, I will use a bottom-up approach, whereby I will use my own assumptions as a starting point to either validate or invalidate through exploration of the relevant literature. The following subsection will discuss my assumptions and initial thoughts on how the influencing variables affect ME.

For *economic development* I expect there to be no clear relationship with ME, as venturing into entrepreneurship can be both need-based as well as opportunity based. Countries with low *economic development* could have more need-based entrepreneurs, whereas countries with high *economic development* could have more opportunity-based entrepreneurs. For low *economic development*, limited access to jobs could be an explanation for high levels of ME, where people are forced to become entrepreneurs as a result of limited access to jobs. Conversely, high *economic development* can give people the option and luxury to become entrepreneurs. Ultimately, this could lead to similar levels of ME for low- and high *economic development* countries. Perhaps there is a U-shaped relationship, where countries in the middle of the spectrum lack both the need and the opportunities for entrepreneurship. Alternatively, an inverted U-shaped relationship could appear, as countries in the middle of the spectrum have both the need and opportunities for entrepreneurship, causing values of ME to rise. As for *technological development,* I think ME can exist without technology, after all it includes all forms of non-technology-based entrepreneurship too. I therefore expect to be little relationship between *technological development* and ME. ME includes all forms of non-tech entrepreneurship too; ME can exist without technology. I expect *institutions* to have significant influence on the amount of both ME and TE in a country. As all entrepreneurs, whether in ME or TE, must adhere to the laws of the country, if those are built to encourage entrepreneurship it will become more attractive to be an entrepreneur and vice versa. I expect there to be little to no difference in the influence of *institutions* between ME and TE. As for culture, I think it is well established that *(national) culture* is an influencer for ME, which I expect will show in the literature review. A specific culture (or, cultural profile) can encourage or inhibit ME. Concerning *education,* for ME, lack of *education* can push people into entrepreneurship for lack of opportunities. Conversely, *education* may give people the skills, knowledge, and confidence to step into ME. I therefore expect to see a similar, unclear relationship between ME and *education* as there was for ME and *economic development*. As for *demography,* I expect those who are younger, and perhaps willing to take on more risks, to be more prone to entrepreneurship than older persons in a lifestyle with more responsibility.

The following sections will discuss the findings in the literature on each of these influencing variables.

ECONOMIC DEVELOPMENT

Wennekers et al. (2002) state that increased economic development boosts entrepreneurial opportunity through increased variety in consumer demand (which is positively related to economic development), as smaller suppliers of specialized products can capture market opportunity. Furthermore, the level of economic development influences the attractiveness of entrepreneurship, as the likelihood of availability of financial resources for new firms increases. Additionally, as economic development increases, economies become more service-based. Wennekers et al. (2010) state that the relationship between the rate of start-up firms and economic development is U-shaped. The Global Entrepreneurship Monitor (GEM) has measured the relationship between economic development and total entrepreneurship rate (total level of ME), as shown in the figure 2.1 below, with total

entrepreneurial rate - the percentage of adults in a country engaging in ME – displayed on the y-axis and the corresponding countries, grouped by income level, displayed on the x-axis.

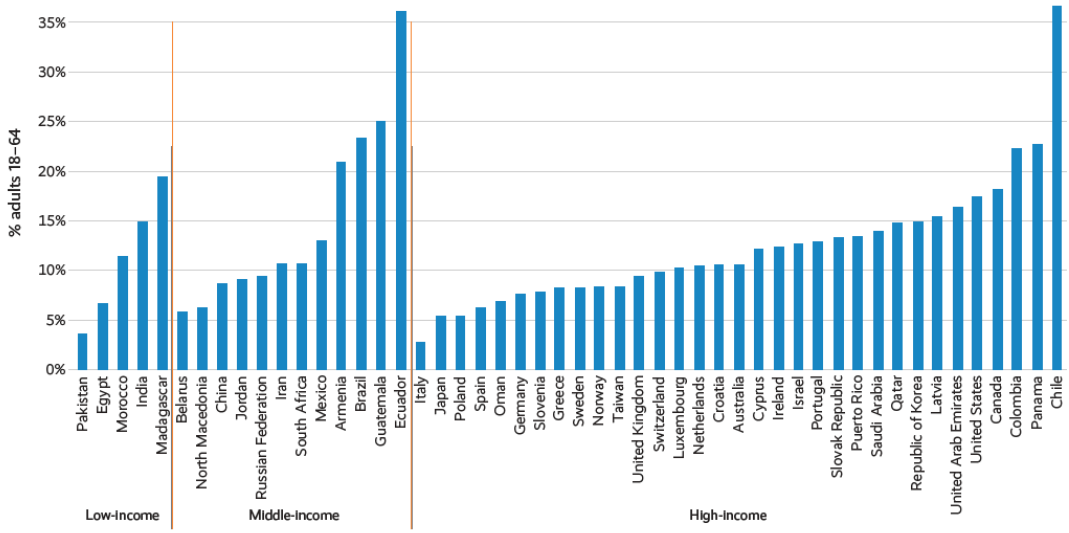

Figure 2.1 Total early-stage entrepreneurial (ME) activity grouped by income level. (Source: GEM report 2020)

The relationship is complex according to the GEM data; there are countries in all groups – low, middle and high income – that are low and high on ME. Additionally, economies with capital markets are more conducive to ME because of the 'pull' effect they have on ME, as these economies offer more incentives in the form of large and direct rewards to those successful in creating economic value. However, poor countries with lack of (job) opportunities might push more people towards ME as well (Muegge, 2013).

In line with expectations discussed earlier, there is no clear relationship between ME and *economic development*, as countries across the *economic development*-spectrum show different values of ME. However, there is neither a U-shaped nor inverted U-shaped relationship visible. The presented graph however, shows nothing about the type of entrepreneurship prevalent in these income groups, and as such no conclusions can be drawn on the prevalence of service-based firms. It is doubtful whether a shift to services is always the case as wealth increases, as wealth can be generated and maintained through manufacturing economies as well.

Technological development

The literature shows more link between ME and *technological development* than initially expected. For ME, *technological development* leads to lower transaction costs and lower minimum efficient scales across many industries (Wennekers et al, 2002), allowing smaller companies to enter and compete. In this sense, *technological development* levels the playing field to some extent (e.g., an advancement in espresso machines perhaps allows the product to be sold at a cheaper price, allowing small-budget entrepreneurs to enter the coffee market).

Institutions

As mentioned before, Wennekers et al (2002) also include the family, educational, economic and political systems, and legislation in the category of institutions. Rather similarly, institutions are defined by North (1994) as "the humanly devised constraints that structure human interaction. They are made up of formal constraints (e.g., rules, laws, constitutions), informal constraints (e.g., norms of behaviour,

conventions, self-imposed codes of conduct), and their enforcement characteristics. Together they define the incentive structure of societies and specifically economies". These definitions show the overlap between the institutional definition and other variables, such as culture and education. The difficulty in comparing various sources is a recurring theme throughout this thesis, as variables are not defined similarly across the literature; this will be discussed in more detail later. This thesis will define institutions as government and the policies embedded in the national start-up ecosystem. Governments can therefore implement policies either conducive, neutral or unfavourable to ME, with Wennekers et al. (2002) stating that they "determine the net rewards and the risks" of entrepreneurial opportunities. In the same paper, they do mention that the effectiveness of governmental support schemes is questionable and encourage more research into these variables. However, Van der Horst et al. (2000), Klapper et al. (2006), Dreher & Gassebner (2007), have provided empirical evidence of governmental regulations being able to adversely affect entrepreneurship by putting up barriers. Additionally, there is empirical evidence for taxes being able to directly influence profitability and growth of firms, either positively or negatively, indirectly affecting the attractiveness of entrepreneurship (Levie & Autio, 2008).

The result of the literature review is in line with the aforementioned expectation, with institutions able to encourage or inhibit ME. Additionally, the argument can be made for the government-ME relationship to have a self-reinforcing feedback loop; with increasing ME comes increased government support and vice-versa. There are different theories as to what starts this loop. According to Shane and Venkataraman (2003) the answer is external shocks: "external shocks lead to institutional change that generates entrepreneurial opportunities. In the absence of these external shocks, however, institutional stability enhances the legitimacy of existing organizations, which makes it difficult for entrepreneurs to found firms to challenge them".

CULTURE

Culture is a fuzzy concept and different definitions of culture draw attention to different aspects of culture. The multiplicity of definitions also means that culture can be analysed at different levels, from the family level to the national level, with all types of subcultures in between. For a discussion of the definitions of culture please refer to Bierstedt (1938), Weiss (1973), and Jahoda (2012). This thesis will limit the discussion to what is understood as national culture. There are several definitions of national culture (or, *culture*) found in the literature: "patterns of values, ideas and other symbolic-meaningful systems as factors in the shaping of human behaviour" (Kroeber & Parson, 1958), "stereotyped patterns of learned behaviour which are handed down from one generation to the next" (Barnouw 1973), "the collective programming of the mind that distinguishes the members of one group or category of people from another" (Hofstede, 2001) and "the enduring set of values of a nation, a region, or an organization" (George & Zahra, 2002). In relation to ME, there are several frameworks on the influence of *culture*, as found in Thurik & Dejardin (2011):

The aggregate psychological traits approach

This framework sees ME as the result of aggregate individualistic entrepreneurial values, where "the more individuals with entrepreneurial values there are in a society, the more individuals will display entrepreneurial behaviour (Davidsson, 1995; Shane, 1993)

The social legitimation (or, moral approval approach)

"For the social legitimation or moral approval approach, higher entrepreneurial activity within some countries can be explained by the general incidence of culture and institutions favourable to entrepreneurship" (Thurik & Dejardin, 2011). A favourable culture can include high-status to entrepreneurs, entrepreneurship education and policies conducive to entrepreneurship. Ajzen (1991), provides empirical evidence for this theory.

The dissatisfaction approach

The dissatisfaction approach takes a very different view of the culture-entrepreneurship relation and suggests that "in a predominantly non-entrepreneurial culture, a clash of values between groups may drive potential self-employed into actual self-employment" (Baum et al., 1993). "Interestingly, Mitchell, Smith, Morse, Seawright, Peredo, and McKenzie, in a study of entrepreneurial cognition, find that entrepreneurs across eleven countries share a common "culture" of entrepreneurship that is distinct from the beliefs of non-entrepreneurs" (George & Zahra, 2002).

Additionally, Morrison (2002) states that there is a significant relationship between entrepreneurship and culture, being an important determinant in the decision to venture into entrepreneurship. In that sense culture conditions individuals with pro- or anti-entrepreneurial values and can increase or lower the number of people venturing into entrepreneurship. Although a link between *culture* and ME is repeatedly mentioned in the literature, there is debate on the way it influences ME. Looking at an embedded national culture as an influencing variable on ME, the social legitimation approach would seem most probable. It would mean that there is such a thing as an "entrepreneurial culture" that stimulates the interest in ME. Alternatively, the dissatisfaction approach fits with the idea of a Schumpeterian entrepreneur, as someone who shakes up the status quo, possibly out of dissatisfaction or frustration. As for the aggregate psychological traits model, I would argue that it could be a function, or product of the social legitimation approach or dissatisfaction approach, as increased social legitimation could increase the number of individuals with entrepreneurial values. Similarly, a growing group of dissatisfied individuals can increase the number of individuals with entrepreneurial values. The next chapter will discuss specific ways to measure culture, as the framework of measurement is often linked to the specific definition of culture.

EDUCATION & DEMOGRAPHY

The evidence on the influence of education on ME is inconclusive. Some authors state that a high level of education and specific entrepreneurial education may steer some towards ME and is therefore favourable to ME, while others arrive at the opposite conclusion, with countries with higher levels of education having less entrepreneurship and entrepreneurship education showing little positive correlation and sometimes even negative effects (Wennekers et al, 2002). This means that many entrepreneurs lack a high level of formal education. This could mean that some people may be forced into ME due to lack of opportunities created by a lack of education, while others may go into ME because of opportunities created by their educational background.

This is not to say that there is no causal relationship between education and ME, as it can, at the very least, influence and encourage anti-entrepreneurial behaviour, which was found to be the case in Kenya, South Africa, Singapore, Finland, and Slovenia (Morrison, 2000). In the same paper, Morrison also holds the opposite to be true, that formal education can significantly contribute to creating (or, laying the groundworks for) pro-entrepreneurial behaviour.

While Morrison offers no empirical evidence to support this claim, it is not an unreasonable conclusion, as the formal education system plays a great role in shaping the minds and attitudes of people, whether positive or negative, or even false or true. If encouraging or fostering entrepreneurial behaviour has much to do with an individual's perception of whether they possess the necessary skills to venture into entrepreneurship, education is likely a contributor. If the negatives are highlighted, it is no surprise it would lead to negative perceptions of entrepreneurship. Peterman & Kennedy (2003) however, provide empirical evidence of education being able to influence perceptions of entrepreneurship, and state a cultural effect on students' attitudes. Possibly, education, or the attitude in education, is a function of the national culture and the overall attitude to entrepreneurship present in a country. Thus, many combinations of level of *education* and level of ME in a country are possible and like *economic development,* there is no clear-cut relationship between ME and *education*. In line with the assumptions for *demography*, according to Wennekers et al (2002), demographic factors include ethnic origin, gender, and age, with people in the 25-45 age range most likely to engage in ME.

2.3 Technology Entrepreneurship

Despite efforts to write this subsection along a similar structure as the ME subsection, the complex nature of TE demands a slightly different storyline. A brief overview of the current definitions, as with ME, will not suffice, because to understand and define TE, a description of its nature and its intrinsic links to several domains must be given. This section will therefore start with the importance of TE and then research the definition of TE by reviewing the current available definitions, discussing the nature of TE, its links with several domains, and the difference with ME. After that, levels of analysis will be discussed once more, to narrow down the scope of TE for this thesis. That section will end with the definition of TE for this thesis. The final subsection will review the influencing variables at the country level found in the literature. This section will end with a model of influencing variables for TE.

2.3.1 Definition and Importance of TE

The importance of technology entrepreneurship as a global phenomenon has been on the rise for the past four decades (Bailetti, 2012). Governments and the public both agree that the development and exploitation of technology is crucial to solving some of the major challenges mankind is facing, such as global warming, energy supply, mobility, population growth, demographic shifts, and globalization (Litan & Song, 2008; Spiegel & Marxt, 2011). Advancing technology and translating that technology into a commercially viable business is one of the keys to (sustainable) competitive advantage and drivers of economic growth for individuals, firms, regions and nations, as well as a driver of innovation (Stokes, 1997; Litan & Song, 2008; Hitt et al, 2010; Spiegel & Marxt, 2011; Bailetti, 2012). As such, TE is recognized as being a source of scalable economic growth (Beckman et al, 2012) and responsible for improvements in job creation, social welfare, ecological sustainability, and wealth creation (Mosey et al, 2017). Some authors even state that TE does not only have a positive effect, but that it is a necessity for economic growth (Beckman et al, 2012). Therefore, the importance of TE cannot be overstated for leaders and management teams of small and large firms that try to create, deliver, and capture value for their firm, as well as governments and regional economic development agencies that seek to utilize TE for the benefit of their country and region (Bailetti, 2012). Because of TE's significant impact and contribution to the economy (Mosey et al, 2017), it is increasingly a field of interest to researchers (Bailetti, 2012), as the practical implications of research into TE can have broad-reaching impact and improve "the scale and chances of entrepreneurial success" (Muegge, 2013).

Despite this, TE is, as of yet, underdeveloped as a research field compared to other entrepreneurship, economics and management fields (Ferreira et al, 2016; Bailetti, 2012; Ratinho et al, 2015). This, along with the multidisciplinary nature of TE, causes difficulty in clearly delineating the field and finding consensus in the literature. Like ME, there is no consensus on the definition of TE, with many authors suggesting their own. To form a clear image of what TE is, the following subsections will discuss some of the definitions suggested in the literature, along with the nature and characteristics of TE.

CURRENT DEFINITIONS OF TE IN THE LITERATURE

In describing TE, Beckman et al (2012) consider it to be a combination of two things: entrepreneurship and technology-based innovation, because of its close ties to technological innovation, emerging markets, and the creation of new products. This emphasis on the creation of 'the new' is echoed by Garud & Karnoe (2003), who write that, in addition to discovery of pre-existing options, TE also includes the creation of the new, either through transformation or a recombination of available resources.

Shane and Venkataraman (2003) define TE as "the process by which entrepreneurs assemble organizational resources and technical systems, and the strategies used by entrepreneurial firms to pursue opportunities", while to Beckman et al (2012) TE exists when "developments in science or engineering constitute a core element of the opportunity that enables the emergence of a venture, market, cluster, or industry". According to Spiegel and Marxt (2011), TE is "related to the successful formation, exploitation and renewal of products, services and processes in technology-oriented firms". Garud & Karnoe (2003) define it as "an agency that is distributed across different kinds of actors, each of which becomes involved with a technology and, in the process, generates inputs that result in the transformation of an emerging technological path" and Bailetti (2012) suggests to define TE as "an investment in a project that assembles and deploys specialized individuals and heterogeneous assets that are intricately related to advances in scientific and technological knowledge for the purpose of creating and capturing value for a firm". Lastly, we have Nicholas & Armstrong (2003) defining TE as "organization, management and risk bearing of a technology-based business", Jones-Evans (1995) as "establishment of a new technology venture" and "ways in which entrepreneurs draw on resources and structures to exploit emerging technology opportunities", by Liu et al (2005).

As ME can also involve technology, it is important to minimize the overlap between the categories of ME and TE; therefore, several takes on what sets TE apart from ME will be discussed next. According to Bailetti (2012), what distinguishes TE from other entrepreneurship types (e.g., social entrepreneurship, small business management, and self-employment) is the collaborative experimentation and production of new products, assets, and their attributes, which are intricately related to advances in scientific and technological knowledge and the firm's asset ownership rights. Colovic & Lamotte (2015) write that the differences between ME and TE is its focus "on new opportunities through innovation in science and engineering" and its strong ties with technology management. Similarly, Shane & Venkataraman (2003) write that what sets TE apart from ME are the strong intellectual links to technology management, the strategies (which are more focused on reducing uncertainty and managing knowledge flows) and that it "depends heavily on the development of the technological system and the rest of the institutional environment in which they are embedded". Beckman et al (2012) state that entrepreneurship revolves around creating and discovering new opportunities, but what differentiates TE from ME is the focus on new opportunities enabled through science and engineering innovation. The following table (2.2) summarizes this subsection.

What sets TE apart from ME?	*Source*
Collaborative experimentation and production of new products, assets, and their attributes, which are intricately related to advances in scientific and technological knowledge and the firm's asset ownership rights.	Bailetti (2012)
Focus "on new opportunities through innovation in science and engineering" and its strong ties with technology management.	Colovic & Lamotte (2015)
Strong intellectual links to technology management and that heavy dependence on "the development of the technological system and the rest of the institutional environment in which they are embedded".	Shane & Venkataraman (2003)
Focus on new opportunities enabled through science and engineering innovation	Beckman et al (2012)

Table 2.2 Characteristics of TE that sets it apart from ME

Thus, there are many definitions of TE in the literature, but from all of these definitions it is clear that TE is (i) a complex multi-actor phenomenon that is (ii) intricately linked to scientific and technological change and (iii) the exploitation thereof; what sets it apart from ME (beyond specifically involving the exploitation of technology) is its interdependence on technological change. In turn, collaboration and scientific and technological change are closely related to each other. To fully understand TE, these aspects of the nature of TE will be discussed in the following subsections.

Technology entrepreneurship is a complex multi-actor phenomenon that is intricately linked to scientific and technological change and the exploitation thereof.

On the nature of TE: Technological change is collaborative

Scientific and technological change is not a single-actor phenomenon but happens through "a synthesis of the inputs of a number of actors" (Usher, 1954; Latour, 1991, Garud and Kanoe, 2003) and the emergence of a technological path builds on the efforts of many (Bijker et al., 1987; Bijker & Law, 1992; Latour, 1991; Garud and Karnoe, 2003). Similarly, Ferreira et al (2016) clearly state that "technological progress cannot be attributed to a single individual". These authors go on to state that the actors themselves are embedded in the path they create. Every actor involved in a technological path will, because of their individuality, interpret something in a slightly different way. These differences are called "interpretive asymmetries" and they will lead to "opportunities through creative synthesis" as each actor adds something that is uniquely their own, creating new knowledge and a path that is unique and dependent on the actors involved with it. Actors become embedded and interwoven in technological paths that they shape in real time (Garud and Karnoe, 2001; Kreiner and Tryggestad, 2002) and "as it gains momentum, the emerging path begins enabling and constraining the activities of involved actors" (Dosi, 1982; Garud, 1997; Kemp et al., 1998; Garud & Karnoe, 2003). Thus, in turn, the relationship between the actors and technological change becomes one of mutual shaping, as these paths, including the "accumulating artifacts, tools, practices, rules and knowledge" (Garud & Karnoe, 2003) begin shaping the actors over time. TE is collaborative therefore means that TE is a collaboration of different actors, but also one of collaboration with technological change.

ON THE NATURE OF TE: TECHNOLOGY ENTREPRENEURSHIP IS COLLABORATIVE

Because technological change is collaborative, and the process of creation (or reconfiguration) is directly influenced by different actors (Ferreira et al, 2016), TE itself is collaborative in its very nature. This collaborative nature of TE is often emphasized in the literature and is not limited to those generally hailed as entrepreneurs – those who create and discover new ideas – and is not even limited to a team within a firm, but also includes those who create complementary assets (Teece, 1986), institutional forums (e.g., policymakers, universities) (Garud and Rappa, 1994) and even customers and users that provide feedback on technology and products as they emerge (Rosenberg & Nathan, 1982; Von Hippel, 1986; Kline and Pinch, 1996; Garud & Karnoe, 2003; Tripsas, 2009; Ferreira, 2016). Similarly, Bailetti (2012), states that TE does not revolve around a single individual but that it is about "managing joint exploration and exploitation" in a team, working towards a goal, where each member has a role. Similarly, "in the global information economy, the actions and outcomes of a technology entrepreneur are deeply interconnected with the actions and outcomes of others" (Muegge, 2013).

As such, the relationship between TE, actors and technological change is complex and interdependent. This relationship is further complicated by the fact that it is unstable; actors are free and can come and leave as they please (Latour, 1991).

What sets technology entrepreneurship apart from mainstream entrepreneurship is its interdependence on scientific and technological change

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2.3.2 LEVELS OF ANALYSIS FOR TE

In addition to choosing the country level, there is one more distinction to make to further narrow down the scope of this thesis. TE, the way it is defined above, does not delineate between type of firms. Spiegel and Marxt (2011) have provided a division between activities done by New Technology-Based Firms (NTBF), and Incumbent Technology-Based Firms (ITBF), shown in Figure 2.4. This thesis will focus on NTBF.

Therefore, for this thesis, TE encompasses the creation of a firm where the exploitation of a (new) technology is essential to the business model and therefore products and services the firm is providing. The same can be applied to ME, where ME of course is not concerned specifically with the exploitation of (new) technology, according to the differences with TE as described above.

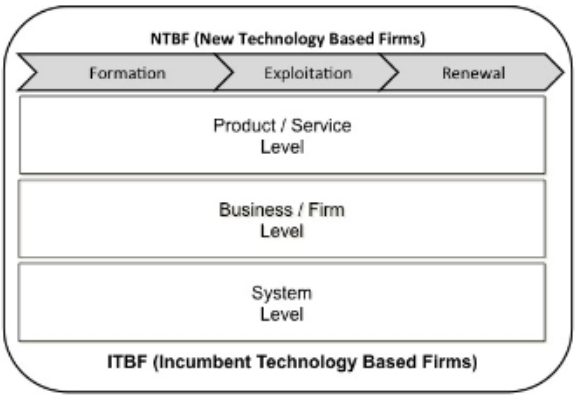


Figure 2.2 Framework for TE analysis (Source: Spiegel & Marxt, 2011)

2.3.3 SELECTION OF INFLUENCING VARIABLES FOR TECHNOLOGY ENTREPRENEURSHIP

Now that the definition of TE has been established and its nature and importance to society have been discussed, this section will explore the variables mentioned in the literature that influence TE on a country level. These are, according to Colovic & Lamotte (2015), technological environment, ICT infrastructure, Research & Development (R&D) investment, and educational background, with the last two variables echoed by Ferreira et al (2016). Muegge (2013) names institutional arrangements, governance structures, technology, and the economy, while Wright et al (2007) mention human capital and education. Urbano et al (2019) also indicate human capital, in addition to laws, regulations, policies, property rights, government programs, competition, financial resources and access to subsidies, industry, market size and market regulations, as well as national culture as influencing variables. Mazzucato (2013) found state funding to be an important variable and lastly Nacu and Avasiclai (2014) mention market demands as an influencing variable.

The goal of this thesis is to compare ME to TE and find out what variables influence one differently than the other, therefore one set of influencing variables will be explored for both ME and TE. Non-overlapping variables are therefore not considered, but nearly all variables mentioned in the TE literature can be placed in the same categories as those mentioned for ME, namely *economic development, technological development, institutions,* and *education, and demography*. *Culture* is not mentioned much in the TE literature but will be explored precisely because of its absence in the literature and its strong links with ME. Additionally, as The Netherlands and Japan are culturally vastly different, the *cultural* variable could potentially explain (part of) the difference between the ME and TE levels of these countries. The following table (2.3) categorises the variables mentioned for TE under those mentioned for ME.

Influencing variable (from ME literature)	*Similar variable found in TE literature*
Economic development	• The economy (Muegge, 2013) • Competition, financial resources and access to subsidies, industry, market size and market regulations (Urbano et al., 2019) • Market demands (Nacu & Avasiclai, 2014)
Technological development	• Technological environment, ICT infrastructure, R&D investment (Colovic & Lamotte, 2015; Ferreira et al., 2016) • Technology (Muegge, 2013)
Institutions	• Institutional arrangements, governance structures (Muegge, 2013) • Laws, regulations, policies, property rights, government programs (Urbano et al., 2019) • State funding (Mazzucato, 2013)
Culture	• National culture (Urbano et al., 2019)
Education	• Educational background (Colovic & Lamotte, 2015; Ferreira et al., 2016) • Education (Wright et al., 2007)
Demography	• Human capital (Wright et al., 2007; Urbano et al., 2019)

Table 2.3 Linking variables found in the TE literature to those in the ME literature

Thus, the same set of variables will be explored for TE as for ME, namely *economic development, technological development, institutions, culture, education, demography.* The following section will firstly

2.3.4 Exploration of the influencing variables for TE

This subsection will firstly discuss my assumptions on the way *economic development, technological development, institutions, culture, education, and demography* influence TE (differently than ME), after which each of the variables will be explored through literature review.

For TE, I expect it to be more likely in countries with high levels of *economic development*, because of the infrastructure needed to start TE (ICT, R&D etc.), and thus, countries with higher *economic development* show higher levels of TE. Like mentioned in the ME section, I expect to see little to no difference in the influence of *institutions* between ME and TE. I expect the influence of *culture* to be different for TE than for ME, otherwise The Netherlands and Japan would most likely not show opposite values for ME and TE. Therefore, *culture* could not influence TE at all, have a much weaker influence on TE, or have a different influence on TE. Different could mean that The Netherlands' specific culture is suitable to ME and Japan's culture is suited to TE, or that there is an inverted relation, where a "bad" culture for ME could be a "good" culture for TE). As for *education* and *demography,* I expect a "typical" technology entrepreneur to be highly educated and young, willing to take big risks, as this type possesses both the technical knowledge and being young, perhaps the willingness and the freedom to take big risks.

The following sections will discuss the findings in the literature on each of these influencing variables. Unlike the ME section that started with *economic development*, due to the nature of TE the first variable that is discussed is *technological development*.

Technological Development

Some of this subsection may read as repetitive, as we have established technological advancement as intrinsic to TE, but I think it is important to go over *technological development* as an external influencing variable as well, one that can either foster or inhibit TE. As defined by Colovic & Lamotte (2015) the technological environment is the "scientific knowledge and technology produced and available in the country", including the "result of investment in innovation and R&D made both by private firms and public institutions". They also found an inverted U-shaped relationship between R&D investment and the likelihood of TE, which is linked to the process of *knowledge spillover*. *Knowledge spillover* is a theory developed by Bahrami and Evans (1995) which describes the spread of technology and ideas; it states that endogenously created knowledge (e.g., in large corporations or through government R&D) "results in knowledge spillovers that allow entrepreneurs to identify and exploit new business opportunities" (Ferreira et al, 2016). Countries with low R&D investment will therefore have little chance of *knowledge spillover,* and in high R&D investment environments, characterized by being dominated by big firms, there is less *knowledge spillover*, resulting in less access to R&D and less chances for new firms to exploit new technologies. Countries with a moderate level of R&D expenditure will therefore outperform countries with very low or very high R&D investment in technology firm creation. Additionally, access to ICT infrastructure is found to have significant impact on the proliferation of TE (Colovic & Lamotte, 2015); because for TE to be able to exist at all, there must be a minimum of ICT infrastructure, making it a prerequisite for TE.

In line with expectation, *technological development* is therefore a hard requirement for TE, with a minimum needed for TE to exist at all. However, the literature did not explicitly state that more *technological development* automatically leads to more TE. For at least R&D, one aspect of *technological development,* after a certain point, more development leads to a decrease of TE levels.

Economic development

The existence of ICT infrastructure as a prerequisite for TE implies that a country must have a certain level of *economic development* as well, to have the means to create the required ICT infrastructure. More specific influences under *economic development* are market demands, which are mentioned by Nacu and Avasilcai (2014) as being able to either foster or inhibit TE. Urbano et al (2019) mention competition, financial resources, industry, and market size as an influence on TE. Lastly, Urbano et al (2019) also concluded from their study that economic cycles play a moderating role, intensifying or diminishing the effects of the other factors in times of economic stability or crisis. In times of economic crisis people are more likely to focus on survival and remaining competitive, which will lead to the identification and exploitation of more technology entrepreneurship opportunities, either new or existing.

The influence of economic development is more intricate than initially thought, where economic development is not just expressed in an absolute number, but in specifics such as market demands and financial resources as well. However, like with *technological development* I assume that a minimum has to exist for TE to exist, as TE requires funding, and although this can be private funding, I deem low-developed economies less likely to have the economic infrastructure mentioned above as an influence on TE as well-developed as high economic development countries.

Institutions

Institutional influences, meaning laws, regulations and policies (North, 1991, 2005; Scott, 1995), are an influencing factor on TE because formal barriers (e.g. ease of incorporation, taxes) can be increased or lowered by the government. Urbano et al (2019) found that property rights and government programs enhance TE development. Therefore, the institutions have the power to support and facilitate the development of TE initiatives and reduce their risk as they start and grow. Similarly, negative regulative environmental conditions, namely a lack of support for science and technology, can decrease the likelihood of new ventures developing TE initiatives. Additionally, Mazzucato (2013) found that state funding has a significant impact on TE. However, governmental stimulus for TE through corporate venture capital injection can have a positive effect but must be accompanied by “seven intangible factors: access to new ideas, models, informal forums, specific opportunities of the region, safe networks, access to large markets and executive leadership” (Venkataraman, 2004; Ferreira et al, 2016), otherwise it will lead to low-quality entrepreneurship. If done correctly, increases in corporate venture capital injection can lead to an increase in the number of patents registered.

Like ME, the *institutions* variable is found to be able to encourage or inhibit TE. However, it seems that there are more requirements for *institutions* to gain the desired effect for TE than for ME, and it is perhaps a more complicated form of entrepreneurship to work with from an institutional standpoint.

Culture

In contrast to ME, there was surprisingly little to find about the relationship between culture and TE specifically, other than Urbano et al (2019) finding that an unsupportive national culture can decrease the likelihood of new ventures developing TE initiatives.

What is then the definition of an "unsupportive national culture"? It is unlikely that the culture that supports ME is the same as the culture that supports TE, as we see in the comparison of The Netherlands and Japan. If that were so, The Netherlands and Japan would not show vastly different values for ME and TE. The lack of research does not allow for a firm conclusion, and I would lean towards one of two options, based on this literature as well as the cultural literature for ME: (i) for TE, culture follows the social legitimation approach, with a supportive culture for TE being different than one for ME, or (ii) for TE, culture follows the dissatisfaction approach, with entrepreneurs involved in TE showing similar values cross-country. The last option would mean that TE is unaffected by national culture (or, much less affected), and an unsupportive national culture would not inhibit TE (or, inhibit only slightly). Both could be an explanation for Japan showing low ME, but high TE values.

Education & Demography

For education, the importance of universities has been emphasized, as they are responsible for generating the human capital needed for the development of TE (Wright et al, 2007; Ferreira et al., 2016). Additionally, Colovic & Lamotte (2015) argue that technology entrepreneurs are "more likely to be young individuals with a high level of education".

This is in line with expectations, with the additional emphasis on education being focused on science or technology, as specific knowledge is needed to move in the technology space. As for *demography*, like with ME, TE entrepreneurs are most likely young individuals, with the differing factor being the level of education. Therefore, *demography* will not be considered further as an individual variable, as it can be scaled under *education*, and factors such as ethnic origin and family background are deemed to be more individual level variables.

2.4 Comparison of the variables for ME and TE

There was no literature available making a direct comparison between variables influencing ME and TE, nor ME and TE itself. The necessity to constantly combine literature of two fields made the comparison considerably difficult. For example, the variables were often not defined in the same way for ME and TE, meaning different variables having the same name in different papers, or variables having a different name but in fact being the same variable.

Additionally, there is noise in the data, as in the ME literature, TE is often treated exclusively as a subset of ME. Thus, comparing ME to TE means comparing TE to ME *including TE* (which is analogous to comparing the entire population to men specifically, for example). The difference between the two categories could therefore be smaller here than it is in reality.

The table below (2.4) summarizes the sections on the influencing variables by discussing the differences in the way the influencing variables affect ME and TE.

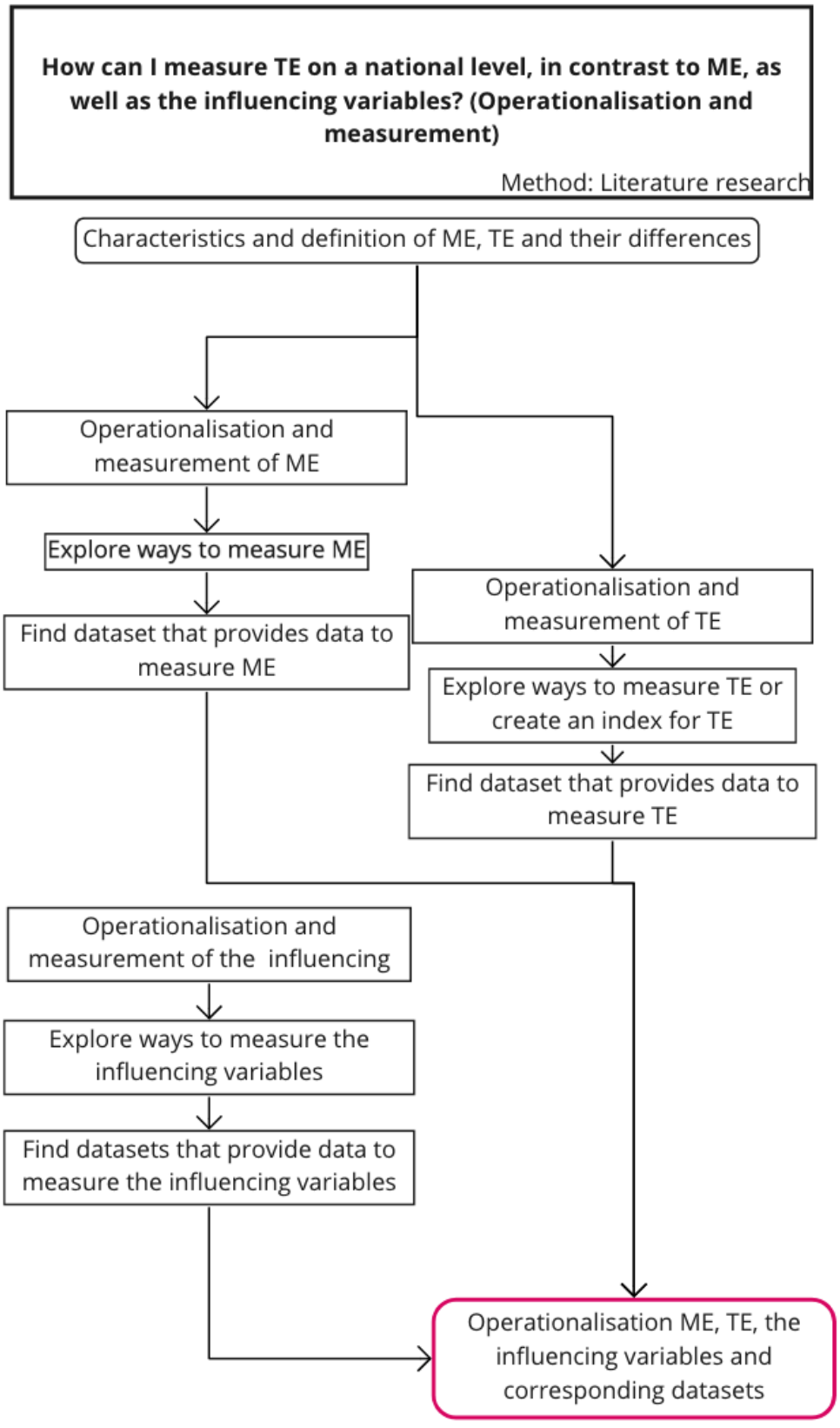
Influencing Variable	*Mainstream Entrepreneurship*	*Technology Entrepreneurship*
Economic development	No clear relationship with ME.	A minimum of economic development must be present for TE to exist. Highly developed economies may be better environments for TE
Technological development	Leads to lower development costs and lower minimum efficient scales	Hard requirement and prerequisite for TE. Inverted U-shaped relationship with R&D investment.
Institutions	Institutions can encourage or inhibit ME through its policies	Similar to ME, but needs additional TE specific policies (e.g., concerning property rights)
Culture	Several theories on how national culture affects ME, possibly through *social legitimation*, where a national culture holds values conducive to entrepreneurship	Unknown, but unlikely to be similar to ME. Perhaps the *dissatisfaction approach* is linked to TE
Education	Inconclusive evidence on relationship with ME; need for ME through lack of education or opportunity for ME through educational background	More likely to be (young) individuals with a high level (university) level of (technology-specific) education.

Table 2.4 Effect of the influencing variables on ME and TE

2.5 CHAPTER CONCLUSION

This chapter explored the relevant literature to answer the two sub-questions of this master thesis, "What is technology entrepreneurship (TE) and what are its differences with mainstream entrepreneurship (ME)?" and "What variables influence ME on a national level and what variables influence TE on a national level?". To focus the research the national level of analysis was chosen. Next, the definition and importance of ME, along with several historical entrepreneurship theories, were discussed. ME was defined as "the activity of exploiting an opportunity for financial gain by starting a business, with the potential to be an instrument for change and wider economic growth". TE, a subset of ME, was defined as "a complex multi-actor phenomenon that is intricately linked to scientific and technological change and the exploitation thereof." The most important factor that distinguishes TE from ME was found to be its interdependence on scientific and technological change. A set of influencing variables for both ME and TE was found, consisting of *economic development, technological development, institutions, culture,* and *education.* The next chapter will discuss how to operationalise and measure these influencing variables.

Chapter 3:
Operationalisation and measurement



3 | Operationalisation and Measurement

Now that both the definitions and influencing variables of ME and TE have been established, the next step is to operationalise ME, TE and the influencing variables to answer the third sub-question of this thesis, "How can I measure TE on a national level in contrast to ME, as well as the influencing variables?". This chapter will review the available research, datasets, and the ways in which both ME and TE, as well as the influencing variables have been operationalised and measured previously. The chapter will follow this order, where first operationalisation and measurement of ME will be discussed, then TE, and finally the influencing variables. The next chapter will build on this and compare the levels of the influencing variables to the overall level of ME and TE in the Netherlands and Japan to see which variables affect ME and TE differently.

3.1 Measuring Mainstream Entrepreneurship

The choice was made to use the Global Entrepreneurship Monitor dataset. This section will discuss this dataset, the way it operationalises and measured ME, and the reasons for choosing this dataset.

3.1.1 The GEM dataset

The Global Entrepreneurship Monitor (GEM) research initiative, first published in 1999 by the GEM consortium, is an annual study aimed at providing empirical, internationally comparable data on entrepreneurial activity (Reynolds et al., 1999, 2005). In it, the "prevalence, determinants, and consequences of entrepreneurial activity" (Urbano et al., 2018) are studied and the data has been assembled as such to facilitate cross-national comparisons (Reynolds et al., 2005). The dataset proposes relationships between entrepreneurial activity and economic growth at the national level (Levie & Autio, 2008), and provides a basis to understand why some countries are more entrepreneurial than others, how entrepreneurial activity varies over time and what policies boost entrepreneurship (Reynolds et al., 2005; Bosma & Levie, 2010; Alvarez & Barney, 2013; Bergmann et al., 2014). It currently provides the largest and most widely used, harmonized cross-national dataset on entrepreneurship (Reynolds et al, 2005; Urbano et al., 2018), having published data on more than 120 economies and forming the basis of more than 106 entrepreneurship-focused research papers (Bergmann et al, 2014). Additionally, according to Bergmann et al. (2014), the GEM dataset is unique because "(1) there is no other source for comparable data on entrepreneurship from so many different countries, (2) unlike existing national statistics GEM captures all kinds of entrepreneurial activities and (3) GEM captures start-up efforts at a very early stage (i.e., nascent entrepreneurship) as well as new and established businesses."

Another important thing to note is the multi-level nature of the GEM model, which was another consideration in choosing this dataset. The GEM model recognizes the difficulty in analysing ME (or TE) as mentioned earlier in this thesis, with influences of micro-level variables at the macro level, where the national measures are often aggregations of activity at the individual level. This is also emphasized by Reynolds et al. (2005), where he states that "unlike other national economic characteristics, like GDP or inflation, national entrepreneurship can be considered as the net result of individual decisions to pursue entrepreneurial initiatives".

3.1.2 How does GEM measure entrepreneurship?

The GEM research measures entrepreneurship (ME) mainly through two surveys: the Adult Population Survey (APS) and the National Expert Survey (NES).

Adult Population Survey

The Adult Population Survey (APS) is GEM's method to directly estimate the participation of the adult population in new firm creation (Reynolds et al, 2005). It provides, on a national level, standardised data on entrepreneurial activity (Bergmann et al., 2014) and looks at characteristics, motivations and ambitions of individuals starting businesses, as well as social attitudes towards entrepreneurship (GEM, 2020). It is collected from a random sample of at least 2000 adults from 18 to 64 years old in each of the participating countries (Urbano et al, 2018). For a full list of indicators measured in the APS please refer to Reynolds et al. (2005) and the GEM website.

National Expert Survey

The National Experts Survey (NES) investigates the national conditions that specifically foster or retard entrepreneurial activity (Urbano et al., 2018) and tries to "get a deeper understanding of the strengths, weaknesses, and major issues regarding entrepreneurship in the respective country" (Reynolds et al., 2005; Bergmann et al., 2014). It assesses nine conditions that GEM identified to have a significant impact on entrepreneurship, referred to as the Entrepreneurial Framework Conditions (EFCs). These nine conditions are related to access to financial resources, governmental influence, education, R&D transfer, market dynamics, physical infrastructure, and cultural and social norms (Reynolds et al., 2005; GEM, 2020). According to Levie & Autio (2008) these EFCs define the rules of the game for entrepreneurial activity and, ceteris paribus, "governments that ensure superior EFCs should expect higher national rates of entrepreneurial activity—and higher rates of economic growth." The NES is performed annually, through standardized questionnaires and face-to-face interviews with at least 36 national experts per country (Urbano et al., 2018).

Total Entrepreneurship Activity Rate

The most important outcome of the GEM research is the level of entrepreneurship in a country, namely the Total Entrepreneurship Activity (TEA) rate. The TEA rate measures the percentage of the population between 18-64 years old who are either a nascent entrepreneur (involved in the process of starting up a business) or are active as owner-managers of a young firm (less than 42 months old) (Wong et al., 2005; GEM, 2020). This is in line with Wennekers et al. (2002) who state that business ownership rate is the most important static indicator of ME. Additionally, Wong et al. (2005) have distinguished three subtypes of entrepreneurship rates from the overall TEA rate: Opportunity TEA, Necessity TEA and High Potential TEA. Necessity TEA rates concern those entrepreneurs that are involved in entrepreneurship as a last resort, because there is no other option for work, whereas opportunity TEA rates concern those entrepreneurs that are pursuing an opportunity, e.g., from the drive to be independent or increase their income. High Potential TEA concerns the entrepreneurs that are involved in firms that have 'high growth potential', which will be discussed in more detail in the next subsection discussing operationalisation of TE. According to Wong et al (2005), the different types of TEA have different types of impact on economic growth, with High Potential TEA having the largest (potential) impact. What is important to note with this categorisation is that it is not mutually exclusive and the possibility for overlap between all three categories exists. Perhaps those engaging in entrepreneurship to pursue an opportunity have a higher chance of creating a high growth potential firm, as they maybe have set more ambitious goals besides providing for their needs, but those who engage in entrepreneurship out of

necessity are certainly not disqualified from doing the same. However, for the purpose of this thesis, whether a high growth firm is created by an entrepreneur engaging in entrepreneurship out of necessity or opportunity is irrelevant, what is important is the creation of a high potential firm itself.

This distinction between several types of entrepreneurial activity is important, as several authors (Levie & Autio, 2008; Wong et al., 2005) have noted that the GEM model fits with the tradition of both Schumpeter and Kirzner, including both types of entrepreneurs in their TEA index, with the Schumpeterian entrepreneur being the rare, high impact innovator and the Kirznerian entrepreneur the replicative arbitrageur, as described in chapter two of this thesis. Wong et al. (2005) describe this distinction by stating that the TEA index includes "true" Schumpeterian entrepreneurs as well as managerial business owners (i.e., Kirznerian enterpreneurs). The distinction is further emphasized by Reynolds et al. (2005), who also state that "this more restricted definition is consistent with the Schumpeterian view", meaning those entrepreneurs that have high potential impact on the economy. Need-based entrepreneurship is then defined as being reflective of Kirznerian entrepreneurship.

For the purpose of this thesis, the TEA rate from the GEM dataset will be analogous to ME.

3.2 Measuring Technology Entrepreneurship

This section covers the literature discussing measurement of TE and the way this thesis will measure TE.

3.2.1 How is TE measured?

There is no single indicator specifically measuring TE but, as the TEA index from the GEM dataset covers different types of entrepreneurship, several authors have proposed ways to extract a measure for TE from the GEM dataset. Laplume et al. (2014) have done this by taking the sample of early-stage entrepreneurs (firms less than 42 months old) and use a measure from the APS to subtract the group of entrepreneurs using technologies and procedures available for less than one year, thus defining TE firms as new firms utilising the latest (available for less than one year) technology or procedures.

Wong et al. (2005) have taken a different, more extensive approach. They based their research on several studies that confirm that not all new firms contribute equally to economic growth, and that out of all the new firms, the rapidly growing firms (which is less than 5% of new firms) account for the vast majority of new job creation (Birch, 1987; Kirchhoff, 1994; Storey, 1994; Westhead & Cowling, 1995). In their own research, Wong et al. found that, of the different types of entrepreneurship, only high growth potential entrepreneurship is a significant contributor to economic growth. This has led them to use the GEM data to create the "High Potential TEA" index. Wong et al. (2005) started with the assumption that "the ambitions and growth expectations of entrepreneurs are a likely antecedent to achieving future high performance", and from there operationalised the High Potential TEA index from the GEM data through four criteria: (i) potential for employment growth, (ii) market impact, (iii) globalised customer base and (iv) use of new technology, where all four criteria must be fulfilled. The GEM APS survey includes questions to filter for these criteria and find *high potential innovative start-up attempts*, namely, (i) the venture plans to employ at least 20 employees in 5 years, (ii) the venture indicates at least some market creation impact, (iii) at least 25% of abroad customers, and (iv) usage of technology not widely available for more than one year (Wong et al., 2005). Additionally, Levie & Autio (2008), have extracted a *High Growth Potential TEA index* from the GEM data in a similar way. Once

more emphasizing the difference between high- and low-impact entrepreneurship, Wong et al (2005) additionally concluded, from a lack of strong correlation between innovation and new business creation (i.e., ME), that there is little overlap between the two and "only a very small proportion of entrepreneurs engage in true technological innovation." In essence, what Wong et al. (2005) are saying, is that there is little correlation between ME and TE, because TE is defined as being intrinsically related to technological innovation.

This poses a problem for the definition of entrepreneurship by Schumpeter. He defines entrepreneurship as having innovation included, but as technological innovation and ME are uncorrelated, this definition of entrepreneurship cannot apply to the entire larger category of ME. However, we've established that the subset TE is closely, and intrinsically, related to technological innovation. Therefore, we will conclude that Schumpeterian entrepreneurship is in fact TE. Additionally, Kirzner's definition of entrepreneurship is still applicable to ME. This thesis will therefore conclude that the Schumpeterian entrepreneur is the technological entrepreneur and the Kirznerian entrepreneur is the mainstream entrepreneur.

Although Wong et al. (2005) have named their index "High Potential TEA", their definition is very closely related to the definition of TE in this thesis. Firstly, this thesis has described TE as being intricately linked to technological change and innovation, having a high impact on job creation and economic growth, with a small number of TE firms being responsible for a disproportionately large amount of GDP. The high potential entrepreneurship by Wong et al. (2005) is described as the sole form of entrepreneurship engaging in true technological innovation; the only form of entrepreneurship that is a significant contributor to economic growth and responsible for the vast majority of new job creation. Additionally, Levie & Autio (2008) suggest that in poorer countries, TEA is more dominated by low-growth expectation start-ups than in high-income countries, echoing the notion of thesis, that for TE to exist, a minimum of economic development and ICT development must exist within a country. TE will therefore be operationalised as equal to High Potential TEA, as defined by Wong et al. (2005) and will use the GEM data in a similar way, with the major exception being the globalised customer base filter, as I have found no indication of TE being strongly related to having a globalised customer base in the literature. Additionally, Japan, being one of the most homogenous societies in the world would perhaps have a more inward focus and be more concerned with solving problems within their own society through TE, forgoing export. Neighbouring countries and open borders would make export easier for The Netherlands as opposed to the island group of Japan, but it does not guarantee a high level of TE in The Netherlands. Lastly, a firm in the Netherlands would feel the need to seek international customers much quicker than a firm in Japan because the population, and therefore potential market size, is about ten times smaller. This dimension is therefore excluded, as it is deemed to give a skewed image.

Additionally, what Wong et al. (2005) have established here is a method to measure entrepreneurial ambition. There have been studies that found a positive correlation between growth intentions and subsequent firm growth, innovative motivation and post-entry performance, and high commitment to entrepreneurial ambitions and eventual success (Davidsson, 1991; Bellu and Sherman 1995; Kolvereid and Bullvåg 1996; Vivarelli and Audretsch 1998; Gundry and Welsch, 2001; Wiklund & Shepherd 2003; Giotopoulos et al 2017). Additionally, Hart (2012) and Autio (2005) have found a correlation between initial expectations and eventual growth, although mentioning that it is 'imperfect'. Growth intentions are thus a necessary condition to become a high growth firm, and therefore an important predictor for

firm success (Terjesen et al 2015), but only a small percentage of those within that group reach their goal, and Stam (2010) states that firm growth is difficult to predict and largely an arbitrary process. Alternatively, Stam et al (2011) found no correlation between ambition and eventual firm growth. Several authors have used this same model in GEM related studies (e.g. Levie & Autio, 2008, 2011; Giotopoulos et al., 2017). However, none of these studies have tested this model over an extended period of time, so whether the entrepreneurs, or what percentage of these entrepreneurs, that indicate to have high growth ambition (or potential) eventually fulfil those ambitions remains unknown. There are of course obvious difficulties in researching this, as it requires an extensive longitudinal study where the sample of start-ups to measure and follow must be sufficiently large, in order to have a reasonable set of firms left at the end, because inevitably many start-ups will fail. I would be remiss if I did not mention the potential shortcomings of operationalising TE in this manner, however this thesis will operationalise TE in a similar way. I find the literature in favour of the relation between ambition and eventual growth more compelling than those unfavourable of this relation, both in number and content, as well as several other authors using this method to measure TE.

Lastly, the GEM data measures the percentage of those within TEA offering a product new to all or some customers, named the new product index. We can infer from the description of TE in chapter two strongly that technological innovation in TE expresses itself in new products. Therefore, this "new product index", will be used to create an index for TE as well.

The GEM's Total Entrepreneurial Index will be analogous to ME and the subset of TE will be extracted from ME using the TE index, which is created by a combination of four elements, (i) usage of the latest technology (0-5 years), (ii) new product, (iii) high job creation, and (iv) new market.

3.2.2 The TE Index

The four elements used to create an index for TE are thus (i) usage of the latest technology (0-5 years), (ii) new product, (iii) high job creation, and lastly (iv) new market. These four indices are all measured as a percentage of those within ME (TEA in the GEM dataset). To extract the subset of TE, the product of these indices is used. In contrast to using the sum, where some values might be doubly counted or missed, using the product gives the subset where all criteria are fulfilled. Below a sample calculation is provided.

In this example TE only consists of those entrepreneurs using the latest technology and offering new products. The TE index is the subset of entrepreneurs fulfilling both these criteria. If the percentage of those in ME using the latest technology is 40% (a) *and the percentage of those in ME offering new products is 20%* (b)*, the calculation is as follows:*

$$a = 40\%$$
$$b = 20\%$$
$$TE = a * b$$
$$TE = 8\%$$

3.2.3 NOTES ON THE OPERATIONALISATION OF TECHNOLOGY ENTREPRENEURSHIP

What has been discussed so far in this thesis should make it clear that TE is a difficult concept to precisely operationalise. Several of the elements used could be omitted through argumentation of relevance. Conversely, the number of elements could be expanded almost indefinitely. In its purest form, TE is merely venture creation with the usage and exploitation of new technology. The most closely related element of the other three would be the *New Product* – the product is new to some or all customers – as, in my opinion, usage of new technology expresses itself first in a renewed, or new product. *High Job Creation* and *New Market* are added, but could just as well be removed. For *New Market,* the argument would be that a business creating a new market is innovative, and thus engaging in TE, but I do not believe it is a prerequisite for TE, as those not creating a new market could be engaging in TE as well. The same can be said for *High Job Creation Expectation*. TE companies that have a high job creation are great contributors to the economy, which is a hallmark of TE. However, companies with less, or delayed job creation expectation might still be innovative and use the latest technologies. Additionally, this element measures an absolute number (10 jobs or more), which might exclude companies that remain smaller over a longer period of time, who might be just as innovative but have a different product. Additionally, due to the way the GEM data is measured, a new product, a new market and high job creation can be in any industry. Therefore, the index for TE *must* include *Usage of New Technology*, as without this element, there is no TE specificity. As the rest of the elements can be taken in or out of the equation through argumentation, the following chapter will present different forms of the TE index. The following table summarises operationalisation of both ME and TE.

Type of entrepreneurship	*Operationalisation*	*Data source*
Mainstream Entrepreneurship	Total Entrepreneurship Rate (Percentage of 18-64 population who are either a nascent entrepreneur or owner-manager of a new business)	GEM
Technology Entrepreneurship	Calculated as the product of (some of) the following elements:	GEM
TE: New Technology 1	Percentage of respondents within TEA reporting that they use technology not available one year ago	GEM
TE: New Technology 2	New technology 2: Percentage of respondents within TEA reporting that they use technology newly available between 1-5 years ago	GEM
TE: New Product	Percentage of respondents within TEA: reporting that product is new to all or some customers	GEM
TE: High Job Creation	Percentage of respondents within TEA: reporting new market (few/no businesses offer the same product)	GEM
TE: New Market	Percentage of respondents within TEA expecting 10 or more jobs 5 years after the business has started	GEM

Table 3.1 Influencing variables found in the literature

3.3 INFLUENCING VARIABLES

This section will discuss the operationalisation and measurement of the influencing variables for ME and TE. The specific influencing variables are not measured as such, but several measurements – which will be referred to as "elements" – are taken to draw conclusions about the overall influencing variable

(e.g., economic development is measured through the element GDP per capita). In most cases the GEM dataset has operationalised several elements for the influencing variables in some way, which will therefore be used. Where possible, other data sources have been used, to cross-check and compare the GEM data. It is important to note that many of the elements chosen here are based on association, either directly from literature research described in the previous chapter or logically following the literature research, but no causal relationship is found with the overall influencing variable or the levels of TE and ME. This means that, for example, that the level of education can increase the level of TE in a country, but that this relationship is not one-directional per se; the level of TE in a country can also increase the level of education. Where an empirical relationship was found, a mention is made in the individual subsections that follow.

3.3.1 Economic Development

The obvious choice to measure *economic development* is the Gross Domestic Product (GDP). It is a widely used index to compare the size and health of economies (IMF, 2020) and is therefore suited to the purpose of this thesis. However, as the size of a country's economy is dependent on the size of the population, this thesis will use the adjusted index, GDP per capita. The data is mainly found in the World Bank database, with missing data supplemented by the IMF database.

3.3.2 Technological development

This thesis will use several elements to measure *technological development*. Firstly, similar to Wong et al. (2005), the ratio of patents to GDP will be used. Patents are a way to formalise and capture innovation, especially in context of business and entrepreneurship, the use of patents is clear. To make cross-country comparisons, the ratio of patents to GDP will be used to control for larger economies having a disproportionately higher number of patents. This element will be a combination of data from OECD and World Bank data. Secondly, research and development (R&D) expenditure as a percentage of GDP is used as an element to measure *technological development.* Chapter two established the link and inverted U-shaped relation between R&D investment and TE. I expect a country that has higher R&D expenditure to have more R&D present, up to a certain point, and therefore more opportunity for technological innovation, and therefore more opportunity for TE. Thirdly, ICT investment as a percentage of total non-residential gross fixed capital formation, will be used, as higher ICT infrastructure is required for TE, as established in chapter two. I expect to see higher values for countries with higher TE levels. Lastly, the number of broadband subscriptions, fixed and mobile, per 100 inhabitants is used, as reflective of effective ICT infrastructure in a country, and whether the population indeed has access to ICT infrastructure required for TE. Again, I expect countries higher on TE to show higher values for this element. All aforementioned data can be found in the OECD, IMF and World Bank databases. Lastly, R&D transfer (i.e., the ease with which new firms are able to capitalise on research, either performed in large incumbents or governmental R&D, to start a new firm), will be used. This is found in the GEM dataset, rated on a five-point scale, with 5 being the most favourable condition to R&D transfer. This element is taken as reflective of *knowledge spillover* (discussed in chapter two), because a higher number of patents or more R&D investment in a country does not necessarily lead to better technological environments for TE. Potential entrepreneurs must be given the opportunity to capitalise on a higher number of patents and more R&D investment in a country. I therefore expect a country with high R&D expenditure, high Patents/GDP in combination with high R&D transfer to have more TE than a country that has lower values for these elements.

3.3.3 Institutions

Institutions is a fuzzy variable, making it difficult to operationalise and measure. It is not defined similarly across the literature and its measurement is often through subjective interpretation. As a simplification, the operationalisation will limit institutions as being able to foster or inhibit entrepreneurship, in line with what has been defined as *institutions* earlier in this thesis. The GEM consortium has created several indices to measure the institutional variable, namely the EFCs, "Government policies: support and relevance" (the extent to which public policies support entrepreneurship and whether entrepreneurship is a relevant economic issue), "Government policies: taxes and bureaucracy" (the extent to which public policies support entrepreneurship and whether taxes or regulations are either size-neutral or encourage new (small) firms), "Government entrepreneurship programmes" (the presence and quality of programs directly assisting new (smaller) firms at all levels of government [national, regional, municipal]) and "Commercial and legal infrastructure" (the presence of property rights, commercial, accounting and other legal and assessment services and institutions that support or promote new (smaller) firms). These indices are rated on a five-point scale by national experts with intimate knowledge of their respective national entrepreneurial environment, with five being the most conducive to entrepreneurship. This thesis will therefore use these for indices as elements to measure *institutions.* Note that, although "commercial and legal infrastructure" is not measured as a "government" variable by GEM, this index was chosen as an element for *institutions* as well, as the government exercises heavy influence over the commercial and legal infrastructure of a country. I have not found an additional source to cross-check the *institutions* influencing variable.

3.3.4 Culture

In this section several national culture models will be compared, after which the one best suited for this thesis will be chosen. The paper by Morden (1999) will be used for this purpose, as this paper discusses a wide variety of models of national culture; its contents are summarized below.

Models of national culture

Morden categorizes the cultural models into three categories: Single Dimension Models, Multiple Dimension Models and Historical-Social Models. The third category concerns European specific and Southeast Asian specific models, which are not suited for our purpose, namely cross-national analysis, therefore this category will be excluded. The single dimension models could potentially be excluded as well, because of the complex nature of both ME, TE, and culture in general. I do not believe that the difference between the Netherlands and Japan can be expressed in a single variable, as a lot of information will be lost. These models are included however, as it highlights an important aspect of culture and the difficulty in operationalising and measuring culture. Depending on the single dimension model that is chosen, The Netherlands and Japan could have a vastly different or similar culture, which will become clear as the models are discussed.

Single Dimension Models

Single Dimension Models analyse culture based on a single variable, and the models discussed by Morden are *high and low context cultures*, *monochronic and polychronic cultures* and *Fukuyama's analysis of trust*, which differentiates between low and high trust cultures.

High and low context cultures

Hall's (1960, 1972, 1990) model is based on the single variable of context, with context meaning the way people obtain information and knowledge. In a high context culture, information is gathered from

personal information networks (i.e., friends, business acquaintances, relatives). Low context cultures are characterized by information-seeking through "research base" (e.g., reading, reports, databases and information sources) (Morden, 1999).

According to this model, the Netherlands is a low-mid context culture and Japan is a high context culture.

Monochronic/Polychronic

Lewis (1992) made the distinction between monochronic and polychronic cultures. This scale focuses on the way cultures deal with time, with monochronic cultures seeing time as a valuable and scarce resource, causing individuals in that culture to "act in a focused manner, concentrating on one thing at a time within a set time scale" (Morden, 1999). These cultures are characterized by the phrase "time is money" (Morden, 1999). Where monochronic cultures are interested in punctuality, polychronic cultures are "flexible and unconstrained by concerns with time." (Morden, 1999). Punctuality or time schedules are not their main concern, instead acting opportunistically, or in an unplanned manner, doing many things at once.

On the monochronic/polychronic scale, The Netherlands and Japan are right next to each other, at the lower-mid end of the monochronic-polychronic scale.

Fukuyama's analysis of trust

Fukuyama's (1996) model differentiates between high- and low-trust societies, but this model focuses more on organisation and management. High-trust societies are characterized by delegation of responsibility from the upper to the lower levels of the organisation, indicating a high level of trust and flexibility. Low-trust societies "must fence in and isolate their workers with a series of bureaucratic rules" (Morden, 1999).

The Netherlands and Japan are both characterized as high-trust societies.

Multiple dimension models

Multiple dimension models analyse culture on multiple dimensions, below the Hampden-Turner & Trompenaars and the Hofstede models are discussed.

Hampden-Turner & Trompenaars

The model proposed by Hampden-Turner & Trompenaars is, similar to Fukuyama's analysis of trust, an organization and management-focused model. It proposes seven value dilemmas between national cultures, and the resolution of these dilemmas will allow managers to understand "key cultural differences taken by different nationalities to the process and practice of management" (Morden, 1999). The seven value dilemmas are listed below, for a complete description of each dilemma please see Morden (1999):

1. Making rules and managing exceptions (universalism versus particularism).
2. Deconstructing and constructing (analysing versus integrating)
3. Managing communities or individuals (individualism versus communitarianism)
4. Internalising the outside world (boundary management or inner- directed versus outer-directed)
5. Synchronising time processes (time as "sequence" versus time as "synchronisation")
6. Achieved status versus ascribed status

7. Equality versus hierarchy

Hofstede

Hofstede's dimensions of national culture is the most widely used framework for national culture and measures culture along six dimensions. Some dimensions show similarity to those used in the Hampden-Turner & Trompenaars model, and although it is applicable in management settings, it is not management specific. This is the cultural model this thesis will use, because comparisons with other literature will be easiest with the most widely used framework and it emphasizes the differences between the Netherlands and Japan. A description of all the dimensions is given below:

Power distance

The power distance dimension "expresses the degree to which the less powerful members of a society accept and expect that power is distributed unequally." (Hofstede Insights, 2021)

Individualism-collectivism

This dimension deals with the degree to which the self-image of members of a society is defined in terms of "I" or "we". Individualist cultures are focused on themselves and their direct families, whereas collectivist cultures are more focused on "we", ranging from relatives, to a particular ingroup, to the entire nation.

Masculinity – feminism

Masculine cultures are characterized by competitiveness and a preference for "achievement, heroism, assertiveness and material rewards for success" (Hofstede Insights, 2021). Feminine cultures are more "consensus-orieted" and prefer "cooperation, modesty, caring for the weak and quality of life" (Hofstede Insights, 2021).

Uncertainty avoidance

This dimension deals with uncertainty, ambiguity, and the future, and "expresses the degree to which the members of a culture feel uncomfortable" about these concepts (Hofstede Insights, 2021). Cultures that have a high score for uncertainty avoidance "maintain rigid codes of belief and behaviour and are intolerant of unorthodox behaviour and ideas." Cultures with a low score on this dimension "maintain a more relaxed attitude in which practice counts more than principles" (Hofstede insights, 2021).

Long term orientation – short term orientation

Cultures characterized by short term-orientation prefer to "maintain time-honoured traditions and norms while viewing societal change with suspicion" (Hofstede Insights, 2021). Long term-oriented cultures "take a more pragmatic approach: they encourage thrift and efforts in modern education as a way to prepare for the future" (Hofstede Insights, 2021).

Indulgence – restraint

This dimension is concerned with the free allowance or suppression of gratification. Cultures high on indulgence allow "relatively free gratification of basic and natural human drives related to enjoying life and having fun", whereas cultures high on restraint suppress "gratification of needs and regulates it by means of strict social norms" (Hofstede Insights, 2021).

The Hofstede cultural dimensions are rated on a 0-100 scale, and data can be found on the Hofstede cultural dimensions website. According to Pinillo & Reyes (2011), the individualism – collectivism (IC)

dimension is the most significant dimension in relation to entrepreneurship, where a high level of individualism indicates a more entrepreneurial culture. I expect countries with higher levels of ME to therefore have higher values for the IC dimension. The GEM consortium also has an EFC named "cultural and social norms", from the National Expert Survey, rated on a five-point scale, with five being the most conducive to entrepreneurship. The GEM data should give a similar image to the Hofstede data and can be used for cross-checking purposes.

3.3.5 EDUCATION

The GEM dataset measures the percentage of entrepreneurs (those within TEA) with at least post-secondary education. This thesis will use this measurement as an element for *education.* This data will be cross-checked with data from the OECD database, namely the percentage of the population that has had tertiary education. The OECD database has split this into two groups, those between 25-34 years of age and those between 55-64 years of age. Although entrepreneurs are more likely to fall within the younger age category, both groups will be used, as entrepreneurs are not exclusively young people. The previous chapter established that TE is dependent on human capital with technology-specific education. Therefore, as a TE specific element, the number of universities offering technology majors per 1 million inhabitants is used, calculated from Times Higher Education data, which offers the number of universities offering technology majors per country. Naturally, I would expect this element to have much higher values in Japan than in The Netherlands.

The following table summarises this section, by showing the influencing variable, the way it is operationalised and what source will be used.

Influencing variable	*Measured as (elements)*	*Source*
Economic Development	GDP per capita (current US$)	World Bank & IMF
Technological development	Patents to GDP ratio	Combination of "triadic patents family" from OECD and GDP from World Bank
	R&D Expenditure (as % of GDP)	OECD
	Mobile broadband subscriptions (/100 inhabitants)	OECD
	Fixed broadband subscriptions: (/100 inhabitants)	OECD
Institutions	Governmental policies: support and relevance (1-5 scale)	GEM
	Government policies: taxes and bureaucracy (1-5 scale)	GEM
	Government entrepreneurship programs (1-5 scale)	GEM
	Commercial and legal infrastructure (1-5 scale)	GEM
Culture	Cultural and social norms (1-5 scale)	GEM
	Hofstede cultural dimensions	Hofstede Insights

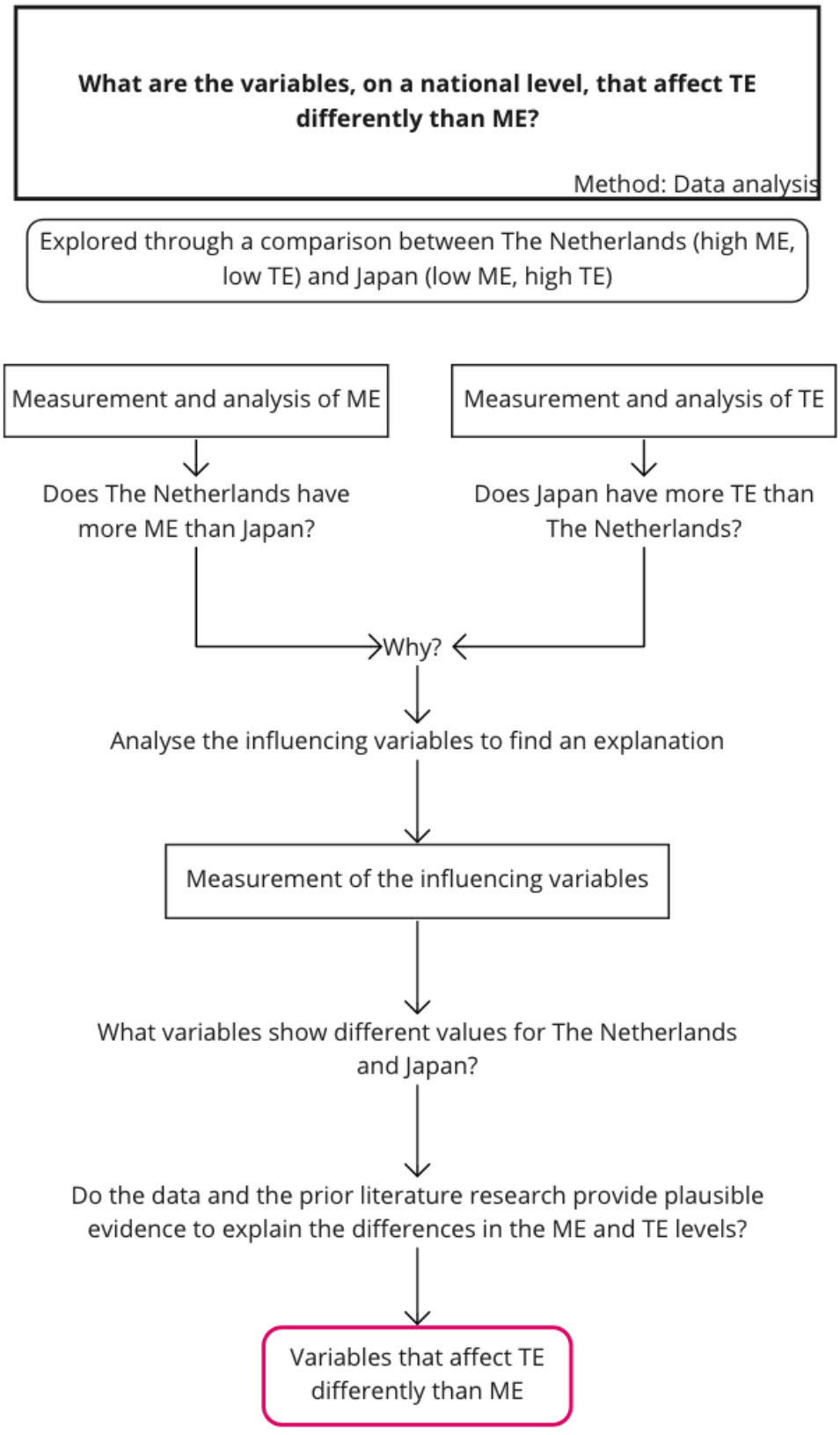
Education	Tertiary education (% of 25-34 year olds)	OECD
	Tertiary education (% of 55-64 year olds)	OECD
	Universities offering technology majors (per 1 million inhabitants)	Times Higher Education

Table 3.2 Operationalisation and measurement of the influencing variables

3.4 CHAPTER CONCLUSION

In this chapter the third sub-question of this thesis, "How can I measure technology entrepreneurship on a national level in contrast to mainstream entrepreneurship, as well as the influencing variables?" was answered. The overall level of ME in a country will be measured by using the TEA rate from the GEM dataset, which measures the percentage of the population (18-64 years old) engaged in entrepreneurship. The GEM dataset was created with the goal of cross-national comparison, which is the goal of this thesis as well. It is the largest and most widely used dataset in entrepreneurship research, meaning that use of the dataset eases comparison with other research. Additionally, both TE and ME can be operationalised and measured using that same dataset. Although there is no single indicator available that exactly measures TE in a country, this thesis has operationalised TE for a best-fit approach. The TE index is created by the product of (i) usage of the latest technology (0-5 years), (ii) new product, (iii) high job creation, and lastly (iv) market impact. These are all found in the GEM dataset, and thus the TE subset is extracted from the TEA index through these criteria. Since the overall levels of ME and TE are influenced by a set of influencing variables, logically, what follows is that the overall levels of ME and TE are influenced by higher or lower levels of these variables. Therefore, to explain the differences in the overall levels of ME and TE between the Netherlands and Japan, it is important to measure these variables as well. The individual variables from the models for both ME and TE are operationalised in this chapter, with the main data sources being the GEM dataset, OECD, World Bank and IMF databases. Another important finding from this chapter is the conclusion that Kirznerian entrepreneurs are mainstream entrepreneurs and Schumpeterian entrepreneurs are technology entrepreneurs. The next chapter will gather the data and measure the individual variables, and overall ME and TE rates at the country level.

Chapter 4: Results

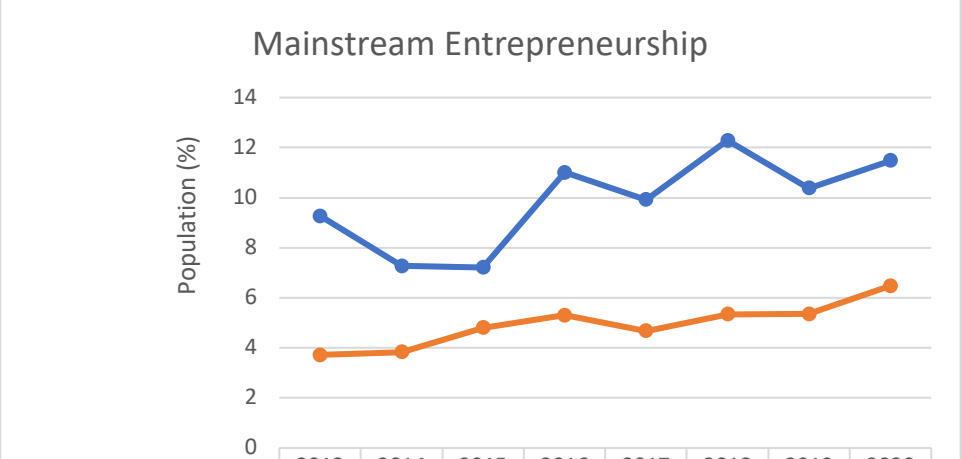


4 | Results

In this chapter, the relevant data is gathered, analysed and discussed to the main research question "What are the variables, on a national level, that affect technology entrepreneurship differently than mainstream entrepreneurship?". The first section will cover mainstream entrepreneurship (ME), the second section will cover technology entrepreneurship (TE) and the third section will cover the influencing variables. The purpose of this chapter is to use the data, as operationalised in chapter three, to verify the outcome of the literature research and the hypotheses, and ultimately to find an answer as to why The Netherlands has more ME, but less TE than Japan. The data on the influencing variables, namely *economic development, technological development, institutions, culture,* and *education*, will be used to gain insight and draw conclusions in understanding the differences between the ME and TE levels. Data was used starting in 2013, as it introduced some new changes to the GEM dataset. Where possible the most recent data was used (2020), however this was not possible everywhere, with some data being unavailable after 2018.

4.1 Mainstream Entrepreneurship

Mainstream entrepreneurship is measured by the Total Entrepreneurial Activity (TEA) index, found in the GEM dataset. Figure 4.1 shows the TEA index - the percentage of the population between 18-64 years old who are either a nascent entrepreneur (involved in the process of starting up a business) or are active as owner-managers of a young firm (less than 42 months old) – in a graph. The y-axis represents the percentage of the population and the x-axis the time in years. Below the graph, the data is displayed in a table.



	2013	2014	2015	2016	2017	2018	2019	2020
The Netherlands	9,27	7,27	7,21	11,00	9,92	12,29	10,38	11,48
Japan	3,72	3,83	4,80	5,30	4,68	5,34	5,35	6,48

Figure 4.1 Level of Mainstream Entrepreneurship as a percentage of the population

In 2013, The Netherlands starts with ME at 9,27%, and ends at 11,48% in 2020, showing a total increase of 2,21% in this time-period. The lowest point for The Netherlands is in 2015, with 7,21% and its highest point is in 2018, at 12,29%. ME in Japan starts at 3,72% in 2013 and ends at 6,48% in 2020, showing a

total increase of 2,76% in this time-period, which is almost a doubling. Its lowest point is the starting point, and the highest point is the endpoint.

Japan shows a gradual increase over this time-period, whereas The Netherlands, while also showing a total increase, shows more peaks and valleys. The Netherlands has, on average, double the amount of ME in this time-period compared to Japan. The biggest difference is in 2013, at 2,5 times and the smallest in 2015, at 1,5 times.

The data shows that a much larger percentage of the population in The Netherlands engages in ME than in Japan. This is as expected and in line with what has been established in the previous chapters of this thesis. Additionally, the graph shows that this is a consistent finding over the years, and appears to continue, as countries show a similar trend.

4.2 Technology Entrepreneurship

The difficulty with measuring TE has been discussed in the previous chapter and as such, TE will be looked at through different lenses. In this section the four elements used to establish the TE index, namely *Usage of the latest technology, New product index, High job creation expectation* and *Market impact index* are discussed, after which several combinations of these will be used to draw conclusions about the total level of TE in The Netherlands and Japan. From our preliminary findings in chapter one, Japan has more TE. I therefore expect to see higher values for the TE index and the elements used to establish the TE index for Japan.

4.2.1 Usage of the latest technology

Usage of the latest technology is measured as a percentage of those within ME that use technology that was not available 1 year ago, or technology that was not available between 1-5 years ago. Data for this index was not available after 2018, when the Global Entrepreneurship Monitor (GEM) Adult Population Survey (APS) was modified and the questions measuring this index were removed. Figure 4.2 shows the data for *Technology not available > 1 year ago* in a graph, Figure 4.3 shows the data for *Technology not available < 1-5 years ago* in a graph, and Figure 4.4 shows the combined total of both, all with time in years on the x-axis and the percentage of those within TEA using the latest technology on the y-axis. Below all graphs a table with the data is shown.

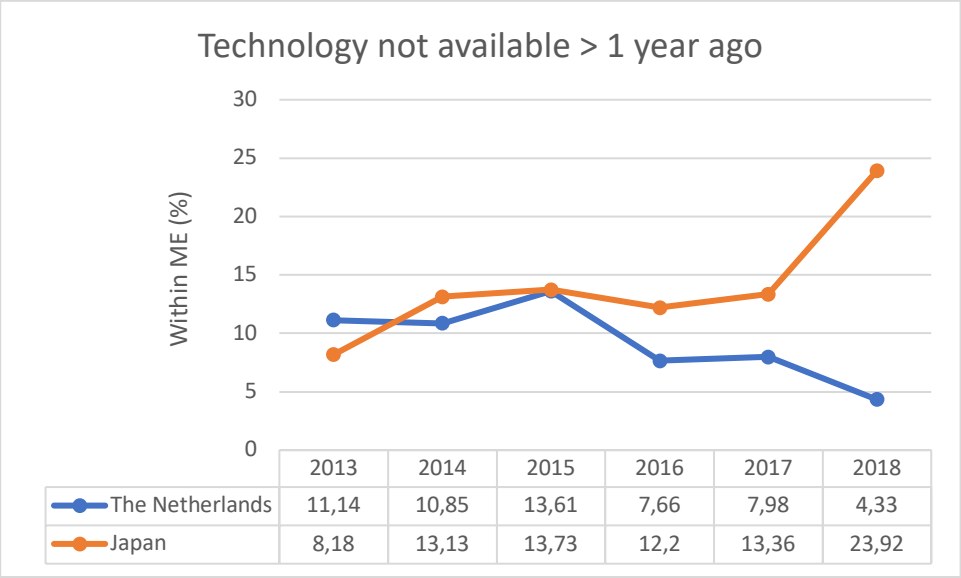


Figure 4.2 Usage of technology not available > 1 year ago as a percentage of those in ME

In 2013, 11,14% of entrepreneurs used technology available for less than 1 year in The Netherlands, and 4,33% in 2018. Its lowest point is 4,33% in 2018 and its highest point is 13,61% in 2015. The Netherlands shows a 6,81% decrease in this time-period. In Japan, this was 8,85% in 2013 and 23,92% in 2018. The data for both countries is quite equal in the years up to 2016, when the usage of technology available for less than 1 year in the two countries start to diverge. The numbers dramatically diverge in 2018, as Japan increases 10,56%, and The Netherlands decreases 3,65%. Japan has a 15,75% increase in this time-period and The Netherlands has a 6,81% decrease, which is about a tripling and a halving compared to 2013, respectively.

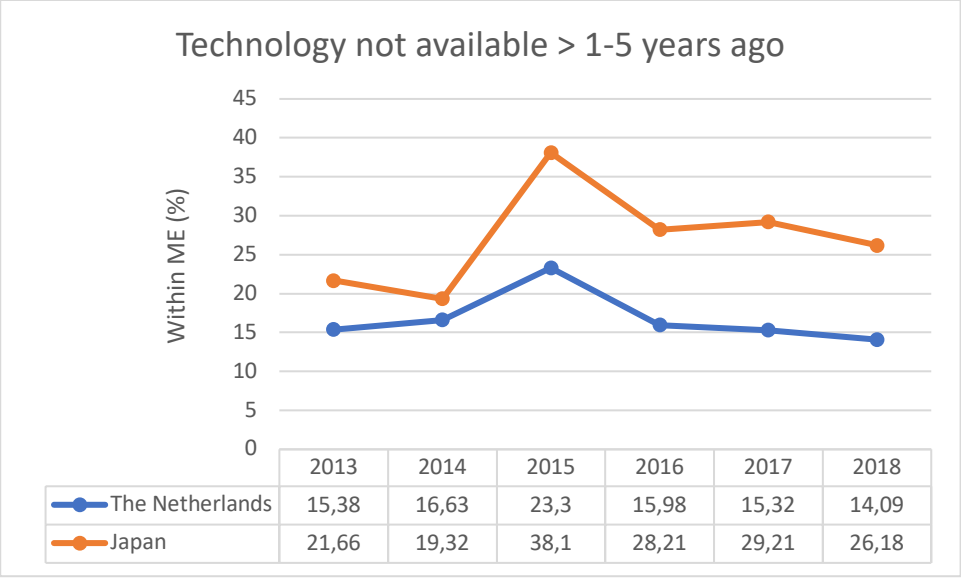
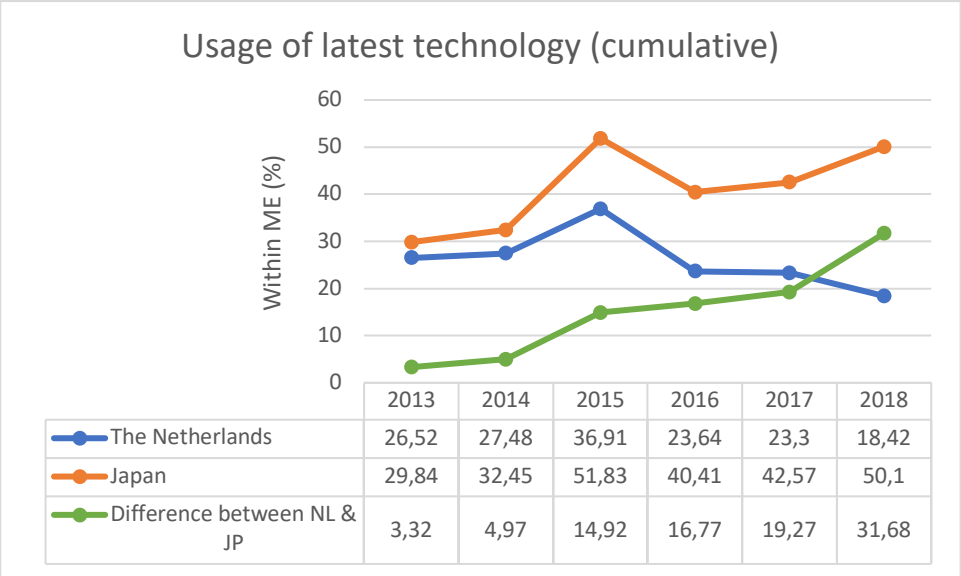


Figure 4.3 Usage of technology not available > 1-5 years ago as a percentage of those in ME

The percentage of entrepreneurs utilising technology that was not available between 1-5 years ago was 15,38% in 2013 and 14,09% in 2018 in The Netherlands. The lowest point is the endpoint, and the highest point is 23,30% in 2015. In this time-period The Netherlands shows a slight decline (1,27%) overall, with one peak in 2015. For Japanese entrepreneurs, the usage of technology not available

between 1-5 years ago was 21,66% in 2013, and 26,18% in 2018. The lowest point is 19,32% in 2014 and the highest point is 38,10% in 2015. In this time-period Japan shows an overall increase of 4,52%, with a large peak in 2015. The next figure (4.5) shows the combined total of both indices.



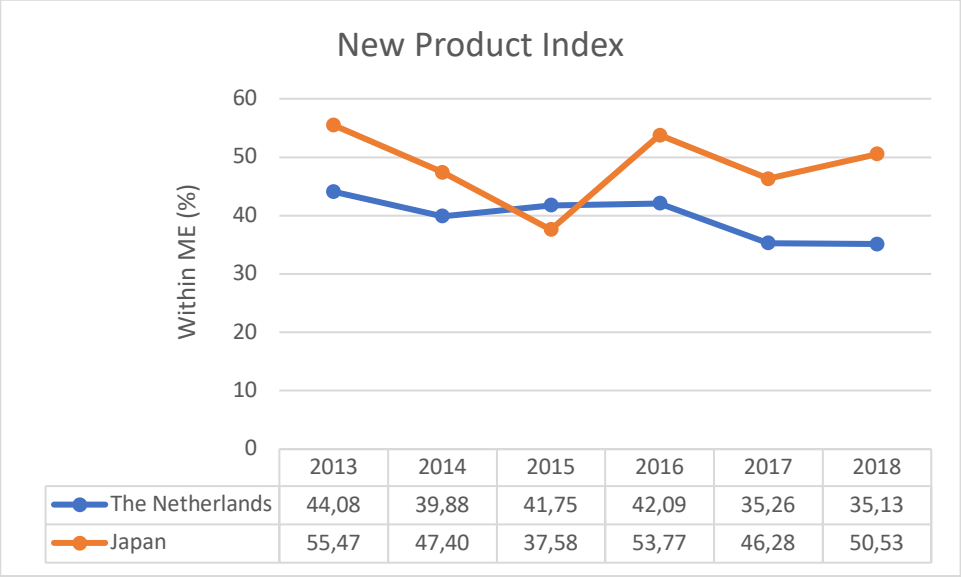
	2013	2014	2015	2016	2017	2018
The Netherlands	26,52	27,48	36,91	23,64	23,3	18,42
Japan	29,84	32,45	51,83	40,41	42,57	50,1
Difference between NL & JP	3,32	4,97	14,92	16,77	19,27	31,68

Figure 4.4 Combined usage of the latest technology (available < 5 years) as a percentage of those in ME

Concerning the usage of the latest technology – technology available < 1 year ago and technology available < 1-5 years ago combined – Japan scores consistently higher in this time-period. The gap between the two countries widens as the years go on, from 3,32% in 2013, to 31,68% in 2018, as shown by the green line. As expected, Japan uses more new technology than The Netherlands. Noteworthy though, is that over time, the trend is that as entrepreneurs in Japan use more new technology, those in The Netherlands are using less and less.

4.2.2 New Product

The New Product Index is measured as a percentage of those within TEA that state that their product is new to all or some customers. Data for this index was not available after 2018, when the GEM APS was modified and the questions measuring this index were removed. Figure 4.5 shows the data for *New Product* with time in years on the x-axis and the percentage of those within TEA stating that their product is new to all or some customers on the y-axis. Below the graph a table with the data is shown.



	2013	2014	2015	2016	2017	2018
The Netherlands	44,08	39,88	41,75	42,09	35,26	35,13
Japan	55,47	47,40	37,58	53,77	46,28	50,53

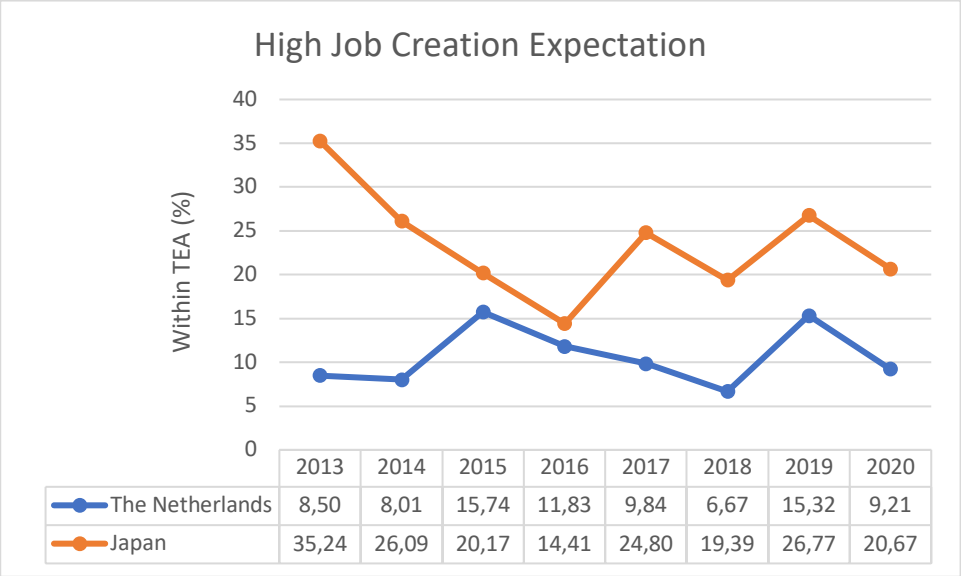
Figure 4.5 New Product Index; percentage of those within ME whose product is new to some or all customers

The percentage of new firms offering a new product to all or some customers in The Netherlands was 44,08% in 2013 and 35,13% in 2018. Its lowest point in this time-period is the endpoint and the highest value is at the starting point. Overall, The Netherlands shows an increase of 0,71% in this time-period. The percentage of new firms offering a new product to all or some customers in Japan was 55,47% in 2013 and 50,53% in 2018. Its lowest point in this time-period was 37,58% in 2015 and the highest value is at the starting point. Overall, Japan shows a decrease of 4,95% in this time period. On average 8,81% more entrepreneurs in Japan indicate that their product is new to all or some customers compared to The Netherlands in this time-period.

The data shows, as expected, entrepreneurs in Japan to create more new products than entrepreneurs in The Netherlands.

4.2.3 High job creation expectation

High job creation expectation is taken from the GEM dataset, where it is measured as a percentage of those within TEA that expect to create 10 or more jobs within 5 years. This data is shown in figure 4.6, with the y-axis representing the percentage of the population and the x-axis the time in years.



	2013	2014	2015	2016	2017	2018	2019	2020
The Netherlands	8,50	8,01	15,74	11,83	9,84	6,67	15,32	9,21
Japan	35,24	26,09	20,17	14,41	24,80	19,39	26,77	20,67

Figure 04.6 High Job Creation Expectation as a percentage of those in ME

High job creation expectation in The Netherlands was 8,50% in 2013 and 9,21% in 2020. Its lowest point in this time-period is 6,67% in 2018 and its highest point is 15,74% in 2015. Overall, The Netherlands shows an increase of 0,71% in this time-period. High job creation expectation in Japan was 35,24% in 2013 and 20,67% in 2020. Its lowest point is 14,41% in 2016 and its highest point is 35,24% in 2013. Initially, it shows a sharp decline until 2016, after which it increases with alternating highs and lows. Japan shows a decline of 14,57% in this time-period.

Entrepreneurs in Japan expect to create 2,2 times more jobs on average than entrepreneurs in The Netherlands. The biggest difference is in 2013, when entrepreneurs in Japan expected to create 4,15 times more jobs than entrepreneurs in The Netherlands. The smallest difference is in 2016, when entrepreneurs in Japan expected to create 1,22 times more jobs than those in The Netherlands.

This element in itself does not say much about TE specifically, as it currently concerns all forms of entrepreneurship (ME). It must be combined with the other technology-specific elements, however higher values potentially signal higher levels of TE in Japan.

4.2.4 New Market

New Market is taken from the GEM dataset, where it is measured as a percentage of those within TEA that report a new market, meaning that few or no businesses offer the same product. This data is shown in figure 4.7, with the y-axis representing the percentage of the population and the x-axis the time in years.

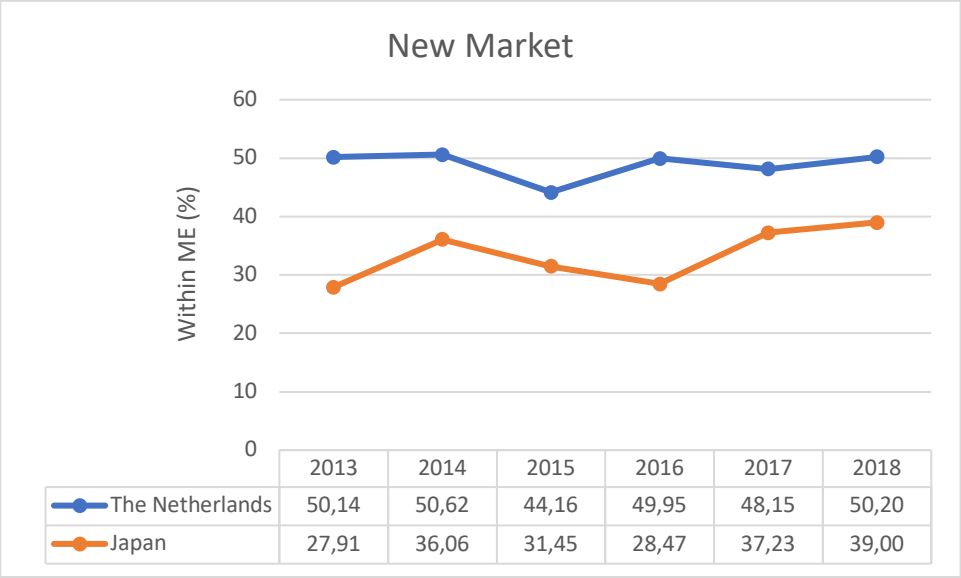


Figure 4.7 New Market as a percentage of those in ME

New Market in The Netherlands was 50,14% in 2013 and 50,20% in 2018. Its lowest point in this time-period is 44,16% in 2015 and its highest point is 50,62% in 2014. Overall, The Netherlands shows an increase of 0,06% in this time-period. *New Market* in Japan was 27,91% in 2013 and 39,00% in 2018. Its lowest point was the starting point and its highest point the endpoint. Overall, Japan shows an increase of 11,09% in this time-period.

Entrepreneurs in The Netherlands report a new market 1,47 times more than entrepreneurs in Japan. Over time, the differences between The Netherlands and Japan seems to decrease, as Japan increases, with The Netherlands only slightly increasing in comparison. The difference in 2013 was 22,23% and the difference in 2018 was 11,20%.

As with the element of *High Job Creation,* this element in itself does not say much about TE specifically, as it currently concerns all forms of entrepreneurship (ME) and all types of (non-technical) innovation as well. I would have expected Japan to score higher on this element, but perhaps this could signal that The Netherlands is rich in types of non-technical entrepreneurship that create new markets, and that TE in Japan does not create many new markets.

4.2.5 Total Technology Entrepreneurship level

This subsection will present several versions of the TE index, through several combinations of the *Usage of the latest technology, New Product, High Job Creation Expectation* and *New Market* elements. These elements are all measured as percentages of the TEA level in a country, and can therefore be applied as filters whereby the product of the filters will lead to the total TE index. First the TE index will only be the *Usage of the latest technology* element, as presented earlier in this chapter, then the *New Product, High Job Creation* and *New Market* elements will be added, respectively. The following table (4.1) shows the different variations of the TE index. The table has abbreviated *Usage of the latest technology* to NT, *New Product* to NP, *High Job Creation Expectation* to HJ and *New Market* to MI. The Netherlands and Japan are abbreviated to NL and JP, respectively.

TE Index	*TE = NT*		*TE = NT x NP*		*TE = NT x NP x HJ*		*TE = NT x NP x HJ x MI*	
	NL	JP	NL	JP	NL	JP	NL	JP
2013	26,52%	29,84%	11,69%	16,55%	0,99%	5,83%	0,50%	1,63%
2014	27,48%	32,45%	10,96%	15,38%	0,88%	4,01%	0,44%	1,45%
2015	36,91%	51,83%	15,41%	19,48%	2,43%	3,93%	1,07%	1,24%
2016	23,64%	40,41%	9,95%	21,73%	1,18%	3,13%	0,59%	0,89%
2017	23,30%	42,57%	8,22%	19,70%	0,81%	4,89%	0,39%	1,82%
2018	18,42%	50,10%	6,47%	25,32%	0,43%	4,91%	0,22%	1,91%
Average	**26,05%**	**41,20%**	**10,45%**	**19,69%**	**1,12%**	**4,45%**	**0,53%**	**1,49%**

Table 4.1 Different variations of the TE index as combinations of the elements

Immediately, the table shows that for every combination of the TE index, Japan has higher values than The Netherlands. Following, graphs will be displayed showing these separate combinations of the TE index. The difference between The Netherlands and Japan is larger for the TE indices with three and four elements than those with one and two. On average over this time-period, from the TE index with one element to the TE index with four elements, Japan has 1,66 times, 2,1 times, 5,36 times and 3,78 times more TE than The Netherlands, respectively. The following paragraphs will discuss each of the TE

indices, along with a graph. Note that the first TE variant is just *Usage of the latest technology.* For a full discussion of this TE index variant please refer to the section earlier in this chapter.

The next figure (4.8) displays TE as the product of *Usage of the Latest Technology* and *New Product*, with the x-axis representing the time in years and the y-axis representing the percentage of TE within ME.

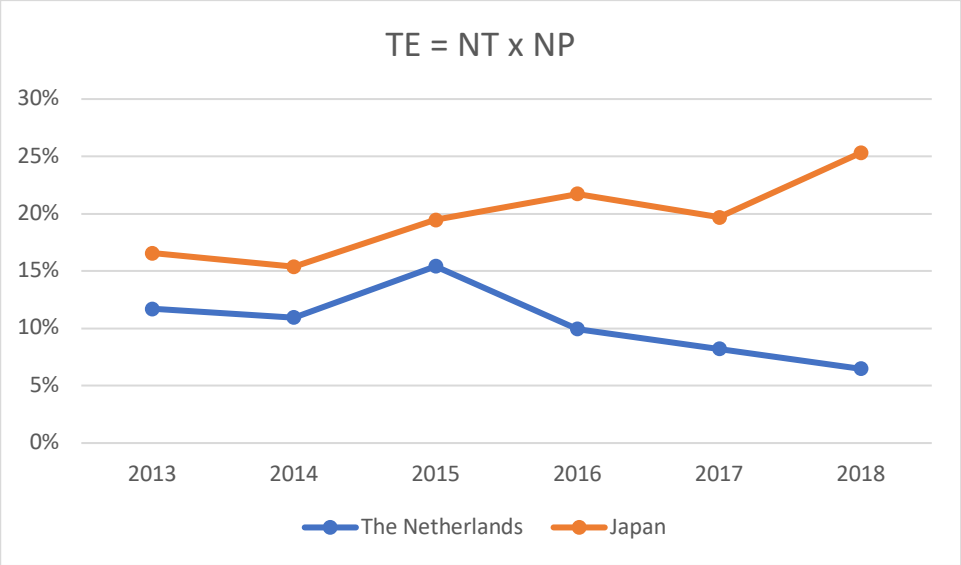


Figure 4.8 TE index as the product of Usage of New Technology and New Product

For the combination of NT and NP, Japan scores higher on TE than The Netherlands throughout the entire time-period, with averages of 19,69% for Japan and 10,45% for The Netherlands. The difference keeps increasing from 2016 onwards. On average, Japan has 2,1 times more TE than The Netherlands, with the smallest difference in 2015 at 1,26 times and the largest difference in 2018, at 3,91 times.

The following figure (4.9) displays TE as a product of *Usage of the Latest Technology, New Product* and *High Job Creation Expectation,* with the x-axis representing the time in years and the y-axis representing the percentage of TE within ME.

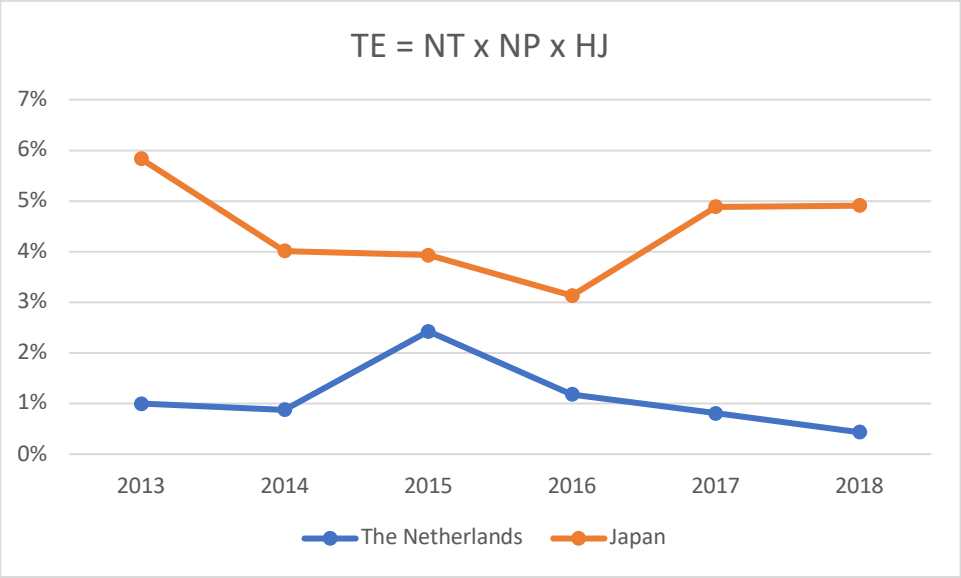


Figure 4.9 TE index as the product of Usage of New Technology, New Product and High Job Creation

For the combination of NT, NP and HJ, Japan scores higher on TE than The Netherlands throughout the entire time-period, with averages of 4,45% for Japan and 1,11% for The Netherlands. The difference decreases until 2015, after which it increases again. On average, Japan has 5,36 times more TE than The Netherlands, with the smallest difference in 2015 at 1,62 times and the largest difference in 2018, at 11,37 times.

The last figure in this section (4.10) shows the TE index as the product of *Usage of the Latest Technology, New Product*, *High Job Creation Expectation* and *New Market,* with the x-axis representing the time in years and the y-axis representing the percentage of TE within ME.

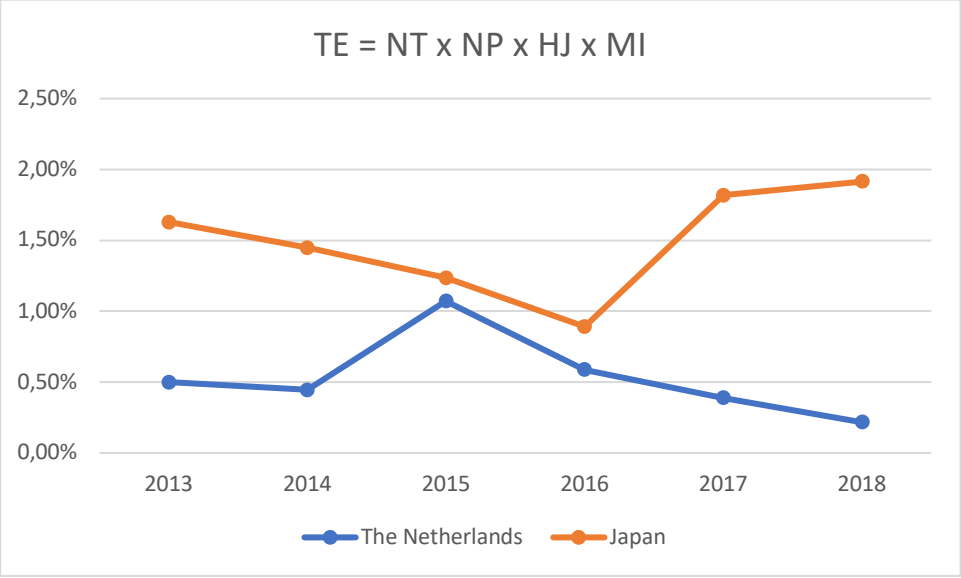


Figure 4.10 TE index as the product of Usage of New Technology, New Product, High Job Creation and New Market

For the combination of NT, NP, HJ and MI, Japan scores higher on TE than The Netherlands throughout the entire time-period, with averages of 1,49% for Japan and 0,53% for The Netherlands. The difference lessens until 2015, after which it increases again. On average, Japan has 3,78 times more TE than The

Netherlands, with the smallest difference in 2015 at 1,15 times and the largest difference in 2018, at 8,84 times.

Japan has a higher value for TE for every iteration of the TE index.

For all variations of the TE index Japan scores higher than The Netherlands. If the last variant with four elements most closely resembles the high-impact entrepreneurship as defined by Wong et al. (2005), by adding elements we are increasing the impact of the TE we are defining. Therefore, at every level of impact, Japan scores higher than The Netherlands concerning TE. The differences between The Netherlands and Japan are seemingly more dramatic as the level of impact increases, as well as over time, due to decreases of The Netherlands and increases of Japan.

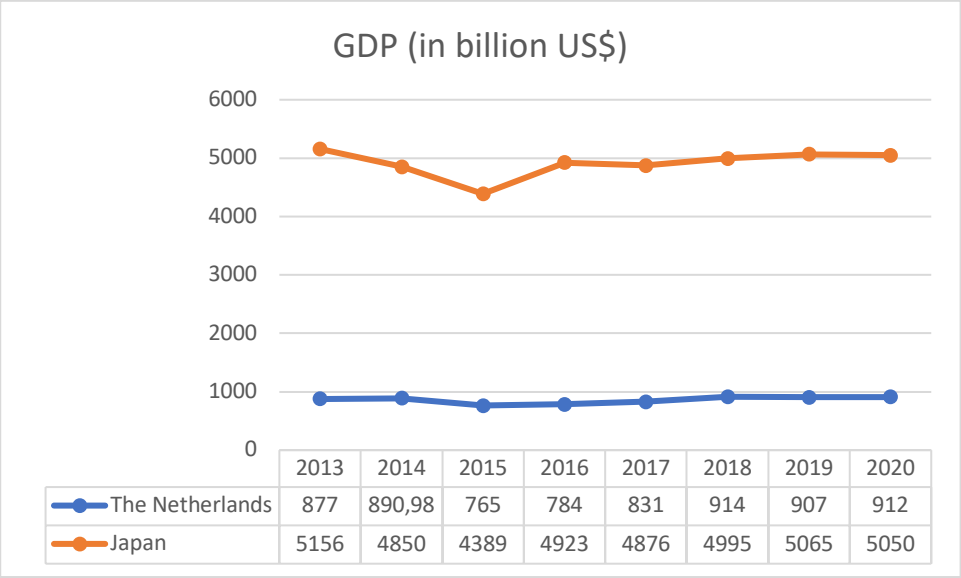
Additionally, the fact that Japan scores higher on every single iteration of the TE index, meaning that, whichever way you look at it, Japan scores higher on TE, indicates that this phenomenon was not due to the way in which the data was gathered. Therefore, we have a clear conclusion that Japan has indeed more TE than The Netherlands.

4.3 Influencing variables

To find what causes Japan to have more TE than The Netherlands, despite having less ME, this section will present the data for the influencing variables for ME and TE in the following order: *economic development, technological development, institutions, culture*, and lastly, *education*. The elements of these influencing variables will be used to draw conclusions on the overall influencing variable and find what variables, on a national level, influence ME differently than TE. Each subsection will discuss an influencing variable.

4.3.1 Economic Development

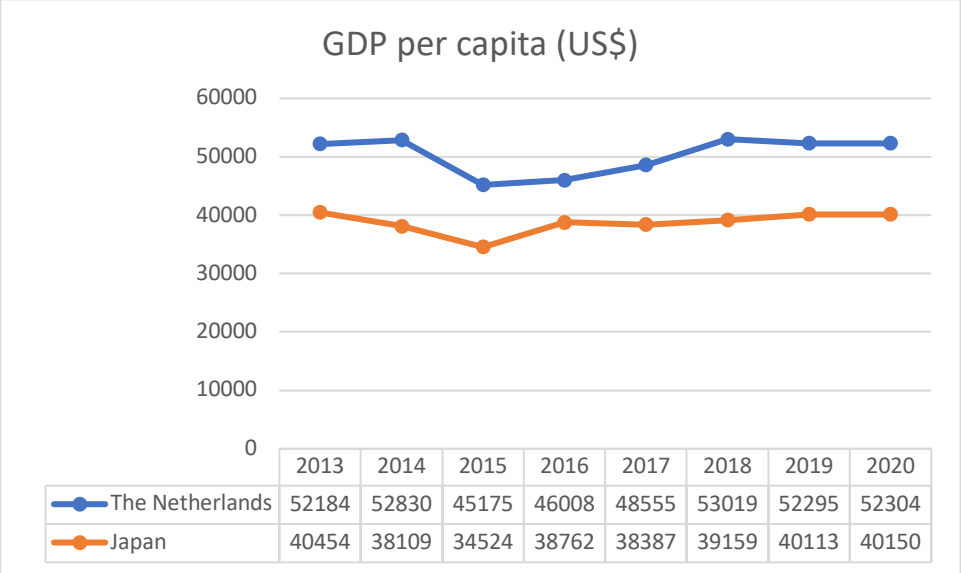
Economic development is measured in GDP, but because Japan is a much larger country than The Netherlands, GDP will be adjusted to GDP per capita, with data from the World Bank, supplemented with data from the IMF. Figure 4.11 shows the GDP in billion US$, with the y-axis representing the billion US$ amount, and the x-axis the time in years. Below the graph, the data is given in a table.



	2013	2014	2015	2016	2017	2018	2019	2020
The Netherlands	877	890,98	765	784	831	914	907	912
Japan	5156	4850	4389	4923	4876	4995	5065	5050

Figure 4.11 GDP in billion US$

Japan has 126,3 million inhabitants (2019), whereas The Netherlands has 17,28 million inhabitants (2019), meaning that Japan has 7,3 times the population of The Netherlands, therefore the GDP has to be adjusted to be able to make comparisons. This is done in figure 4.12, where the GDP is adjusted to GDP per capita. Again, the y-axis represents the US$ amount and the x-axis the time in years. Below the graphs, the data is displayed in a table.



	2013	2014	2015	2016	2017	2018	2019	2020
The Netherlands	52184	52830	45175	46008	48555	53019	52295	52304
Japan	40454	38109	34524	38762	38387	39159	40113	40150

Figure 4.12 GDP per capita in US$

The Netherlands' GDP per capita is, on average, US$11589 higher. Both countries seem to follow a similar trend throughout this time-period. The Netherlands shows a US$120 increase, and Japan a US$304 decrease, which is both very minimal. Both countries are designated as well-developed, high-income economies by the World Bank and IMF.

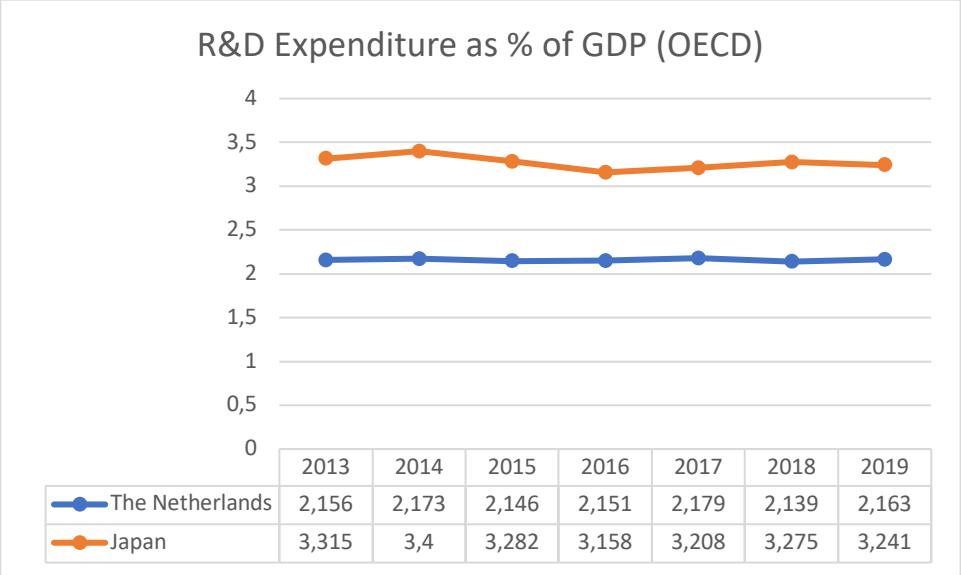
As economic development has a bit of an unclear relationship with ME, whether the countries are well developed or not does not seem to be of much importance. The point here is that the countries are

comparable in terms of economic development. For TE, this data indicates that both countries are good environments for TE. The difference between The Netherlands and Japan's Me and TE levels, is not found in *economic development*, and therefore does not seem to be a variable that influences TE differently than ME.

4.3.2 Technological Development

Technological development is measured through several elements: *the R&D expenditure as a percentage of GDP, the patents to GDP ratio, the number of broadband subscriptions (mobile and fixed) per 100 inhabitants* and *the R&D transfer*. As established in the previous chapters, this influencing variable is more TE specific, as ME can exist without technological development. Therefore, I expect to see more of an influence – meaning higher values for the elements of this influencing variable – in Japan, the country high on TE, compared to The Netherlands.

Figure 4.13 shows the R&D expenditure as a percentage of GDP, from the OECD. The y-axis represents the percentage of GDP and the x-axis the time in years. Below the graph, the data is shown in a table.



	2013	2014	2015	2016	2017	2018	2019
The Netherlands	2,156	2,173	2,146	2,151	2,179	2,139	2,163
Japan	3,315	3,4	3,282	3,158	3,208	3,275	3,241

Figure 4.13 R&D expenditure as a percentage of GDP

In this time-period, The Netherlands spends 2,16% of GDP on R&D on average, whereas Japan spends 3,27% of GDP on R&D. The global average for R&D spending is 2,2% according to the OECD data, meaning Japan's spending is far above the global average. Japan is the fifth highest ranked country in the world concerning R&D expenditure, behind Israel, Korea, Taiwan, and Sweden, respectively.

The *Patents to GDP* ratio is calculated using the GDP data from the World Bank and IMF and the *Triadic patents* data from the OECD (see appendix). Data for 2019 and 2020 is not available yet at the time of writing. Figure 4.14 shows this data in a graph, with the y-axis representing the *Patents/GDP ratio,* and the x-axis the time in years.

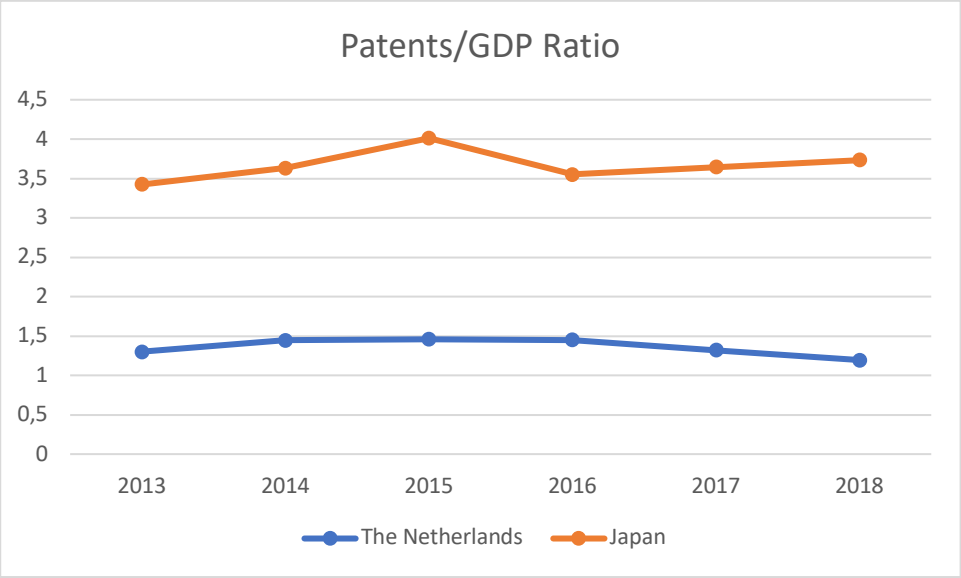
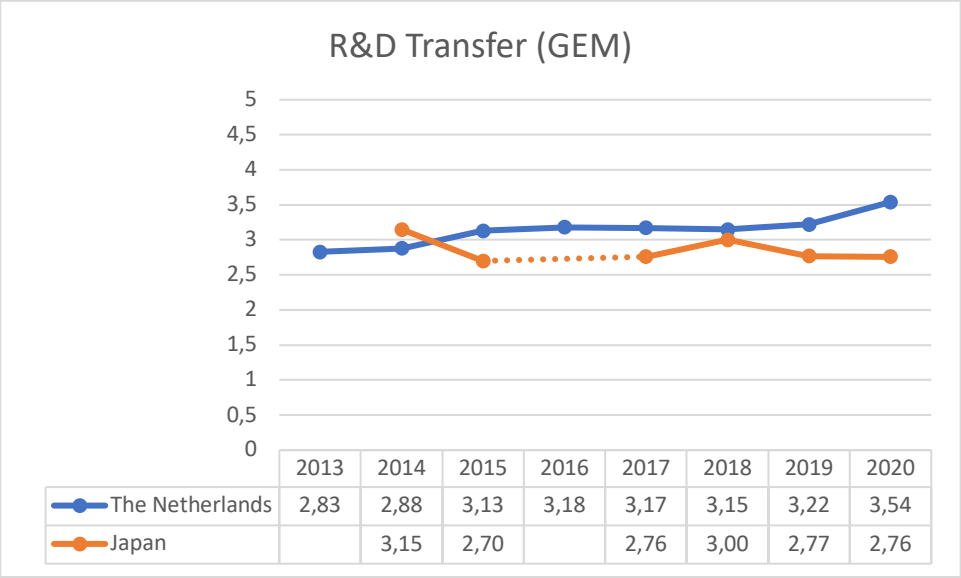


Figure 4.14 Patents to GDP ratio

The graph shows significant differences: at any point in this time-period, Japan has more than double the patents to GDP compared to The Netherlands, and in 2015 almost 3 times the number of patents to GDP. Japan shows an increase in this time-period of 0,31, whereas The Netherlands shows a decrease of 0,11. The fact that more innovations are patented in Japan possibly indicates that in Japan more innovations are created as well. Of course, not all innovations are patented, but this data shows that at least in this form of innovation, Japan scores much higher than The Netherlands.

As noted before, the Patents/GDP ratio in itself does not indicate whether start-ups benefit from the R&D present in the country, as all of the R&D could be private (e.g., within large corporations). GEM has established the *R&D transfer* index in their National Expert Survey (NES), to measure the opportunities for start-ups to capitalise on the R&D in a country. Like all indices in the NES, it is rated on a five-point scale by national entrepreneurship experts, with a score of five offering the most opportunities for entrepreneurs to capitalise on R&D in their country. The following graph (4.15) shows this data, with the y-axis representing the five-point scale and the x-axis the time in years. Below the graph the data is displayed in a table. Data for 2013 and 2016 is missing for Japan, as no NES was conducted.



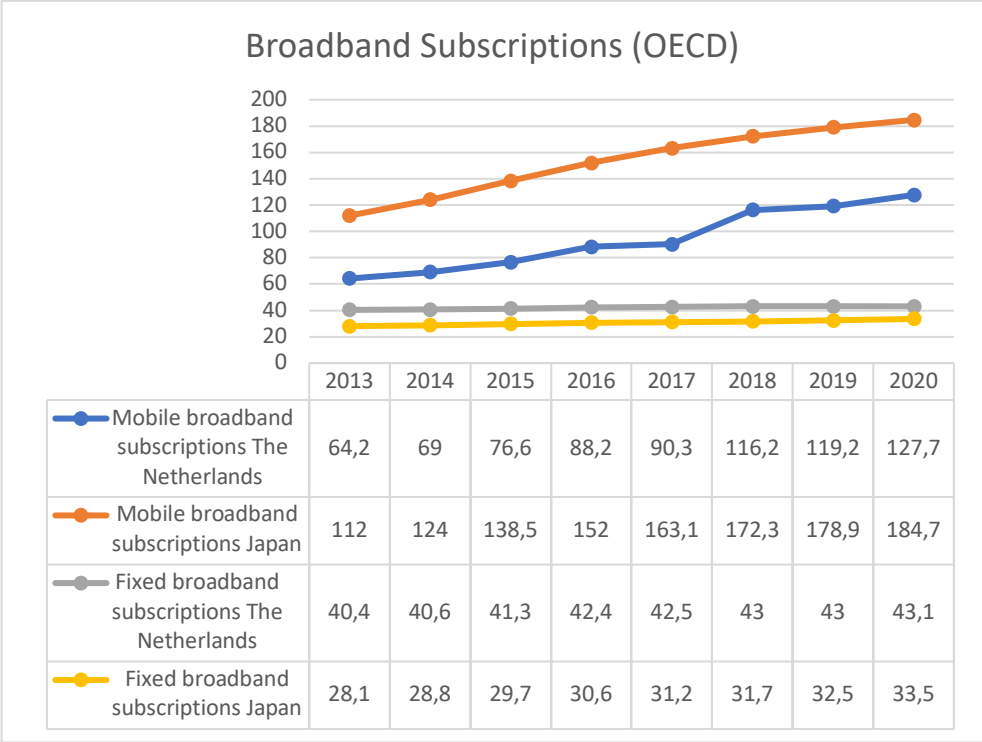
	2013	2014	2015	2016	2017	2018	2019	2020
The Netherlands	2,83	2,88	3,13	3,18	3,17	3,15	3,22	3,54
Japan		3,15	2,70		2,76	3,00	2,77	2,76

Figure 4.15 R&D Transfer. The dotted line indicates missing data.

The Netherlands is rated at 2,83 in 2013 and at 3,54 in 2020, showing an increase of 0,70 in this time-period. Its lowest point is the starting point, and the highest point is the endpoint. The R&D transfer in The Netherlands is 3,14 on average in this time-period. Japan is rated at 3,15 in 2014 and at 2,76 in 2020, showing a decrease of 0,29 in this time-period. The average R&D transfer in Japan is 2,86 in this time-period. The average difference in R&D transfer in this time-period is 0,39 (or, 7,80% if converted to percentages) and the difference between the average of the two countries is 0,28 (or, 5,62%).

The Netherlands has slightly better R&D transfer according to the GEM data. Thus, if R&D transfer is approximately the same in either country, you would expect that the environment in Japan is more conducive to TE because the Patents/GDP ratio in Japan is much higher, meaning that there are potentially more patents for technology entrepreneurs to capitalise on.

The following figure (4.16) displays the number of broadband subscriptions per 100 inhabitants, for both mobile and broadband, from the OECD dataset. The y-axis represents the number of broadband subscriptions and the x-axis the time in years. Below the graph, the data is displayed in a table.



	2013	2014	2015	2016	2017	2018	2019	2020
Mobile broadband subscriptions The Netherlands	64,2	69	76,6	88,2	90,3	116,2	119,2	127,7
Mobile broadband subscriptions Japan	112	124	138,5	152	163,1	172,3	178,9	184,7
Fixed broadband subscriptions The Netherlands	40,4	40,6	41,3	42,4	42,5	43	43	43,1
Fixed broadband subscriptions Japan	28,1	28,8	29,7	30,6	31,2	31,7	32,5	33,5

Figure 4.16 Number of broadband subscriptions per 100 inhabitants.

Both The Netherlands and Japan have more than 100% saturation from 2018 onwards, indicating that at least every person out of 100 has one mobile broadband subscription (or some people have triple subscriptions, and some have none). Mobile subscriptions are on the rise and fixed subscriptions have approximately remained the same in this time-period, which is not surprising as internet access has become increasingly more wireless.

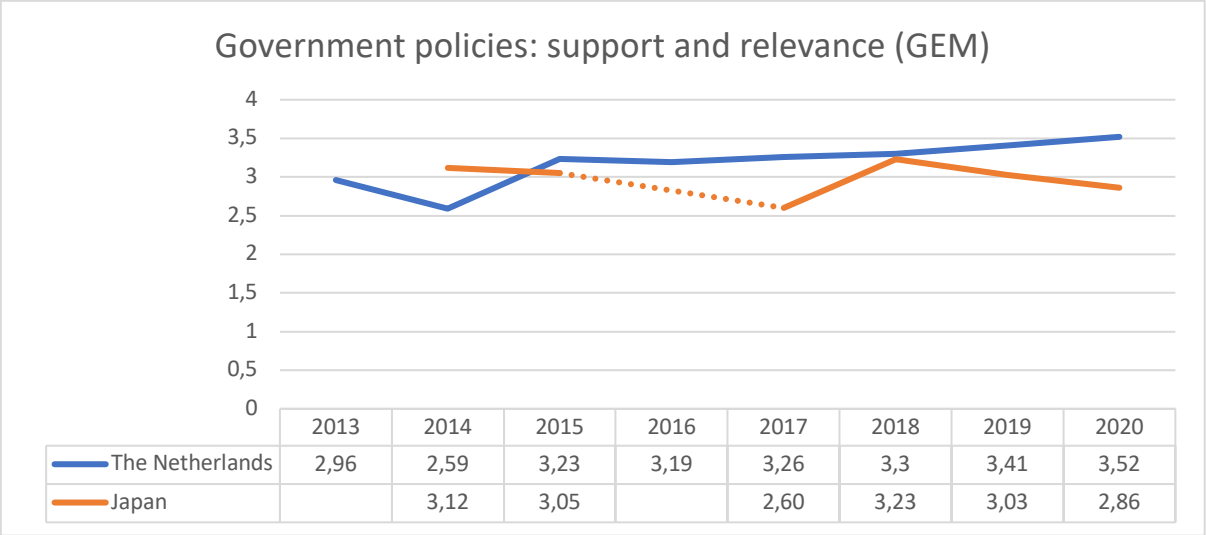
Interestingly, the country with the highest number of broadband subscriptions, Japan, does have the highest amount of TE, but whether having more than 100 broadband subscriptions per 100 inhabitants still improves the technological environment for TE is not clear from this data. It is not a conclusion I would be quick to draw, as I imagine the improvement from having a broadband subscription to having more broadband subscriptions is significantly less (or, perhaps zero), compared to the improvement from having no broadband subscriptions to having a broadband subscription. It could also be due to people having an extra broadband subscription for a work-phone or something similar, which might just be more prevalent in the business culture in Japan than in The Netherlands.

4.3.3 Institutions

The institutional variable is measured by several elements, namely *Government policies: support and relevance, Government policies: taxes and bureaucracy, Government entrepreneurship programmes* and *Commercial and legal infrastructure*, from the NES in the GEM dataset. These were all rated on a five-point scale by national entrepreneurship experts. Once again, Japan did not conduct a NES in 2013 and 2016.

Government policies: support and relevance

Figure 4.17 shows the data for *Government policies: support and relevance*, with the y-axis being the 5-point scale and the x-axis the time in years. Below the x axis, the table with the data is shown.



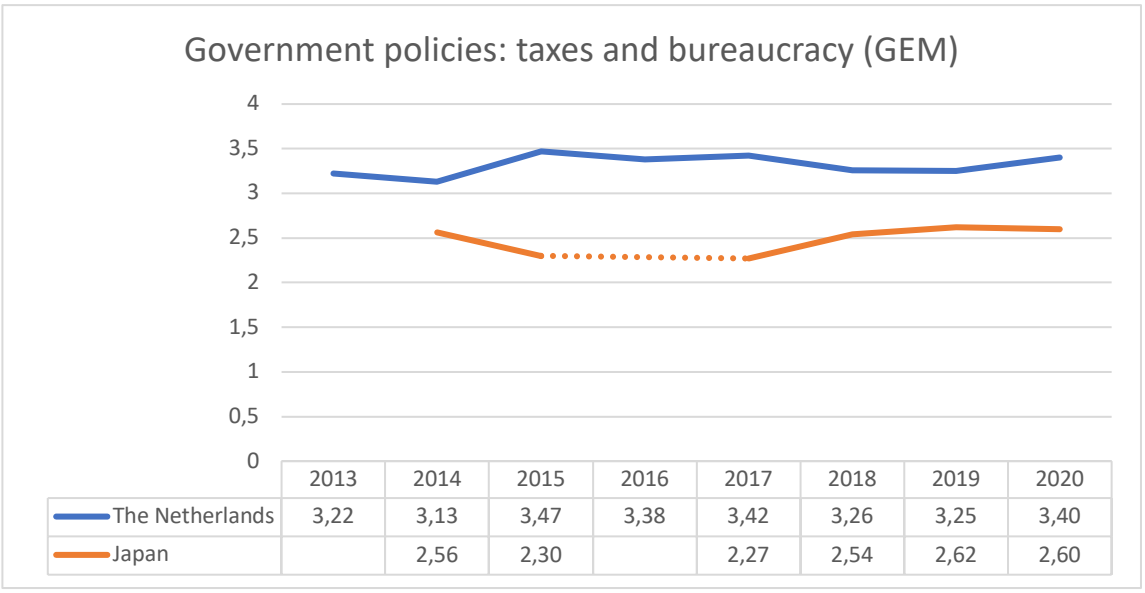
	2013	2014	2015	2016	2017	2018	2019	2020
The Netherlands	2,96	2,59	3,23	3,19	3,26	3,3	3,41	3,52
Japan		3,12	3,05		2,60	3,23	3,03	2,86

Figure 4.17 Government policies: support and relevance. The dotted line indicates missing data.

The Netherlands is rated at 2,96 in 2013 and at 3,52 in 2020, showing a total increase of 0,56 in this time-period. Its lowest point is in 2014, at 2,59, and its highest point is the endpoint. Japan is rated at 3,12 in 2014 and at 2,86 in 2020, showing a total decrease of 0,26 in this time-period. Its lowest point is 2,60 in 2017 and its highest point is 3,23 in 2018. The difference between the two countries is small, with the biggest difference being 0,66 and the smallest difference only 0,07. Concerning *government policies: support and relevance*, The Netherlands and Japan have similar environments.

Government policies: taxes and bureaucracy

Figure 4.18 shows the data for *Government policies: taxes and bureaucracy*, with the y-axis being the five-point scale and the x-axis the time in years. Below the x-axis, the table with the data is shown.



	2013	2014	2015	2016	2017	2018	2019	2020
The Netherlands	3,22	3,13	3,47	3,38	3,42	3,26	3,25	3,40
Japan		2,56	2,30		2,27	2,54	2,62	2,60

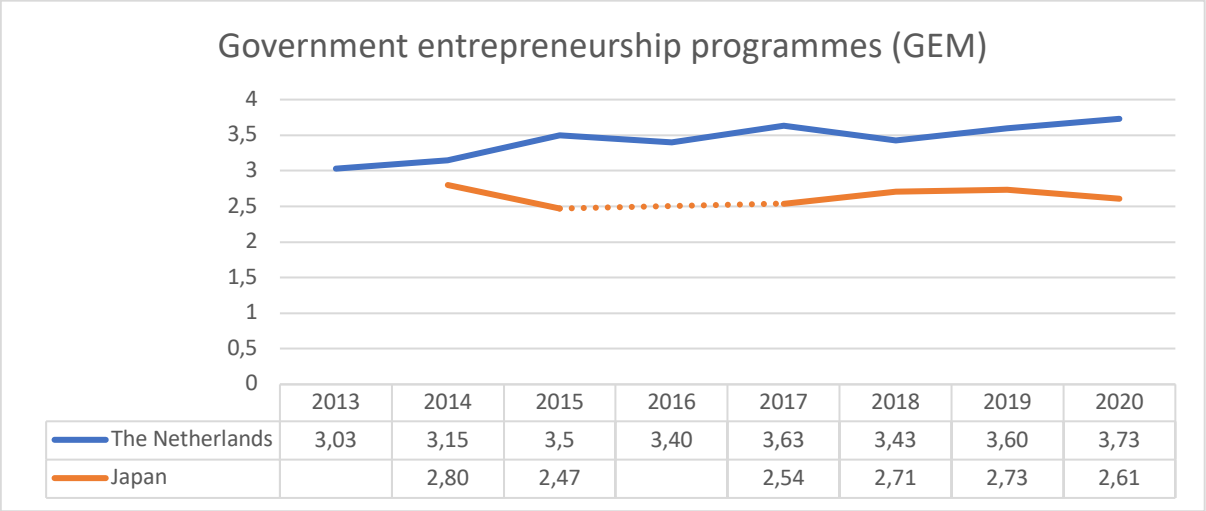
Figure 4.18 Government policies: taxes and bureaucracy. The dotted line indicates missing data.

The Netherlands is rated at 3,22 in 2013 and at 3,40 in 2020, showing a total increase of 0,18 in this time-period. Its lowest point is in 2014, at 3,13, and its highest point is in 2015, at 3,47. Japan is rated at 2,56 in 2014 and at 2,60 in 2020, showing a total increase of 0,04 in this time-period. Its lowest point

is 2,27 in 2017 and its highest point is 2,62 in 2018. The average difference between the two countries is 0,85 – or, 17% if converted to percentages - with the biggest difference being 1,17 (23,4%) in 2015, and the smallest difference 0,57 (11,4%) in 2014. Concerning *government policies: taxes and bureaucracy*, The Netherlands has a more conducive environment for ME and TE than Japan. This can be expressed, for example, through tax reduction for new firms and higher ease of incorporation.

Government entrepreneurship programmes

Figure 4.19 shows the data for *Government entrepreneurship programmes*, with the y-axis being the five-point scale and the x-axis the time in years. Below the x axis, the table with the data is shown.



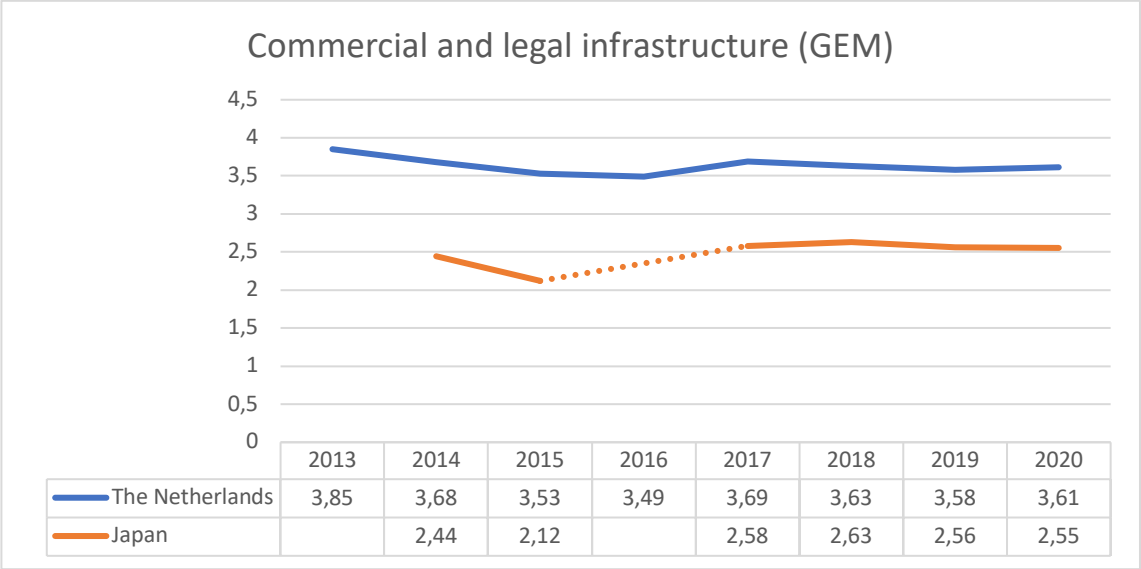
	2013	2014	2015	2016	2017	2018	2019	2020
The Netherlands	3,03	3,15	3,5	3,40	3,63	3,43	3,60	3,73
Japan		2,80	2,47		2,54	2,71	2,73	2,61

Figure 4.19 Government entrepreneurship programmes. The dotted line indicates missing data.

The Netherlands is rated at 3,03 in 2013 and at 3,73 in 2020, showing a total increase of 0,70 in this time-period. Its lowest point is the starting point, and its highest point is the endpoint. Japan is rated at 2,80 in 2014 and at 2,61 in 2020, showing a total increase of 0,19 in this time-period. Its lowest point is 2,47 in 2015 and its highest point is 2,71 in 2018. The average for The Netherlands and Japan is 3,43 and 2,64, respectively. The average difference between the two countries is 0,86 (or, 17,26% if converted to percentages) with the biggest difference being 1,12 (22,4%) in 2020 and the smallest difference 0,35 (7,00%) in 2014. Concerning *Government entrepreneurship programmes*, The Netherlands has a more conducive environment for ME and TE than Japan.

Commercial and legal infrastructure

Figure 4.20 shows the data for *Commercial and legal infrastructure*, with the y-axis being the five-point scale and the x-axis the time in years. Below the x axis, the table with the data is shown.



	2013	2014	2015	2016	2017	2018	2019	2020
The Netherlands	3,85	3,68	3,53	3,49	3,69	3,63	3,58	3,61
Japan		2,44	2,12		2,58	2,63	2,56	2,55

Figure 4.20 Commercial and legal infrastructure. The dotted line indicates missing data.

The Netherlands is rated at 3,85 in 2013 and at 3,61 in 2020, showing a total decrease of 0,24 in this time-period. Its lowest point is 3,49 in 2016, and its highest point is the starting point. Japan is rated at 2,44 in 2014 and at 2,55 in 2020, showing a total increase of 0,11 in this time-period. Its lowest point is 2,12 in 2015, and its highest point is 2,63 in 2018. The average for The Netherlands and Japan is 3,63 and 2,48, respectively. The average difference between the two countries is 1,14 – or, 22,8% if converted to percentages - with the biggest difference being 1,41 (28,2%) in 2014 and the smallest difference 1,00 (20%) in 2018. Concerning *Commercial and legal infrastructure*, The Netherlands has a more conducive environment for ME and TE than Japan.

Concluding remarks on institutions

Because both The Netherlands and Japan show only slight variations in this time-period, the average is taken to show a summary of this variable in figure 4.21. The centre of the figure represents the zero-point, and the outermost ring of the figure the maximum of the five-point scale, with a higher number indicating a more conducive environment for entrepreneurship.

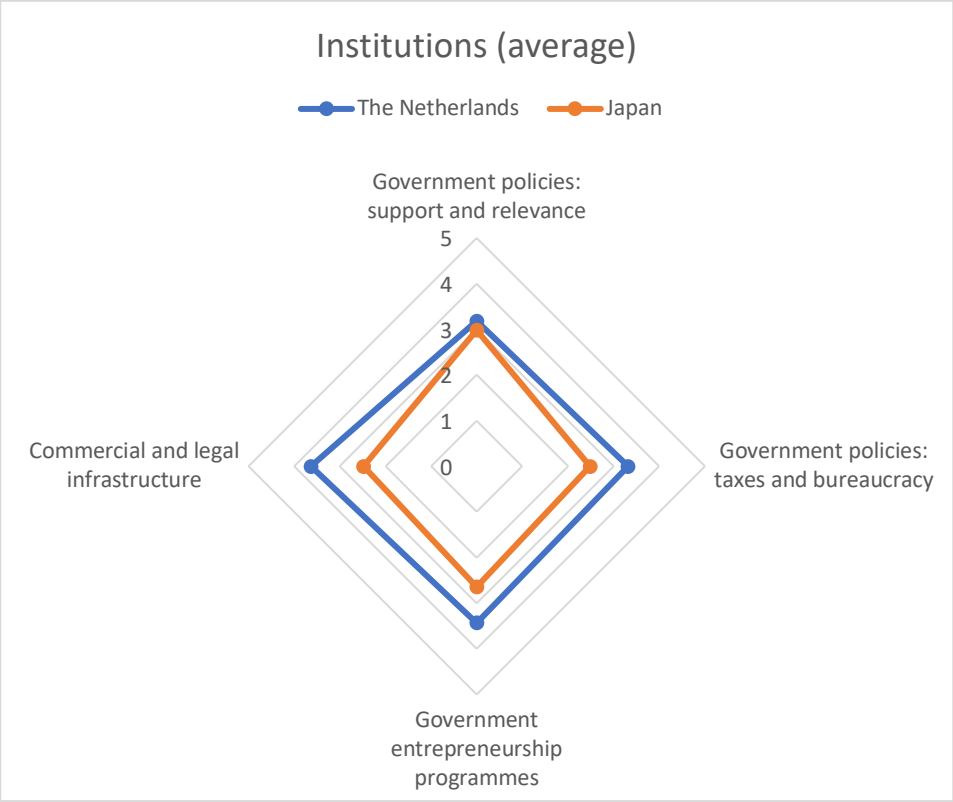


Figure 4.21 The average of the indexes of the institutional variable

The difference between The Netherlands and Japan for *Government policies: support and relevance, Government policies: taxes and bureaucracy, Government entrepreneurship programmes,* and *Commercial and legal infrastructure,* is 0,20 (4,01%), 0,83 (16,69%), 0,79 (15,81%), and 1,15 (23,05%), respectively. Except for *Government policies: support and relevance,* where both countries score similarly, The Netherlands has a more conducive institutional environment than Japan. This indicates that is easier to be an entrepreneur, both for ME and TE, in The Netherlands than in Japan from an institutional standpoint.

4.3.4 Culture

Culture is measured through the GEM's "Cultural and Social Norms" Entrepreneurial Framework Condition (EFC) from the NES, rated on a five-point scale by national entrepreneurship experts for conduciveness to entrepreneurship, as well as Hofstede's cultural dimensions.

Cultural and social norms (GEM)

Figure 4.22 shows the data from the GEM survey, with the y-axis being the five-point scale and the x-axis the time in years. Japan did not conduct the NES in 2013 and 2016.

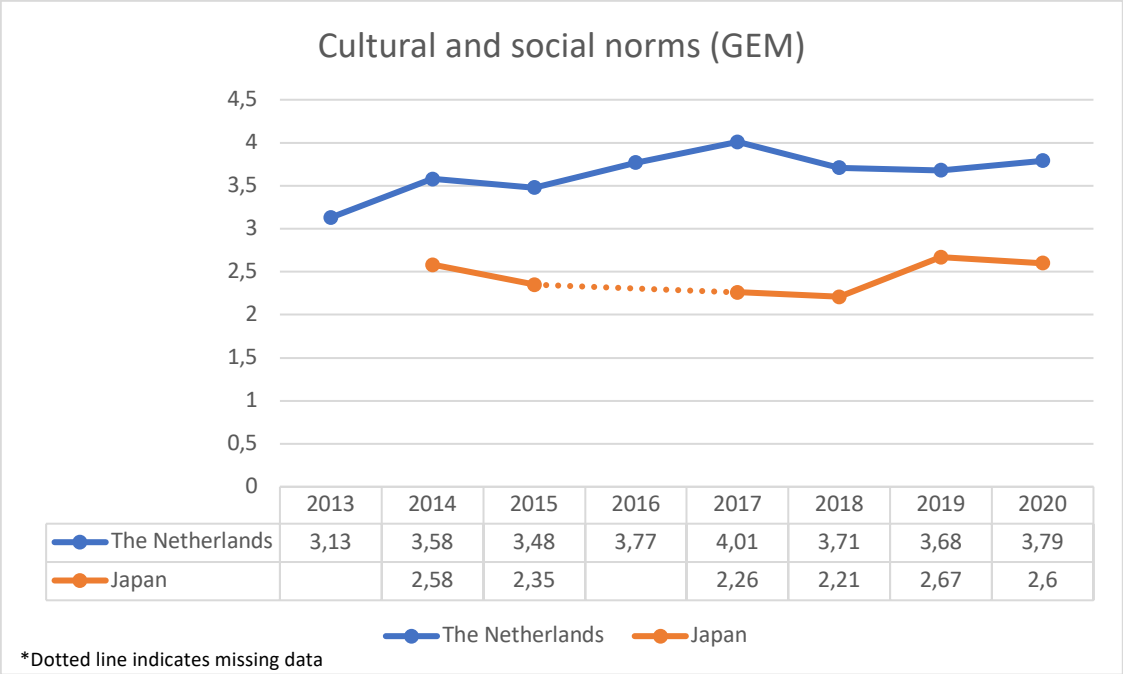


Figure 3.22 Conduciveness of Cultural and Social Norms to entrepreneurship according to the GEM data

The Netherlands was rated at 3,13 in 2013 and at 3,79 in 2020. The lowest point is the starting-point, and the highest point is 4,01 in 2017. The Netherlands shows an overall increase of 0,66 in this time-period. Japan was rated at 2,58 in 2014 and at 2,60 in 2020. Its lowest point is 2,21 in 2018 and its highest point is 2,67 in 2019. Japan shows an overall increase of 0,02 in this time-period.

According to the GEM data, the culture in The Netherlands therefore is much more conducive to entrepreneurship. The difference is at least 1,00 - or, 20% if converted to percentages - with the biggest difference being 1,75 (35%) in 2017.

Hofstede Cultural Dimensions

Table 4.2 shows the Hofstede Cultural Dimensions, which measures national culture on six dimensions. For the dimensions showing a contrast between two opposites, a higher score indicates a preference for the first opposite mentioned, e.g., a high score on the *Individualism – Collectivism* dimension indicates a national culture that favours *Individualism*.

Hofstede Cultural Dimensions	The Netherlands	Japan
Power Distance (PD)	38	54
Individualism – Collectivism (IC)	80	46
Masculinity – Femininity (MF)	14	95
Uncertainty Avoidance (UA)	53	92
Long-term – short-term orientation (LSO)	67	88

Indulgence – Restraint (IR)	68	42

Table 4.2 Hofstede Cultural Dimensions for The Netherlands and Japan

The following figure (4.23) shows the Hofstede Cultural Dimensions graphically, in a radar plot. The centre of the graph is 0 and the outermost ring represents a score of 100.

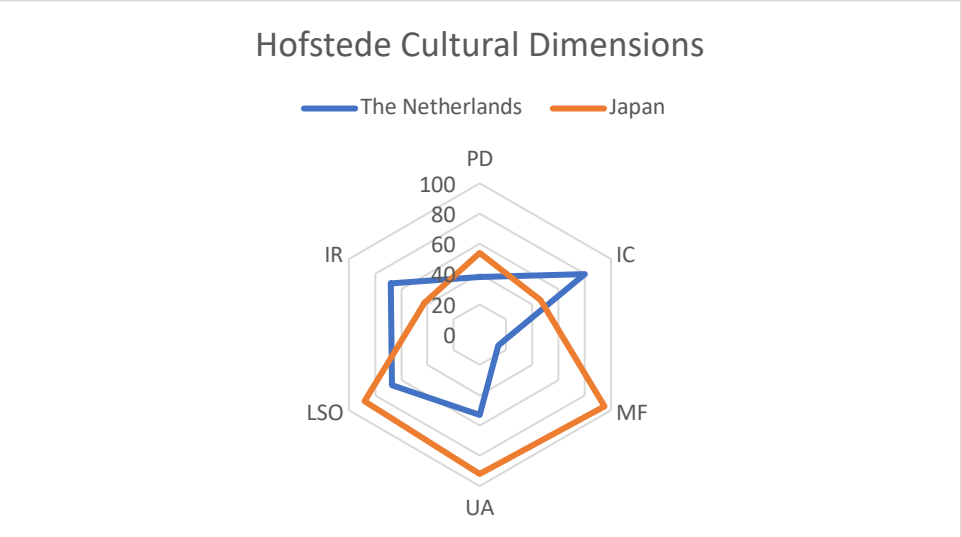


Figure 4.23 Hofstede Cultural Dimensions for The Netherlands and Japan

The Hofstede cultural dimensions show vastly different cultures between The Netherlands and Japan. The average difference between the scores of the two countries is 36 points, with the minimum difference at 16 and the maximum difference at 81. In line with Pinillo & Reyes' (2011) reasoning, who state that the IC dimension is most closely related to entrepreneurship, this graph shows that The Netherlands has a more entrepreneurial national culture than Japan, as the IC dimension is 34 points higher. Additionally, uncertainty avoidance is found to have a negative effect on entrepreneurship (Noorderhaven et al. (1999), Wennekers et al. (2002), which fits with the image for ME for Japan.

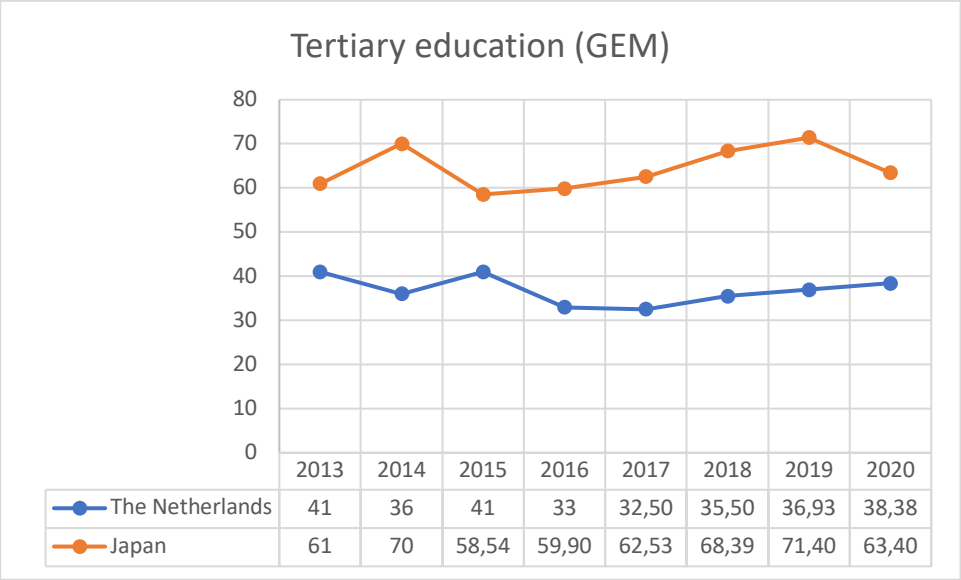
As such, both the GEM and Hofstede data give similar conclusions, namely that The Netherlands has a more conducive cultural environment to entrepreneurship.

4.3.5 Education

Education is measured by the *Tertiary Education* element from the APS in the GEM dataset, cross-checked with *Tertiary Education* from the OECD and the *Number of universities offering technology majors* from Times Higher Education.

Tertiary education

The following figure (4.24) shows tertiary education as measured by GEM in their APS, with the y-axis representing the percentage of the population engaging in entrepreneurship (ME and TE) with tertiary education, and the x-axis the time in years. Below the graph the data is shown in a table.



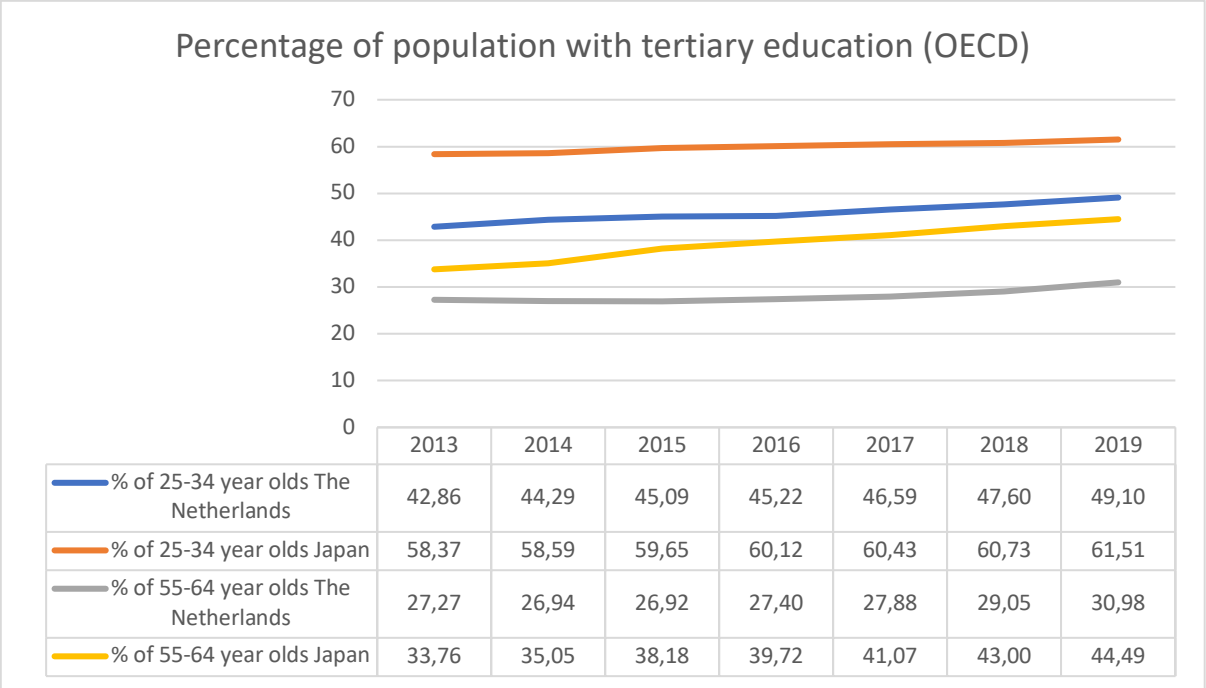
	2013	2014	2015	2016	2017	2018	2019	2020
The Netherlands	41	36	41	33	32,50	35,50	36,93	38,38
Japan	61	70	58,54	59,90	62,53	68,39	71,40	63,40

Figure 4.24 Percentage of those in ME that have at least tertiary education. Note: In 2014, the GEM dataset indicated 14% for The Netherlands. this was changed to 41%, as it was most likely a typographical error.

Tertiary education in The Netherlands starts at 41% in 2013 and ends at 38,38% in 2020, showing an overall decrease of 2,62% in this time-period. Its lowest point is 32,50% in 2017 and its highest point is 41%, in both 2013 and 2015. Tertiary education in Japan starts at 61% in 2013 and ends at 63,40% in 2020, showing a total increase of 2,40% in this time-period. Its lowest point is 58,54% in 2015 and its highest point is 71,40% in 2019. On average, in The Netherlands 36,79% of the population engaging in entrepreneurship has at least tertiary education, and 64,40% of the population engaging in entrepreneurship in Japan has at least tertiary education. The difference between The Netherlands and Japan is on average 27,61%.

A significantly larger amount of the population engaging in entrepreneurship in Japan has at least tertiary education, compared to those in The Netherlands. According to the GEM data, the educational environment in Japan is more conducive to TE than in The Netherlands.

OECD measured a similar variable, but for the entire population of both countries, not just those engaging in entrepreneurship. OECD measures two separate age groups, 25–34-year-olds, and 55–64-year-olds. OECD did not provide data on other age groups. The following figure (4.25) shows the percentage of the population with at least tertiary education, with the y-axis representing the percentage of the population, and the x-axis the time in years.



	2013	2014	2015	2016	2017	2018	2019
% of 25-34 year olds The Netherlands	42,86	44,29	45,09	45,22	46,59	47,60	49,10
% of 25-34 year olds Japan	58,37	58,59	59,65	60,12	60,43	60,73	61,51
% of 55-64 year olds The Netherlands	27,27	26,94	26,92	27,40	27,88	29,05	30,98
% of 55-64 year olds Japan	33,76	35,05	38,18	39,72	41,07	43,00	44,49

Figure 4.25 Percentage of the population with at least tertiary education

In this time-period, in The Netherlands, on average 45,82% of 25-34-year-olds and 28,10% of 55-64-year-olds have tertiary education. In Japan, the averages are 59,91% and 39,32%, respectively. The global average is 44,9% for the 25-34-year age group and 28,4% for the 55-64-year age group, meaning that The Netherlands scores just around the average, whereas Japan has a significantly higher number of people with tertiary education than the global average. For this index, Japan is ranked fourth highest in the world, behind Korea, Canada, and Russia, respectively. Japan has on average 14,10% more people with tertiary education than The Netherlands for the 25-34-year age group. For the 55-64-year age group, Japan has 11,26% more people with tertiary education on.

Both age groups, in both countries, show an increase over this time-period. The difference between the 25-34-year age group between the two countries decreases and the difference between the 55-64-year age group increases.

As concluded earlier in this thesis, tertiary education is conducive to TE, meaning that, according to this data, Japan has a more conducive educational environment for TE than The Netherlands. Thus, both the GEM and OECD data lead to a similar conclusion.

Universities offering technology majors

Not all forms of education are as conducive to TE, therefore this final element is added. This last element measures the number of universities offering technology majors in both countries. As those engaging in TE benefit from a high level of technological education, the higher this index, the better the environment for TE should be. In combination with higher levels of overall tertiary education, this would strongly indicate a better educational environment for TE. The data is found in the Times Higher Education ranking, by counting the number of universities in each country offering technology majors. The following figure (4.26) displays this data in a bar chart, with the y-axis representing the number of universities offering technology majors.

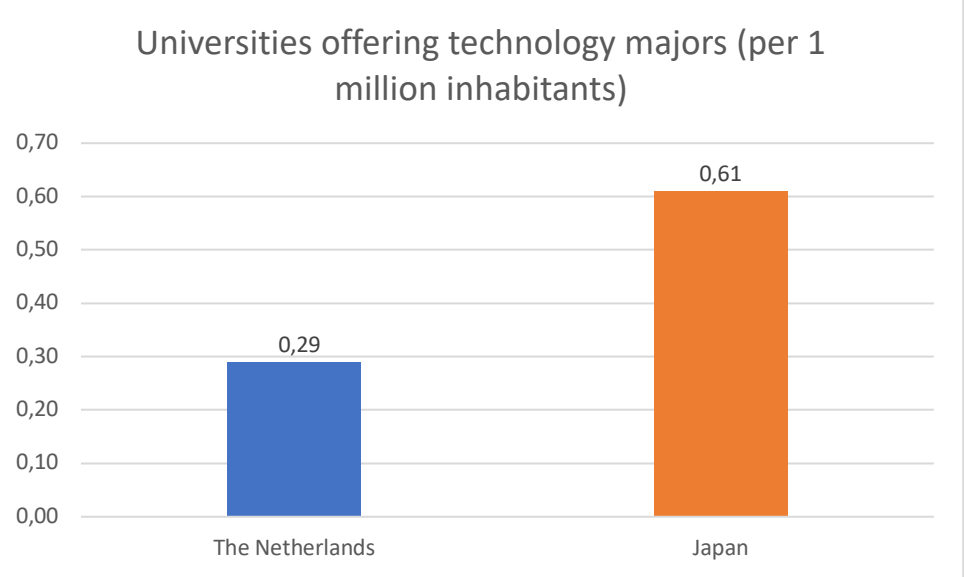


Figure 4.26 Number of universities offering technology majors per 1 million inhabitants

Japan has more than twice the amount universities offering technology majors than The Netherlands. Because technological education is beneficial to the level of TE in a country, Japan has a major advantage concerning this variable.

Concluding remarks on education

Concerning education, the advantage for Japan is amplified when the elements *tertiary education* and *universities offering technology majors* are taken together. In Japan, not only a larger percentage of the population has had tertiary education, but the percentage of those that have studied a technology major is also likely much higher than in The Netherlands. This results in more human capital available for TE, and therefore the potential for TE, from an educational standpoint, is much higher in Japan than in The Netherlands.

4.4 Chapter conclusion

This chapter covered the main research question of this master thesis "What variables, on a national level, affect technology entrepreneurship differently than mainstream entrepreneurship?". First ME and TE were measured both in The Netherlands and Japan. What was stated at the start of this thesis was confirmed in this chapter, that The Netherlands scores higher on ME than Japan, and significantly so, having on average double the amount of ME between 2013 and 2020. As there is no single index for TE, TE was measured by using several combinations of four elements, namely *Usage of New Technology, New Product, High job Creation, and New Market.* For all variations of the TE index Japan scores higher than The Netherlands, giving a clear conclusion that Japan indeed has more TE than The Netherlands. Next, the influencing variables were measured and analysed, which gave interesting results. It showed that The Netherlands scores higher on the variables that affect both ME and TE, but for the TE specific variables, Japan scores much higher.

Economic development is approximately the same in both countries, and they are both designated as high income, well-developed economies. A well-developed economy is conducive to TE, meaning that concerning *economic development*, both countries are equally conducive to TE. Japan scores significantly higher on the *technological development* variable, spending significantly more on *R&D as a percentage of GDP* than The Netherlands and having at least double the *Patents/GDP ratio* between 2013 and 2020. *R&D transfer*, as measured by GEM, is approximately equal for both countries, but because of the significantly higher *Patents/GDP ratio*, meaning there are much more patents available for exploitation, there is much more opportunity for TE in Japan than in The Netherlands. The Netherlands shows a better and more supportive *institutional environment* for entrepreneurship (ME and TE) than Japan. The Netherlands has a more conducive cultural environment for ME, as rated by the GEM data and Hofstede cultural dimensions. Specifically, the *Individualism – Collectivism* index, which is significantly related to entrepreneurship, is 34 points higher in The Netherlands than in Japan, indicating a much more entrepreneurial national culture. Lastly, Japan scores higher on the TE-specific educational variable, as the percentage of the population with tertiary education is significantly higher in Japan compared to The Netherlands, as shown by both the GEM and OECD data. Furthermore, Japan has more than double the number of universities offering technology majors per 1 million inhabitants than The Netherlands indicating a much a higher chance of people gaining technical education, which is conducive to TE.

In conclusion, The Netherlands scores higher on the variables that affect both ME and TE, but Japan scores significantly higher for the TE-specific variables. Thus, the greater amount of TE in Japan can be explained through these results, that despite having lower values for influencing variables traditionally associated with ME, higher levels of TE-specific influencing variables, namely *technological development* and *education* leads to a higher level of TE. The figure on the next page (4.27) summarizes this chapter graphically, showing the difference between influencing variables of The Netherlands and Japan by ratio, with The Netherlands set at 100% and Japan as a multiple of that.

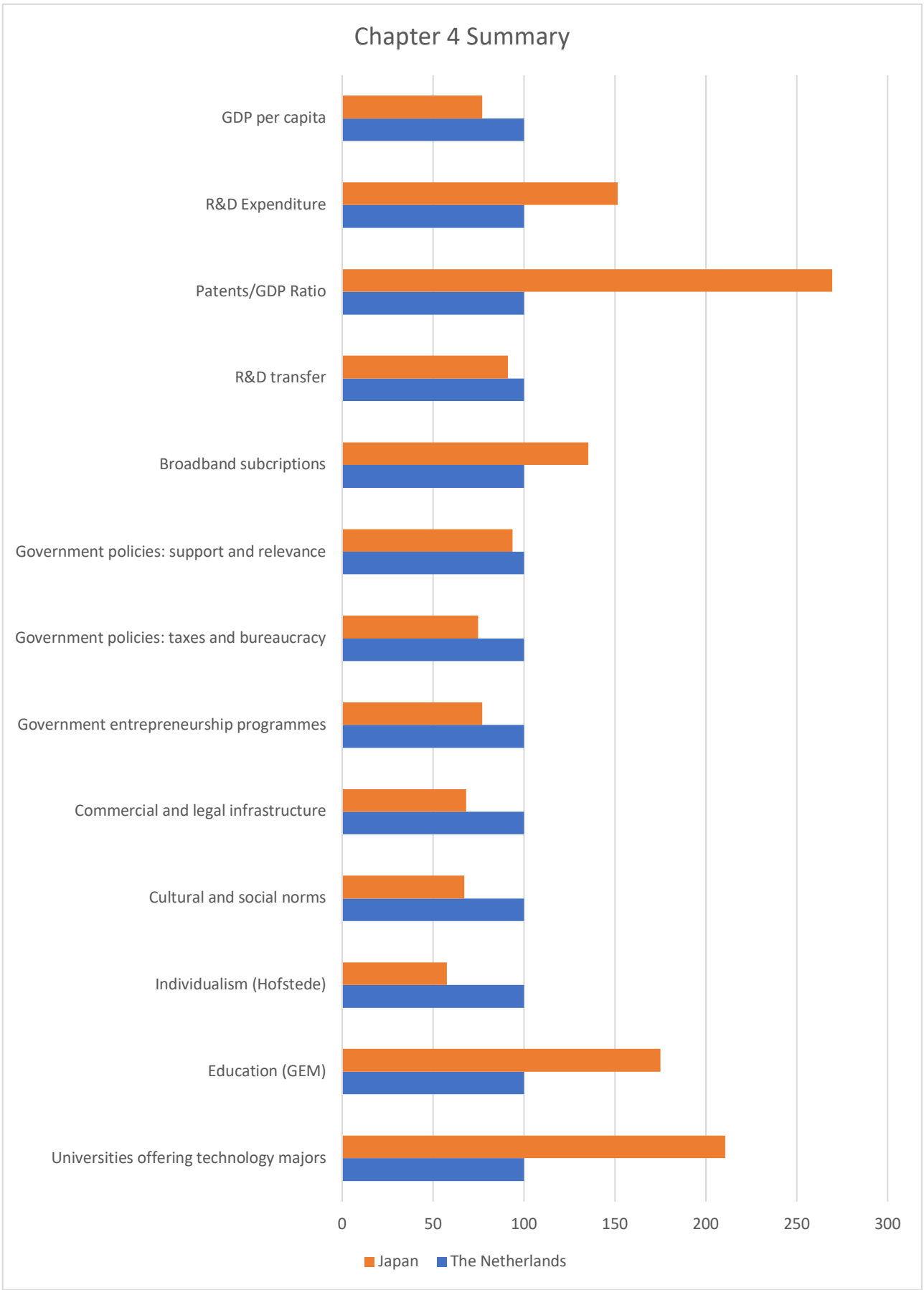
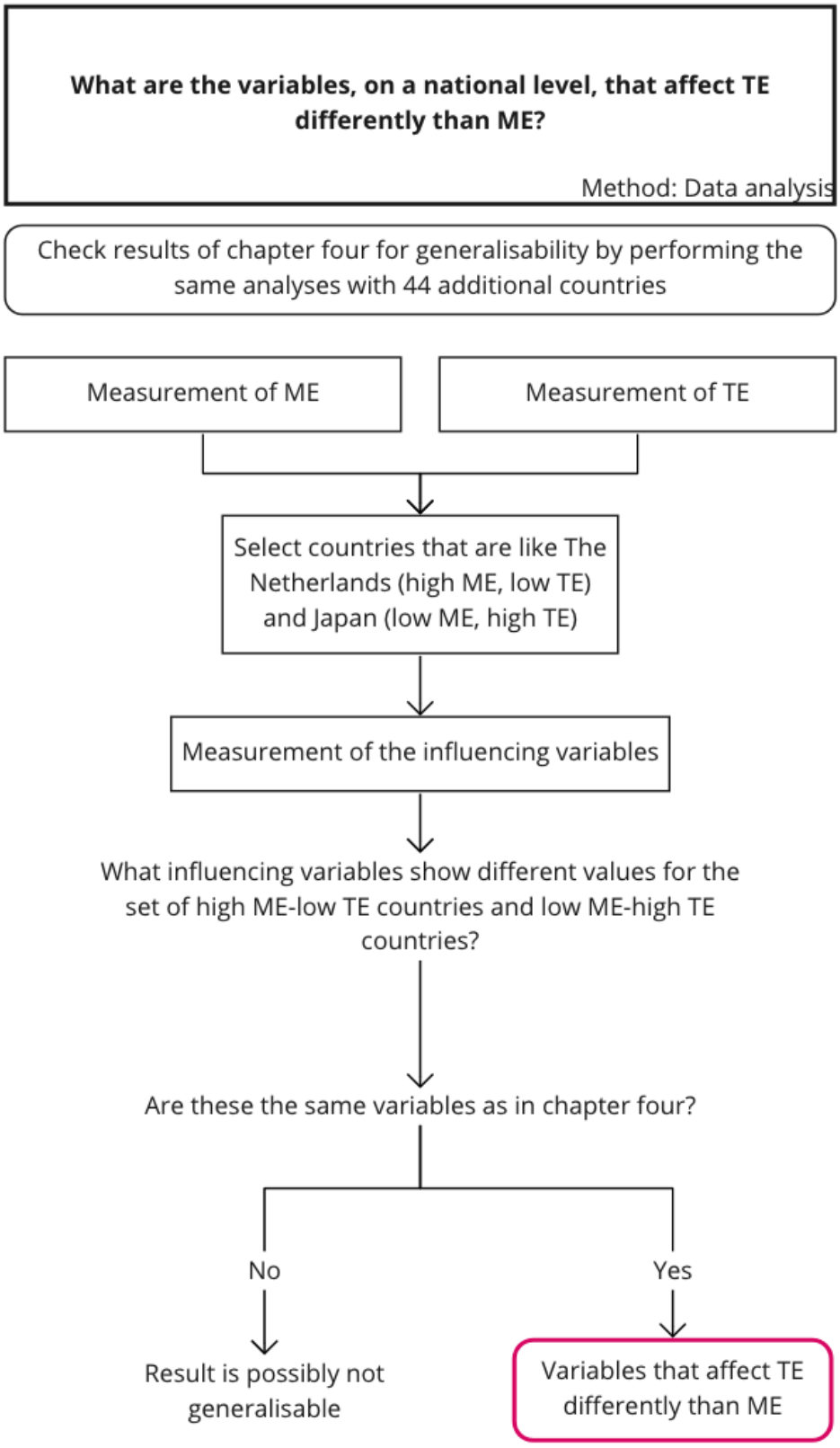


Figure 4.27 Chapter 4 summary

Chapter 5: Generalisability



5 | GENERALISABILITY

The previous chapter demonstrated that The Netherlands has much higher levels of mainstream entrepreneurship (ME). However, Japan is much better at technology entrepreneurship (TE), whichever way TE was defined. This difference is also reflected in the influencing variables, where Japan scores significantly higher on TE specific variables, namely *technological development* and *education.* For non-TE specific influencing variables, namely *culture* and *institutions*, either the Netherlands scores higher or the countries score similarly. Additionally, the Netherlands scores higher on *economic development.*

The goal of this chapter is to move towards generalisability, building on the conclusions from chapter four, and add gravity to the existing conclusions where possible. This is done by looking at an additional sample of countries and explore whether the combination of high TE/low ME and low TE/high ME is an exception only found in the example of Japan and The Netherlands, or whether this is a common phenomenon. This analysis could give three possible outcomes:

1. The low ME/high TE and high ME/low TE categories contain only The Netherlands and Japan. Therefore, The Netherlands and Japan are exceptions to the normal combinations of low ME/low TE and high ME/high TE. This would indicate that ME and TE similar and correlated, as ME and TE move together.
2. The low ME/high TE and high ME/low TE categories contain, in addition to Japan and The Netherlands, many other countries, indicating that Japan and the Netherlands are not exceptions, and combinations of low ME/high TE and high ME/low TE are common. This indicates that ME and TE are two different things, as they move independently. Additionally, this points to ME and TE being influenced by different, or differently by, influencing variables. If they were not, they would move in similar directions and a certain pattern would emerge.
3. Most countries fall in the low ME/high TE and high ME/low TE categories. This would indicate that low ME/high TE and high ME/low TE would be the norm, possibly hinting to a negative correlation between ME and TE.

Whichever the outcome, the next step is to investigate the influencing variables, to see if some explanation for the differing values ME and TE values can be found. The same influencing variables explored in chapter four will be used.

5.1 ME AND TE LEVELS OF ADDITIONAL COUNTRIES

This section will discuss the results obtained from the analysis of the data of the additional countries. From the Global Entrepreneurship Monitor (GEM) dataset a list of 50 additional countries was obtained. A complete description of selection criteria, the list of countries and data transformations can be found in the appendix. After removing the outliers, 46 countries remained (including The Netherlands and Japan). The ME values were available from the GEM dataset and the TE value was calculated as the product of *Usage of new technology, New product, High job creation* and the *New market.* The countries are plotted in figure 5.1, with the x-axis representing the percentage of the population in a country engaged in ME and the y-axis the percentage of the population in a country engaged in TE. The chart is divided into four quadrants, from left to right and top to bottom, low ME/high TE (Q1), high ME/high

TE (Q2), low ME/low TE (Q3) and high ME/low TE (Q4), with the limits set at the average of the ME and TE values of the sample.

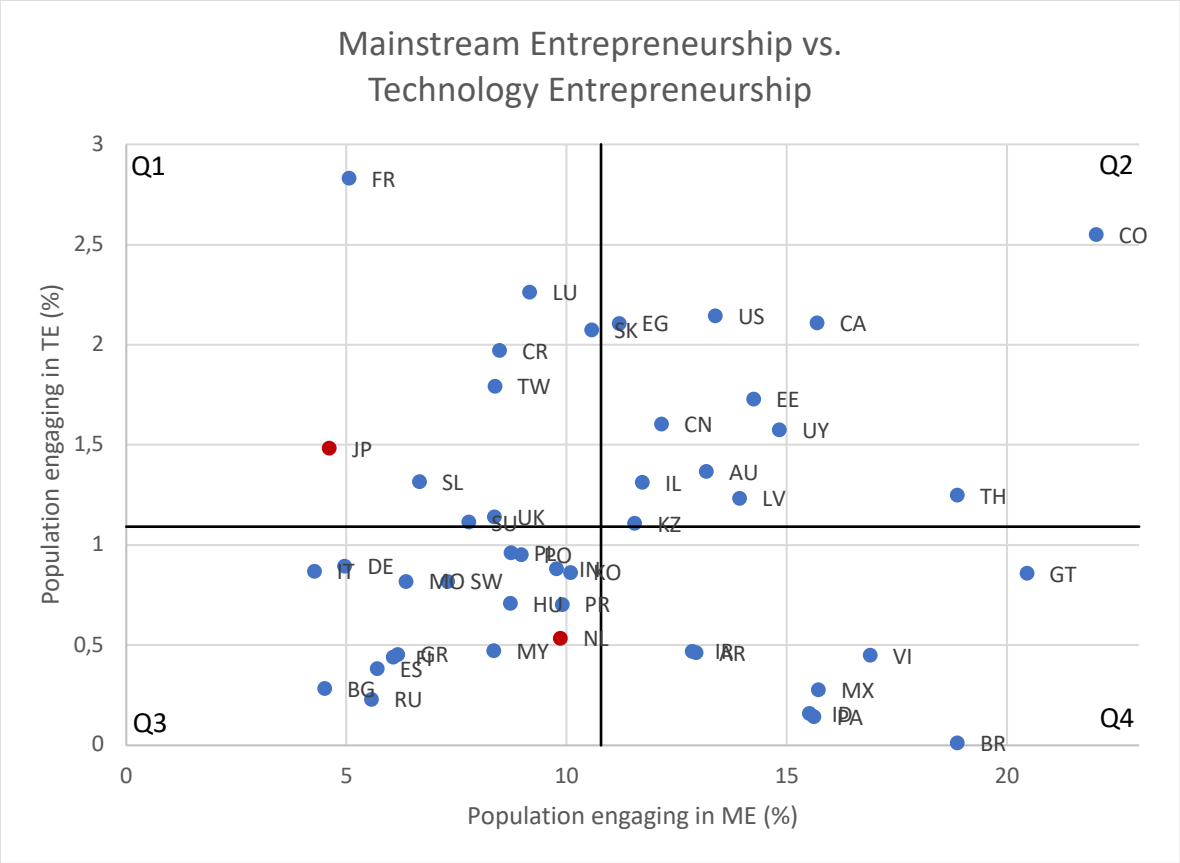


Figure 5.1 ME/TE scatterplot

The chart shows that Japan falls well within Q1 and, unexpectedly, The Netherlands is on the far right of Q3, adjacent to Q4. Until now, The Netherlands has been treated as being high on ME and low on TE. However, in context, the Netherlands is low on both ME and TE.

This chart also immediately shows that both the low ME/high TE and high TE/low ME combinations are not exceptions, but a common phenomenon. The combination is rarer however, than either low ME/low TE and high ME/high TE. Of the 46 countries, 9 are in Q1, 12 are in Q2, 17 are in Q3, and 8 are in Q4. It is therefore most common to be a country that is low on both ME and TE.

The combination of high ME-low TE and low ME-high TE are not exceptions only found with The Netherlands and Japan, but a common phenomenon

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Preliminary observations of the quadrants show that in Q1 (low ME/high TE), every country is a high-income economy (based on GDP per capita) according to the World Bank. Q2 (high ME/high TE) is rather more mixed, with China and the USA, the countries with the highest GDP in the world, as well as some countries with lower GDPs. Q3 (low ME/low TE) is mixed as well, with 7 countries being high-income economies, and 5 lower-income economies according to the World Bank. It could be that these are economies at a "comfortable" level, where there is no real need to engage in ME, but conditions are

not good enough for high TE levels. Other reasons, such as cultural or technological reasons are also possibilities. Q4 (high ME/low TE) mostly consist of low-income economies or developing countries. The fact that ME is high in these countries is consistent with what has been established in this thesis, that lack of opportunity leads to higher levels of ME. However, an environment conducive to TE is also absent in these countries. A possible explanation could be a lack of education, which could push people towards ME, and hinders people from engaging in TE. It is then not too surprising to find The Netherlands in Q3 among the countries with low ME and low TE, as it is neither a low-income economy nor a developing country.

As Technology Entrepreneurship and Mainstream Entrepreneurship move independently, they are different and uncorrelated. They must therefore be influenced by different variables, or influenced differently by the same variables.

The chart shows that ME and TE are very different things, as ME and TE move independently, and all possible combinations are possible. Therefore, the influencing variables for ME and TE must be different. To confirm this distinction and to add weight to the conclusion that ME and TE must be subject to the influence of different variables, the correlation is calculated (the complete description is found in the appendix). The calculated correlation coefficient of 0,071 between Mainstream Entrepreneurship and Technology Entrepreneurship, along with a corresponding p-value of 0,6396. These values indicate that there is very little correlation between ME and TE and whatever correlation is found is, with a high degree of certainty, likely not there. We can therefore confidently conclude that ME and TE are uncorrelated.

5.2 Analysis of the influencing variables

Now that it is established that ME and TE are uncorrelated and different phenomena, this section will seek an explanation for the differences between Q1 (low ME/high TE) and Q4 (high ME/low TE) by looking at the influencing variables, as was done in chapter four with The Netherlands and Japan. The same influencing variables will be analysed, namely, *economic development*, *technological development, institutions, education*, and *culture*. The data used for the comparisons is the average value of the influencing variables of the quadrants between 2013 and 2018. Because the aim of this section is to highlight the differences between the quadrants, the data has been transformed to show ratios, rather than absolute values. In practice, this means that the Q4 values served as benchmark, having been set to 1, with the Q1 values converted to a multiple of the Q4 value. Furthermore, this approach helps to abbreviate the chapter, as multiple variables in different units can be visualised in the same chart.

Chapter four has shown that *technological development* and *education* influence TE differently than ME, I therefore expect to see the same here, with Q1 showing higher values for the elements of these influencing variables. In contrast to the previous chapter, I expect to see a difference here in the *economic development* variable, as Q1 is filled with high-income economies and Q4 is filled with low-income economies, whereas Japan and The Netherlands were comparable in terms of GDP per capita. As for *institutions*, The Netherlands was shown to have a better institutional environment, which would correspond with Q4 showing higher values here. As for *culture*, the comparison between Q1 and Q4

could show interesting results and perhaps shed light on what the cultural profile of a country with low ME/high TE and high ME/low TE looks like. In line with chapter four, the countries high on ME (Q4) should show higher levels of *individualism.*

5.2.1 Economic development & Technological development

The following chart shows influencing variables for both economic and technological development, measured through the elements *GDP per capita, R&D expenditure, mobile broadband subscriptions, fixed broadband subscriptions,* and *R&D transfer*. Because *GDP per capita* is the only element for *economic development*, the choice was made to combine this with the elements for *technological development*. Q4 is set at 1, and the values of Q4 are plotted as a multiple of the Q1 values.

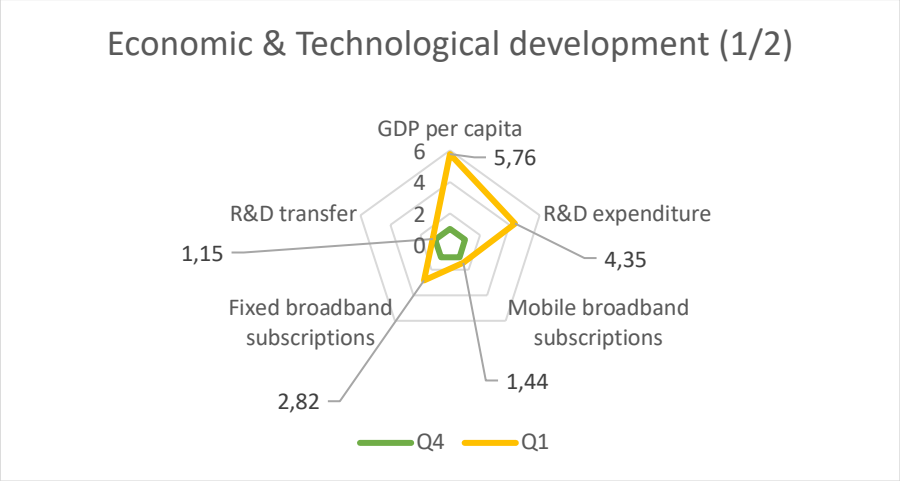

Figure 5.2 Economic and Technological development

The chart shows stark differences for *GDP per capita* and *R&D expenditure*, with Q1 having 5,76 times and 4,35 times the amount of Q4, respectively. Q1 has 2,82 times the amount of *fixed broadband subscriptions* of Q4, and 1,44 times the *mobile broadband subscriptions*. Q1 only shows slightly more *R&D transfer* than Q1.

In contrast to the comparison in the previous chapter, where the Netherlands had higher GDP per capita than Japan, this clearly shows that, on average, countries in Q1, with high levels of TE, have a higher GDP per capita than countries in Q4, with low levels of TE. Therefore, countries with a higher GDP per capita have higher levels of TE, which consistent with the literature, leads to the conclusion that a high GDP per capita is conducive to TE. The results from the previous chapter can be explained by both the Netherlands and Japan being high income countries, and therefore a difference was not visible.

Countries in Q1, clearly have higher *R&D expenditure* than those in Q4. Once again, this is consistent with the literature, as well as the findings in the previous chapter, where Japan consistently had higher *R&D expenditure* than the Netherlands.

Important to note is that for seven out of eight countries in Q4, data on the number of *broadband subscriptions* was not available. I would assume that it is significantly lower than in Q1 countries, but due to the missing data conclusions cannot be reasonably drawn.

The following chart shows the average ratio of *Patents/GDP* for the countries in Q1 and Q4, respectively. Once again, the values of Q1 are plotted as a multiple of the values of Q4, with Q1 set at 1.

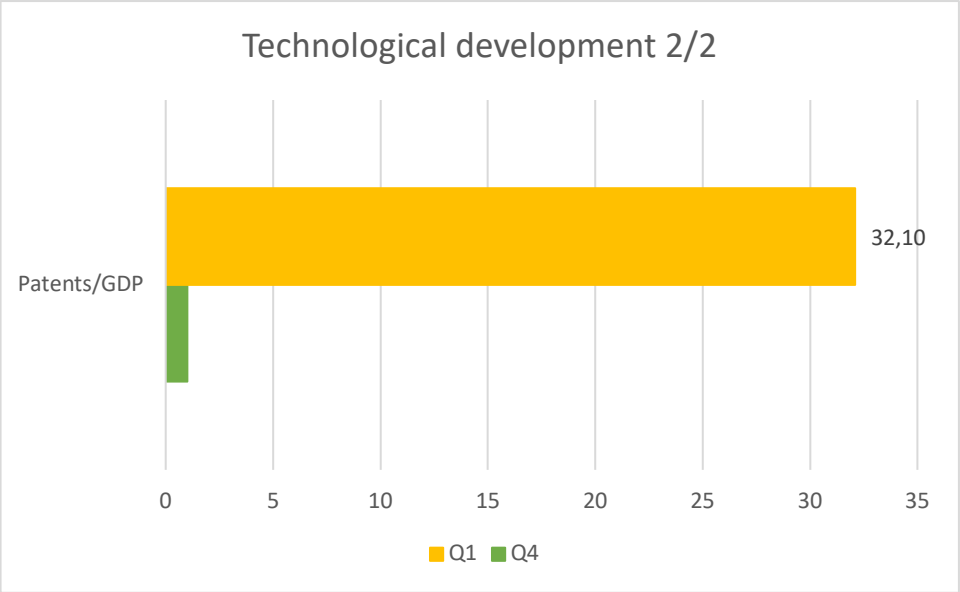

Figure 5.3 Patents/GDP ratio

The chart shows that Q1 has a tremendous 32,10 times the *Patents/GDP* of Q4. This is likely a major contributor to the difference between TE levels, as in Q1 countries, there is opportunity to capitalise on many more patents floating around in the country than in Q4, and thus more opportunity for TE. Interestingly, *R&D transfer* is not that much higher in Q1 compared to Q4, but due to the very large difference in *Patents/GDP* there is much more opportunity for TE in Q1 than in Q4, thus reasonably a contributor to the higher levels of TE.

Therefore, Q1 has a better *economic development* and *technological development,* which both are conducive to TE.

5.2.2 INSTITUTIONS

The following chart shows the influencing variable *Institutions*. This consists of the elements *Government policies: support and relevance, Government policies: taxes and bureaucracy, Government entrepreneurship programmes,* and *Commercial and legal infrastructure*. Once again, the values of Q1 are plotted as a multiple of the values of Q4, with Q1 set at 1.

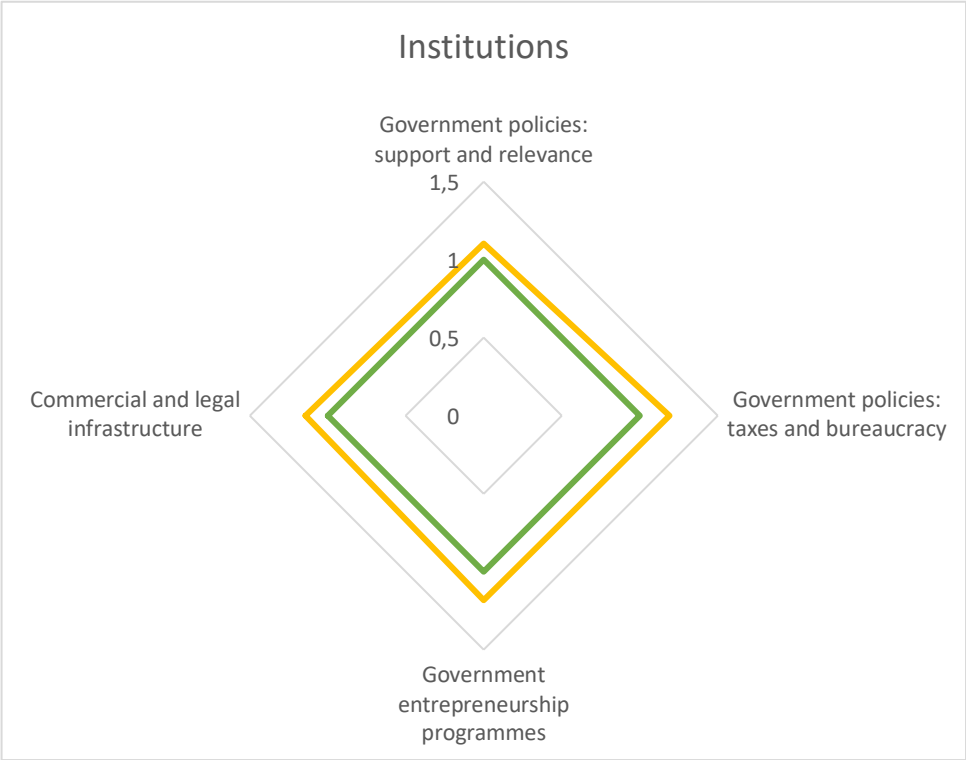

Figure 5.4 Institutions

There is only a small difference between the elements of *institutions* of Q1 and Q4, with the maximum difference being 1,19. Overall, Q1 has a slightly better institutional environment for entrepreneurship than Q4.

This contrasts with the previous chapter, which showed The Netherlands, the country high on ME, to have a better institutional environment than Japan, the country low on ME. I would have expected to see higher values for *institutions* for Q4 than Q1, as a better institutional environment would expectedly lead to more ME. However, comparing this data to The Netherlands and Japan (see appendix) revealed that The Netherlands has higher values for this influencing variable than both Q1 and Q4, and Japan has lower values for this influencing variable than both Q1 and Q4. In context, The Netherlands and Japan are perhaps more exceptions than the norm, and a generalisable conclusion is rather drawn from the results of this chapter.

As Q1 only scores slightly better than Q4, a clear conclusion on *institutions* being more of an influence on TE seems improbable. Perhaps *institutions* is as influential on both ME and TE, which would be consistent with the literature, or *institutions* is not as influential as previously thought.

5.2.3 Education & Culture

The following chart shows the influencing variables *education* and *culture*, measured through the elements *tertiary education* (from the GEM dataset), *universities offering technology majors,* and *cultural and social norms.* Q4 is set at 1 and the values of Q1 are a multiple of Q4.

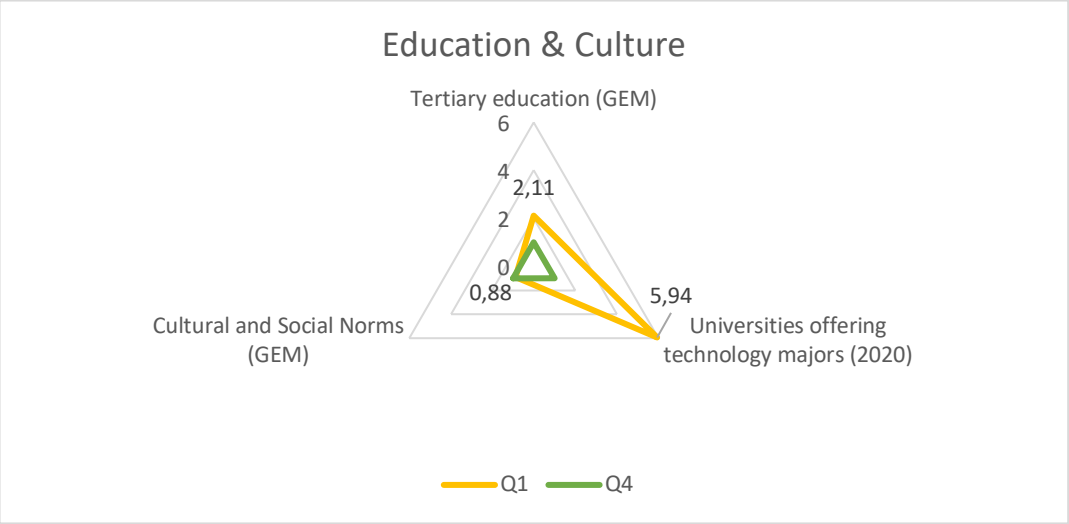

Figure 5.5 Education & Culture

Countries in Q1 have, on average, a little more than double (2,11) the percentage of the population with tertiary education of those in Q4. Countries in Q1 have almost six times (5,94) more *universities offering technology majors per 1 million inhabitants* than countries in Q4, showing a considerable difference.

This is consistent with the literature and the results from chapter four. In fact, the difference is even larger in this comparison than between The Netherlands and Japan. The results clearly show *education* to be a determining factor for the TE levels in a country and an influencing variable that affects TE differently than ME.

Countries in Q1, at 0,88, have slightly worse *cultural and social norms* for entrepreneurship according to the GEM data, which is also consistent with the findings in chapter four. The second chart for culture displays the Hofstede cultural dimensions. This chart also shows the values of Q1 as a multiple of Q4, as in the other charts.

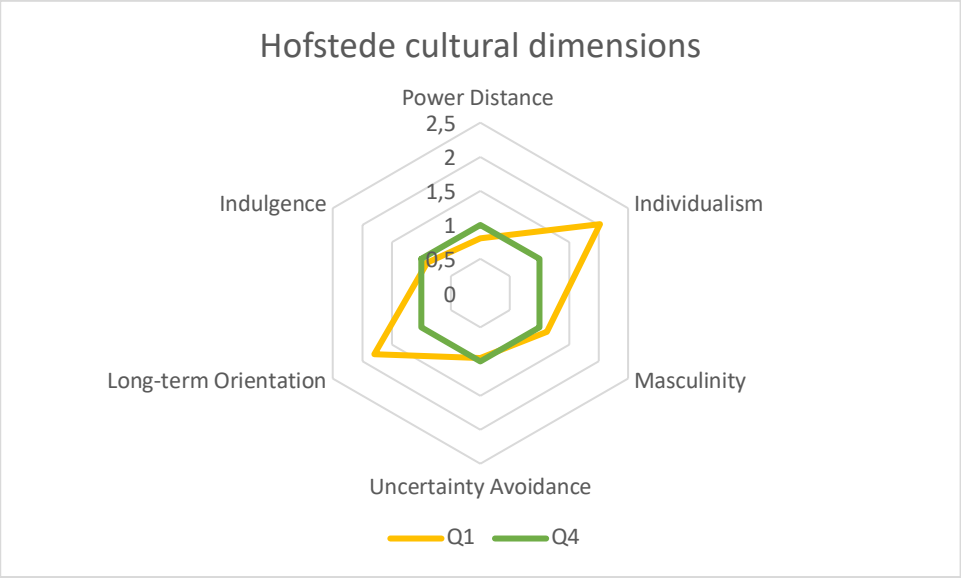

Figure 5.6 Hofstede cultural dimensions

Q1 scores slightly lower for *Power Distance, Indulgence,* and *Uncertainty Avoidance* than Q4. Countries in Q1 have about double the *Long-term orientation* (1,80) and *Individualism* (2,02) of those in Q4. This contrasts with what Pinillo & Reyes (2011) found, stating that high *individualism* is most strongly correlated to entrepreneurial orientation. Following their conclusion, the data should have shown higher *Individualism* scores for countries high on ME, in this case Q4. However, this data shows the opposite and would steer more to a conclusion of *Individualism* being a strong indicator for TE, rather than all forms of entrepreneurship. Previously unexplored, *Long-term Orientation* also seems to be an indicator for higher TE.

A possible explanation for the *individualism* values could be that because the countries in Q4 are more low-income countries, entrepreneurship is driven by a need to provide, rather than to distinguish oneself. In high income countries where there is no such need, TE can then indeed be a form of expression to separate oneself from the rest. A similar explanation for *long-term orientation* could be as follows: countries with low *long-term orientation* could be more concerned in providing for the next day, whereas countries with high *long-term orientation* are keener to engage in TE as it concerns more long-term endeavours and future innovations.

5.3 Chapter conclusion

This chapter reviewed the results of chapter four for generalisability by performing the same analysis on 44 additional countries. The results have shown that The Netherlands and Japan are not exceptions to the rule, but that the combination of having low ME and high TE, or high ME and low TE, is a common phenomenon. The ME/TE scatterplot showed countries in all four quadrants. This indicates that ME and TE are different, uncorrelated things, which was confirmed by correlation coefficient and corresponding p-value. After that, the influencing variables used in chapter four were explored for Q1 and Q4. The reason why countries low on ME can be high on TE can be ascribed to better *economic, technological*, and *educational environments*, and are therefore the influencing variables that influence TE differently than ME.

Some elements of these influencing variables presented themselves as determining factors, showing clear differences in the values for Q1 and Q4. For *economic development*, this was the case for *GDP per capita*, with the results leading to the conclusion that a higher GDP per capita is more conducive to TE. *Technological development* is also shown to be an important influencing variable, particularly the elements *R&D expenditure* and *Patents/GDP*. These elements showed the largest differences between Q1 and Q4, with Q1 having four times the amount of *R&D expenditure* and 32 times the *Patents/GDP* of Q4. Additionally, Q1 most likely has higher broadband subscriptions, possibly indicating better ICT infrastructure. The educational environment is shown to be a major influencer, with countries high on TE having twice the percentage of population with *tertiary education* of those low on TE and six times the number of *universities offering technology majors*. The institutional variable showed little difference between Q1 and Q4, with Q4 having a slightly worse institutional environment. Q1 had slightly worse social and cultural norms than Q4 according to the GEM data. Additionally, a surprising finding was in the Hofstede Cultural Dimensions, which showed Q1 having twice the amount of *long-term orientation* and *individualism* of Q4, possibly indicating cultural precursors for a conducive TE environment.

6 | CONCLUSION & DISCUSSION

The final chapter of this master thesis will synthesize the findings and present the answers to the research- and sub-research questions. In response to the findings of this thesis, the scientific discussion will discuss the scientific contribution, shortcomings and possible improvements of this research. This section will feature insights from an interview with Prof.Dr.ir. Shinichiro Haruyama, professor at the Graduate School of System Design and Management of Keio University, Tokyo Japan. Next, the managerial and policy recommendations section will discuss the practical implications and contributions of this thesis. In addition to the insights from Prof.Dr.ir. Haruyama, this section will also feature interviews with Dr.ir. Bert Enserink and Dr.ir. Els van Daalen, two policy experts from the faculty of Technology, Policy and Management of Delft University of Technology, who give their perspective on the possible implications of this research. Finally, the future research section will cover possible avenues for research that could either improve or add onto the results of this master thesis.

6.1 ANSWER TO THE RESEARCH QUESTIONS

This section will present the answers to the questions posed at the start of this master thesis. First the three sub-questions that guided the research will be answered, after which the main research question will be answered.

6.1.1 WHAT IS TE AND WHAT ARE ITS DIFFERENCES WITH ME?

There is no consensus on the definition of neither ME nor TE. This thesis has defined ME as "the activity of exploiting an opportunity for financial gain by starting a business, with the potential to be an instrument for change and wider economic growth", which encompasses all forms of entrepreneurship, including TE. TE is defined as a subset of ME, "a complex multi-actor phenomenon that is intricately linked to scientific and technological change, and the exploitation thereof." TE being a multi-actor phenomenon must be emphasised, as the very nature of TE requires collaboration, because technological change is collaborative, and the technological path is shaped by the actors that interact with it. As such, the relationship between TE, actors and technological change is complex and interdependent. It is precisely this interdependence on technological change through which TE differentiates itself from ME. In context of historical entrepreneurship theories, this thesis has concluded that ME falls within Kirznerian entrepreneurship and TE within Schumpeterian entrepreneurship. Schumpeterian entrepreneurship is characterized as being a catalyst for change, high impact, (technologically) innovative and rare, which is consistent with the definition and nature of TE. Kirznerian entrepreneurship is defined as more common and low impact, which excludes TE, and therefore ME is treated as reflective of Kirznerian entrepreneurship.

ME is defined as "the activity of exploiting an opportunity for financial gain by starting a business, with the potential to be an instrument for change and wider economic growth." TE, a subset of ME, is defined as "a complex multi-actor phenomenon that is intricately linked to scientific and technological change, and the exploitation thereof."

6.1.2 On a national level, what variables influence ME and TE?

On a national level, it was chosen to focus only on new firms exclusively, rather than including incumbent firms as well. For TE, this specifically refers to New Technology-Based Firms (NTBF). This master thesis has found five variables that influence ME and TE, namely *economic development, technological development, institutions, culture,* and *education.* This set of influencing variables was first found for ME, after which their applicability for TE was subsequently verified. The variables were found to have a relationship with ME, however this was often not the same relationship as with ME.

6.1.3 How can I measure TE on a national level in contrast to ME, as well as the influencing variables?

For ME, the Global Entrepreneurship Monitor (GEM) dataset was chosen to provide national measures of ME through their Total Entrepreneurial Activity (TEA) index, which measures the percentage of the population (18-64 years old) engaged in entrepreneurship, as it is the most widely used dataset in cross-country analysis for entrepreneurship and considers the multi-level nature of ME, consistent with the descriptions discussed in the literature research.

As for TE, there is no single indicator measuring TE available. This thesis has constructed a TE index through a best-fit approach, based on the nature of TE and the work of previous authors found through literature research. For true TE to exist, at its core it must include (i) the usage of new technology. The extension of that is (ii) new products. Further research into the nature of TE indicates that the rare subset of TE that has true economic impact also results in (iii) the creation of new jobs and (iv) new markets. These four indicators were available in the GEM dataset and were used, in different combinations, as filters to construct a measure for TE from the TEA index used for ME.

The influencing variables themselves are difficult to measure and are often multi-dimensional, and no specific indices measuring these influencing variables was found. However, driving these influencing variables are underlying elements which are measurable. The measurements of these elements were used to draw conclusions about the influencing variables. Most elements were found in the GEM dataset, and where possible, combined with an additional source for verification. *Economic development* was measured through *GDP per capita.* For *technological development*, the elements were *R&D expenditure*, *Patent/GDP ratio, R&D transfer*, and *Broadband subscriptions*. *Institutions* was measured through *government policies: support and relevance, taxes and bureaucracy, government entrepreneurship programmes, commercial and legal infrastructure,* all from the GEM dataset. *Education* consisted of the percentage in a population having completed *tertiary education*, and the number of *universities offering technology majors*. Finally, culture consisted of the elements *cultural and social norms* from the GEM dataset, as well as the *Hofstede cultural dimensions*.

ME is measured through GEM's TEA index. TE is measured as the product of (a combination of) (i) the usage of new technology, (ii) new products, (iii) high job creation expectation, and (iv) new markets.

6.1.4 What are the variables, on a national level, that affect TE differently than ME?

To answer this question, a comparison was made between The Netherlands and Japan. The Netherlands showed high values for ME, but low values for TE, and Japan showed low values for ME, but high values for TE. The Netherlands had double the amount of ME on average. Several iterations of the TE index were used, and every iteration clearly showed Japan to have more TE, the difference ranging from twice the amount of TE to nearly four times the amount of TE. Thus, the results were consistent, whichever way TE was defined. These findings were also consistent throughout the analysed time-period (2013-2020) as well as consistent with the preliminary findings in earlier chapters.

Technological development, and *Education* showed higher levels for Japan, whereas *Institutions* and *Culture* showed higher values for The Netherlands. These influencing variables therefore affect TE differently than ME and vice versa. More specifically, higher levels of *Technological development* and *Education,* namely technical education, have a positive influence on the levels of TE in a country. *Institutions* was found to be more conducive to entrepreneurship in The Netherlands than in Japan, thus leading to the conclusion that a better institutional environment leads to more ME. The Netherlands was found to have a better cultural environment than Japan, as rated by the GEM data as well as through Hofstede's cultural dimensions, showing higher levels of *individualism.* This was in line with the literature that stated that the *individualism* dimension was strongly linked to higher levels of ME. *Economic development* showed similar values and thus seemed to have little or no influence in the comparison between these two countries.

The variables found to affect technology entrepreneurship differently than ME are economic development, technological development and education, more specifically technology education.

To check these results for generalisability, (a similar) analysis was performed on 44 additional countries. The first finding, after plotting the countries in a scatterplot (figure 6.1) based on their ME and TE values, was that The Netherlands and Japan were not exceptions and that the combination of high TE/low ME and low ME/high TE was a common phenomenon. The scatterplot was divided into four quadrants, with Q1 (low ME, high TE) being exclusively high-income economies, Q2 (high ME, high TE) and Q3 (low ME, low TE) both mixed with high- and low-income economies, Q3 (low ME, low TE), and Q4 (high ME, low TE) consisting of low-income economies, or developing countries.

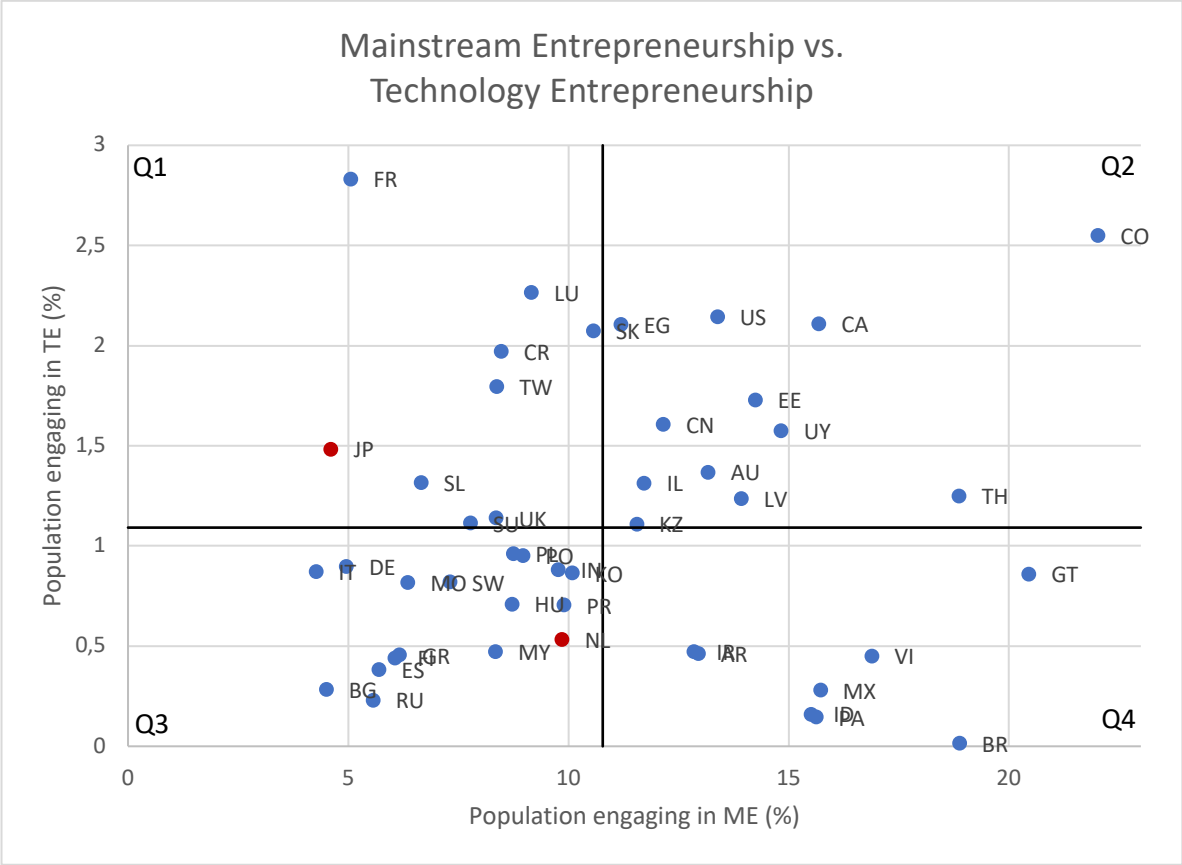

Figure 6.1 ME/TE scatterplot

The scatterplot also showed that TE and ME are unrelated, which was confirmed by a low correlation coefficient and corresponding p-value. Therefore, the influencing variables for ME and TE must be different. Q1 (high TE, low ME) and Q4 (low TE, high ME) were compared to each other and showed that values for the influencing variables *Technological Development,* and *Education* are much higher in countries with high TE, as in the comparison between The Netherlands and Japan. Some of the elements clearly showed differing values, whereas others were more similar between the two quadrants. For *Technological Development, R&D expenditure*, *Patents/GDP,* and *Mobile Broadband Subscriptions* was found to be much higher in Q1 (low ME, high TE). *Education* seems to be a major influencer for TE, as both elements (*tertiary education, universities offering technology majors)* showed significantly higher values in Q1 (low ME, high TE) than Q4 (high ME, low TE), showing clearly that a high level of technical education is beneficial to TE. *Economic Development* was also found to be higher in Q1 (low ME, high TE) than in Q4 (high ME, low TE) countries, which is consistent with prior literature research. Thus, The Netherlands was more of an outlier in that specific comparison. Therefore, the influencing variables that affect TE differently than ME are *Economic Development, Technological Development,* and *Education*. Higher values for these influencing variables will lead likely to higher levels of TE. *Institutions* showed little difference between the two analysed quadrants. For *Culture*, countries in Q4 (high ME, low TE) had slightly better *cultural and social norms* according to the GEM data than countries in Q1 (low ME, high TE). Additionally, Q4 (high ME, low TE) was not found to have higher levels of *Individualism*. On the contrary, Q1 (low ME, high TE) was found to have more *Individualism*, and unexpectedly had higher levels of *long-term orientation*, possibly indicating an additional cultural precursor for high levels of TE.

6.2 Scientific Discussion

This section will discuss the contribution and shortcomings of this research. This section also features an interview with Prof.Dr.ir. Shinichiro Haruyama, a Japanese expert on entrepreneurship, who was asked for his reflection and opinion on the results in light of his knowledge and expertise on Japanese entrepreneurship.

6.2.1 Contribution

A disproportionately large amount of the overall economy is generated by only a small number of technology firms, making not just ME, but TE in particular an important contributor to the economy, job creation and a source of innovation, indicating its value as an independent area of research. However, the current literature does not adequately distinguish between ME and TE for their frameworks and models of analysis, and a comparison between TE and ME was similarly not found. It is important to make this distinction, because if ME and TE are indeed different, application of ME theories and frameworks to TE will give incorrect results. This master thesis has contributed by both addressing the problem and taking first steps in solving the problem.

By contrasting ME and TE through a comparison between The Netherlands and Japan, this thesis has convincingly demonstrated that TE and ME are different. For every iteration of the TE index, the difference between Japan and the Netherlands remained, with the difference seemingly more dramatic as the level of impact of the iteration of the TE index increased. Additionally, this confirms that this phenomenon is not visible due to an error in the way the data was collected, but is real and substantial. These results were confirmed with additional countries, showing clearly that ME and TE are different and should be treated as such.

Therefore, what follows is that the models that apply to ME do not apply to TE and will give incorrect results. This thesis has taken a first step to show where TE differs from ME, and has given a clear picture where the two differ at the level of influencing variables on a country level of analysis, by identifying TE-specific influencing variables.

Contrary to the mixed relationship between *economic development* and ME levels, TE clearly benefits from better economic environments. Likewise, unlike ME, TE also benefits from higher levels of *education* in a country, more specifically technical education. The results for *culture* were interesting and mixed, and not completely in line with the literature. The Netherlands was found to have much higher levels of *individualism* than Japan, in line with Pinillo & Reyes (2011), who found *individualism* to be conducive to ME. However, when comparing Q1 (low ME, high TE) and Q4 (high ME, low TE), Q1 was found to have almost twice the amount of *individualism* of Q4, possibly indicating that *individualism* is not conducive to ME, but rather for TE specifically. This was the opposite of what was found in chapter four. Furthermore, countries high on TE were found to have a high level of *long-term orientation* than those low on TE, something which was not found in prior literature research, thus identifying a possibly important cultural indicator for TE.

These results possibly indicate that by increasing the levels of the influencing variables that specifically boost TE, a traditionally non-entrepreneurial environment (i.e., environments unconducive to ME) can be overcome to achieve higher levels of TE. The results of this thesis can help those engaged in TE to be more aware of their surroundings and possible shortcomings in the start-up ecosystem they are a

part of. Lastly, this research has expanded on the idea of Schumpeterian and Kirznerian entrepreneurs being complimentary by categorising one as belonging to TE and the other to ME.

6.2.2 SHORTCOMINGS

Creating a TE index is a very complex endeavour, and this master thesis does not presume to have created the end-all of TE indices. In fact, the struggle in the way this research handled the TE index should highlight the need for a dedicated TE index, which should be established in the same rigorous way as the ME index. This thesis has simply used four measurements as filters, whereby the product of the filters is the TE index. In doing so, the weight of the different measurements has been set to one, even though in reality this might not be accurate (e.g., high job creation being much less of an influence than usage of new technology). Furthermore, the elements that make up the influencing variables are all measured differently and at times the sources differ too. This, in my opinion, led to a lack in connection between the measurement of elements and the resulting conclusions on the influencing variable. The height of the value of the elements indicates that the influencing variable has a higher value, but there is no established, solid, causal relationship.

TE is not measured in the same rigorous way as ME, therefore the current TE index is lacking, and in some instances, seems to create unreliable data. Some countries were in Q1 (low ME, high TE) unexpectedly, which could have several explanations. It could mean that I was prejudiced, and the index revealed that. However, some countries that were in Q1 scored low on several influencing variables, indicating that either very important influencing variables were missed, or the country did in fact not belong in Q1. The misplacement of a country in a quadrant could be because different countries have different perceptions of innovativeness, leading to something that could be described as an 'ego index', where countries who feel that they are more innovative will claim to be so, when objectively this might not be the case. On the other hand, it could mean that the entire index is incorrect. As mentioned before, the TE index has its flaws, but as it was the result of thorough literature research, I will object to the index being incorrect in its entirety. Lastly, large regional differences within a country could explain why some unexpected TE values were seen. Some countries could have highly developed - perhaps centralised around a capital - regions with the rest of a country being underdeveloped, skewing the image.

There is an infinite number of influencing variables, and the selection used in this research is therefore, by definition, limited. A set of influencing variables for ME was taken as the starting point, and that set was shown to have a different influence on TE than ME. This set however, excluded many TE-specific variables. Furthermore, the way that the influencing variables influence each other has not been taken into consideration (e.g., an increase in education can cause an increase in technological development and vice versa). Underlying influencing variables from lower levels of analysis have also not been considered. As for the measurement of the influencing variables through their elements, an infinite number of elements is similarly available here; therefore, this too is limited. For example, the *Patents/GDP* index only measures one form of innovation. Innovations that do not require patents can be as much part of TE, but these are not measured here. Additionally, the connection between the patents available in a country and the actual number of patents that ends up at NTBFs is unclear. There is some indication through the R&D transfer index, but it is not quantified precisely.

The nature of TE allows for open interpretation to the question "who is the entrepreneur?" Actors come and go in TE efforts, and any actor's contribution might be as valuable. Furthermore, those from a non-

technical background can be just as much part of a team engaging in TE. This complicates the relationship with the antecedent of technology entrepreneurs having technological educational backgrounds.

Although this thesis has concluded that TE is reflective of Schumpeterian entrepreneurship and ME of Kirznerian, ME is likely not exclusively Kirznerian as it includes all forms of entrepreneurship except for TE. True Schumpeterian entrepreneurship is rare, but other forms of Schumpeterian entrepreneurship besides TE are most likely present in the greater group of ME which were not taken into account in this thesis. Furthermore, the TE index (and, to a lesser extent the ME index) is rather one-dimensional. The GEM data only measures 'official' entrepreneurship, many 'unofficial' forms of entrepreneurship (e.g., through non-profits, groups and social movements) are not measured in this thesis.

Lastly, the focus of this thesis was on the levels of TE in a country, but merely increasing the number of TE efforts in a country does not necessarily increase the success rate. Increasing the number of failed TE efforts is not something to strive for and hard to imagine as a positive contributor to the economy. Therefore, besides increasing the absolute level of TE in a country, additional focus must be on increasing the quality and success rate of TE efforts, to achieve the desired positive effect of increased TE in a country.

6.2.3 Interview with a Japanese expert on entrepreneurship

As the focus of this thesis was a comparison between The Netherlands and Japan, it seemed wise to have a Japanese expert with knowledge of the state of entrepreneurship in Japan reflect on the findings of this thesis. That discussion will likely lead to new insights, and if the expert's view is in line with the results, will add validity to the findings of this thesis. This section will present an interview with Prof.Dr.ir. Shinichiro Haruyama, the supervising professor of *entrepreneurship* and *total design of information and communication systems for ubiquitous society* at the Graduate School of System Design and Management of Keio University, Tokyo Japan. A full transcript of this interview is found in the appendix.

Reflecting on the results, Prof. Haruyama stated that he does see lots of ME and TE in Japan, however he did find the situation to be lacking in comparison to other countries and finds that many companies only remain small. Despite Japan's great technological strength, he stated that Japanese companies lack the ability to truly see people's present needs and foresee future needs. He explained this by contrasting *seeds* and *needs*. Seeds are technological innovations, which Japanese companies are very good at creating. However, many of these companies only focus on creating these seeds, and are weak at finding the solutions, or needs, of people in the form of services or products. In contrast, he mentioned Facebook as an example, which at its core is a simple technology, but fits perfectly with the needs of people. Another reason is that Japanese technology companies are often not good at marketing. Prof. Haruyama explained the high *Patent/GDP ratio* through this focus on seeds, which leads to companies filing for many patents. However, many of those patents are sleeping, and are not used for their products. He expressed that even many of his own patents are unused. He also stated that there are even companies in Japan that seek sleeping patents to utilise. He does think that the number of patents in a country has influence on the amount of TE however, and feels it is natural to think that the number of patents and technology entrepreneurship are closely related. Thus, the opportunity for *knowledge spillover* in Japan is high. Reflecting on the big gap in *Patent/GDP ratio* between The Netherlands and Japan, which he was initially surprised by, he said the following: "After

your research, you would think that you can say that Dutch companies should file for more patents, but it is not that easy. I guess, Philips files for many patents each year, but it is not good enough. You have to have hundreds, thousands of companies; each of those filing for many patents," and further stated that the industry size is likely related to the amount of TE in a country.

Prof. Haruyama gave several reasons for why few Japanese people engage in entrepreneurship, causing the low levels of ME. Firstly, he stated that the environment for starting a new venture in Japan is not as good as in The Netherlands or The USA. The lack of investors and venture capitalists in Japan is part of the problem, as well as the Japanese government being strict in enforcing set laws. He provided an example of Uber and similar services being prohibited in Japan to protect taxi drivers. These types of governmental restrictions and regulations are present in all kinds of services and industries, and are a problem and deterrent for starting a company.

On cultural influences, Prof. Haruyama expressed that the attitude among the older generation in Japan is still averse to entrepreneurship. Furthermore, Japan still has a traditional culture of politeness and obeying the elderly, which is hard to change quickly. On the one hand, he sees this as a positive, however, at the same time he expressed that if every generation only obeys their elders, nothing will ever change. This aspect of Japanese culture is also present in the educational system, where, although the level of technology education (e.g., physics, electronics etc.) is very high in Japan, there is little emphasis placed on discussion, debate, or creativity and the like, in high school or university, unlike in Western countries. He stated that this kind of mindset - of growing up without discussions - is a big problem for the attitude towards entrepreneurship. Additionally, the presence of large, successful companies (e.g., Toyota, Sony, Honda), prevents or discourages people to start new ventures, as they are content with a stable job and a high salary. This ties into the Japanese population being highly educated and enjoying a high standard of living. Additionally, he stated many Japanese people not being well-versed in English as an additional barrier for new ventures to expand internationally.

On collaboration with, and support from universities, Prof. Haruyama stated that these kinds of efforts exist, with Keio University also having an incubation office, and more than 100 professors starting companies through Keio University, including Prof. Haruyama himself. But, the number of students starting companies, either while still students or directly after graduation is small, around 1-3 out of 70 graduates.

However, Prof. Haruyama, who wishes to see more entrepreneurship - both ME and TE - in Japan, is hopeful. He sees increased interest in the entrepreneurship course he teaches and notes the eagerness and willingness of students to start companies. This is the general sentiment among the younger population, who are increasingly willing, in addition to working at a company during the week, to start and work on their own companies during the weekends, and the desire to create the next Google or Amazon exists. His assessment is that there is as much opportunity for entrepreneurship in Japan as in a developing country, such as Malaysia or Indonesia, and that if there is a new service that fits with the needs, Japanese people would be happy to adopt it. He mentioned ongoing small law changes that are beneficial to entrepreneurship as well. Additionally, because the economic situation in Japan has been good and stock prices are high, people have additional wealth. This leads to more people becoming investors, which will improve the business environment. Prof. Haruyama stated that if this research is repeated in a few years, Japan might move towards the middle-line of the TE/ME scatterplot, having increased the level of both ME and TE.

The interview with Prof. Haruyama added interesting insights, and through it many of the findings in this thesis about Japan were confirmed, with many of his explanations fitting well within the investigated influencing variables. Firstly, the image of Japan having low ME and high TE was confirmed. Secondly, Japan indeed enjoys a high level of *technological development*, with a high level of *technical education* and *patents/GDP ratio*. Prof. Haruyama agreed with the assessment of *patents/GDP* and TE levels to be closely related through *knowledge spillover*. At the same time, these elements alone are not enough to maximise the level of TE in a country, with Japan lacking in finding product/market fit. However, the lack in these areas is possibly masked by Japan's extremely high *patents/GDP ratio* and thus still resulting in high levels of TE.

Prof. Haruyama added more depth to the *culture* variable by describing the culture of Japan and how it trickles down into *education* and the general attitude towards entrepreneurship. As it currently is, Japanese national culture seems to be an inhibitor to entrepreneurship, both ME and TE. However, the idea that the national culture inhibits entrepreneurship and people increasingly must disagree with the dominant culture to venture into entrepreneurship fits almost perfectly with the *dissatisfaction approach* to culture as described in this thesis. The younger population is increasingly disagreeing with the older generation and venturing into entrepreneurship.

Concerning *education,* clearly national culture has great influence on the educational system, where a culture of agreeableness, devoid of discussion is perpetuated in the educational system, which is reflected in high levels of collectivism and uncertainty avoidance in the Hofstede Cultural Dimensions. An interesting contrast between The Netherlands and Japan arose, with university incubators at TU Delft being utilised heavily by students, whereas the incubator at Keio University is mostly used by the professors.

For *economic development*, specifics such as the presence of a capital market and access to funding through venture capitalists and other investors was mentioned as being important, in line with Mazzucato (2013) mentioned earlier in this thesis. These are variables to be investigated in future research.

Institutions is a big influencer in Japan, with the government enforcing strict rules inhibiting both ME and TE. In that sense the influence of *institutions* is similar for ME and TE, as was found in the results of chapter five.

The size of the technology industry as an additional variable was mentioned as well. However, it seems that the size of the industry can also become an inhibitor to TE, as well-established companies provide job security and a comfortable standard of living, decreasing the desire for entrepreneurship. This is reminiscent of the inverted U-shaped relationship mentioned in chapter two.

Incidentally, he mentioned that currently, China, Taiwan and Korea in certain technology industries are doing much better than Japan. This is in line with the findings of Taiwan and China having higher levels of TE than Japan. Korea is placed near the top of Q3, near Q1, the landscape possibly being dominated by larger firms (e.g., Samsung, LG) rather than smaller TE efforts.

6.3 Policy and Managerial Recommendations

This section will discuss the policy and managerial recommendations following the findings of this thesis. First the policy recommendations will be discussed, with insights from two policy experts. The second subsection will discuss the managerial recommendations.

6.3.1 Policy recommendations

The implication of this research is that it is possible to stimulate TE and ME independently. This is good news for countries that have a goal of increasing TE, but an environment traditionally unconducive to entrepreneurship. It means that all is not lost, and that it is possible to stimulate TE despite having a bad environment for ME. These governments should focus on increasing the levels of *education, technological development,* and *economic development*. For education, this means increasing the percentage of tertiary educated people in the population, more specifically, those with technology majors. For technological development it could mean improving the IT infrastructure in a country and increasing the number of patents available in a country, however, according to Prof. Haruyama, this would have to be a significant increase, which is likely not easy to do.

Interviews with policy experts

The results of this thesis were discussed in interviews with Dr.ir. Bert Enserink and Dr.ir. Els van Daalen, two policy experts from the faculty of Technology, Policy and Management at Delft University of Technology. The interviews were held in a brainstorm format, and they were asked about the implications of this research and their recommendations on a policy level. Full transcripts of the interviews are found in the appendix.

Dr. Enserink did find the cultural theories to account for some difference in the ME and TE levels, and a country's attitude towards technological innovation, but noted that cultural theories are very stereotypical and that in the last 20 years, The Netherlands and Japan have started to look more alike than we could have imagined. In that sense, he found the *dissatisfaction approach* more plausible, that technology entrepreneurs show similar traits across nationalities, and theorised that, similarly, a Dutch, Japanese, Chinese or Indonesian student might share more similar traits than a Dutch student and a Dutch farmer or a Japanese student and a Japanese farmer. Concerning *education,* Dr. Enserink said that the obvious thing was to increase the number of people enrolled in technology education, to increase the available human capital. This is one of the reasons foreign nationals are encouraged to study here, in hopes that they stay and find a job in the technology industry. Important considerations were to increase the interest of high school students in technology majors, as well as increasing the number of women in technology majors. Concerning *technological development* Dr. Enserink mentioned that lowering barriers would be conducive to TE levels. Policies such as tax exemption for companies that launch new products, and policies towards increased international cooperation. For example, if a company cannot find the required human capital in this country, can a policy be made to ease cooperation across borders? Furthermore, increasing the number of incubators, which foster a culture of entrepreneurs helping each other, increase cooperation between university and industry, and to lower administrative barriers for entrepreneurs. The question whether a country should increase its ME levels was less relevant according to Dr. Enserink, as he felt there would always be ME when needed, but fostering the specific knowledge and environment needed for TE is the challenge countries would be facing.

Dr. van Daalen approached the problem by assigning specific ministries to the categories of *economic development, technological development,* and *education,* namely the Ministry of Finance, the Ministry of Economic Affairs and Climate and the Ministry of Education. *Economic development* was found to be difficult to find specific policies to increase the overall GDP of the country and was not discussed further. As for the Ministry of Education, one idea was for the educational budget to be distributed differently. Examples were, giving universities more funding per student, have technology students pay less tuition fees, and to provide technical universities with more funding than non-technical universities. As for *technological development* both the Ministry of Economic Affairs and Climate and the Ministry of Finance could contribute to better environments for TE. The Ministry of Economic Affairs and Climate could increase the funding for start-ups, specifically those at universities. As for The Ministry of Finance, a more favourable tax environment for start-ups could increase the amount of TE.

The interviews with the policy experts emphasised the relevance of the problem discussed in this thesis, and brought out practical solutions and policy implications based on the results. It showed that the results of this thesis can be translated into tangible action with the end goal of increasing TE levels. The results were mostly discussed in relation to the example of The Netherlands and Japan, but these results should be generalizable to more countries. Therefore, countries that have the ambition to increase their TE levels should focus their policies on increasing the level of *education* by increasing the percentage of people studying technology majors in higher education, and by bettering *technological development.* The examples provided in the interviews can be specific ways, depending on the status quo of the country, to fulfil their ambitions. Additionally, countries that lack the necessary *economic development* could, for example, try to increase *technological development* through foreign investment.

As mentioned in the section on shortcomings, in addition to the amount of TE in a country, policies should focus on the quality and success rate of new TE initiatives. Just as increased governmental funding does not necessarily lead to successful TE efforts (Mazzucato, 2013), increasing the number of TE alone, could merely lead to increasing the number of failures and not necessarily the desired positive effects that increased, successful TE brings. A policy that focuses on providing start-ups with help through incubators can be created, as incubators were specifically mentioned by Dr. Enserink as a mechanism through which start-ups help each other through difficult periods, indicating a positive effect on the success rate of TE initiatives.

6.3.2 Managerial recommendations

As this thesis was placed at the national level of analysis, policy recommendations seem more apparent than managerial recommendations, which are placed at the organizational level. However, the results of this thesis do provide insights that can be utilised by managers of technology start-up firms. By now it should be clear that TE is not ME, and managing your TE firm without considering the unique nature of TE will most likely not lead to a successful outcome. Firstly, overall awareness of the national environment, the general attitude towards entrepreneurship and the laws and regulations will serve any manager well. Secondly, because TE benefits from specific human capital, placing your start-up near a university of technology or near an area with many technology companies would offer more opportunities to come into contact with people that have a high level of technical education. Proximity to technical universities, technology companies and R&D centres would additionally increase the chance for knowledge spillover. However, from the interview with Prof. Haruyama, having just the technological know-how is not enough for start-up success, as a product or service must adhere to the

needs of the people. Diversifying your team beyond those with purely technical knowledge, to include those with business and marketing knowledge should be a priority for managers of start-ups. Additionally, as mentioned previously, becoming part of an incubator or accelerator can increase the odds of success for a start-up and is therefore a managerial recommendation. Lastly, those with the ability to establish themselves in a country of choice, can establish themselves in a country that has high values for all the influencing variables of importance mentioned in this thesis, to increase the odds for success.

6.4 Future research

Throughout the process of creating this master thesis several findings have come up which will be suited for future research. The first recommendation is to perform the analysis with an even larger sample of countries, which will add to the robustness of the conclusions. Secondly, as mentioned in the shortcomings of this research, there is a number of influencing variables missing, for both ME and TE, as well as ME- and TE-specific variables. For example, access to funding, market influences, the existence of capital markets and the size of the (high-)tech industry in a country could all be influencing variables. Further complicating the matter is the fact that these influencing variables could also be predecessors or influencing variables to the influencing variables used in this thesis. For example, the size of the (high-)tech industry can directly influence the number of patents in a country, and national culture can directly affect governmental laws, policies and the educational system. I would highly recommend researching the interconnection between the influencing variables, and whether and how they influence each other across levels of analysis (i.e., from individual to national).

As mentioned briefly earlier in this thesis, the data in this thesis has shown association between the influencing variables and the overall levels of ME and TE, but has not empirically proven causation. The proven association, along with the work of other authors discussed in the literature research provide plausibility for a causal relationship, however. But for many of the causal relationships between the influencing variables and the overall levels of ME and TE described in this thesis, an inverse-causal relationship can be argued (e.g., higher levels of TE lead to more technological education). Furthermore, at the high level of country analysis, there are likely other variables that influence and covary, which possibly distort a clear-cut causal relationship. Therefore, causal relationships between the influencing variables and the overall levels of ME and TE should be researched. The example of Japan illustrates a mechanism for a causal relationship between *economic development* and increased levels of entrepreneurship (both ME and TE): the highs of the capital markets, which are likely more prevalent in well-developed (or, high GDP per capita) economies, provide people with additional wealth who then seek out investment opportunities, which include entrepreneurs, thus stimulating higher levels of entrepreneurship. For *technological development: R&D expenditure, Patents/GDP ratio* and *R&D transfer* all work through the mechanism of *knowledge spillover*, as discussed in chapter two, increasing opportunity for ME and TE, and thus likely the overall levels of TE and ME. For *institutions*, empirical evidence is provided of regulations and taxes being able to increase or diminish levels of entrepreneurship, which also became clear in the interview with Prof. Haruyama. Additionally, that interview strongly implies a causal relationship between national culture and levels of entrepreneurship in Japan, with *culture* affecting other influencing variables such as *institutions* and *education.* Note that the attitude in education towards entrepreneurship was not measured in this thesis, only the level and

type of education. Additionally, it should be noted that none of the implied causal relationships discussed here rule out the possibility of a reciprocal or self-reinforcing relationship.

Thus, in reality the landscape of influencing variables is considerably more complex than presented previously in this thesis. The following figure (6.2) shows what the landscape of influencing variables could potentially look like, considering (reciprocal) causation between the influencing variables and the levels of ME and TE as well as the additional influencing variables. Once more highlighting the complexity of the interrelationships, this figure is likely still missing much.

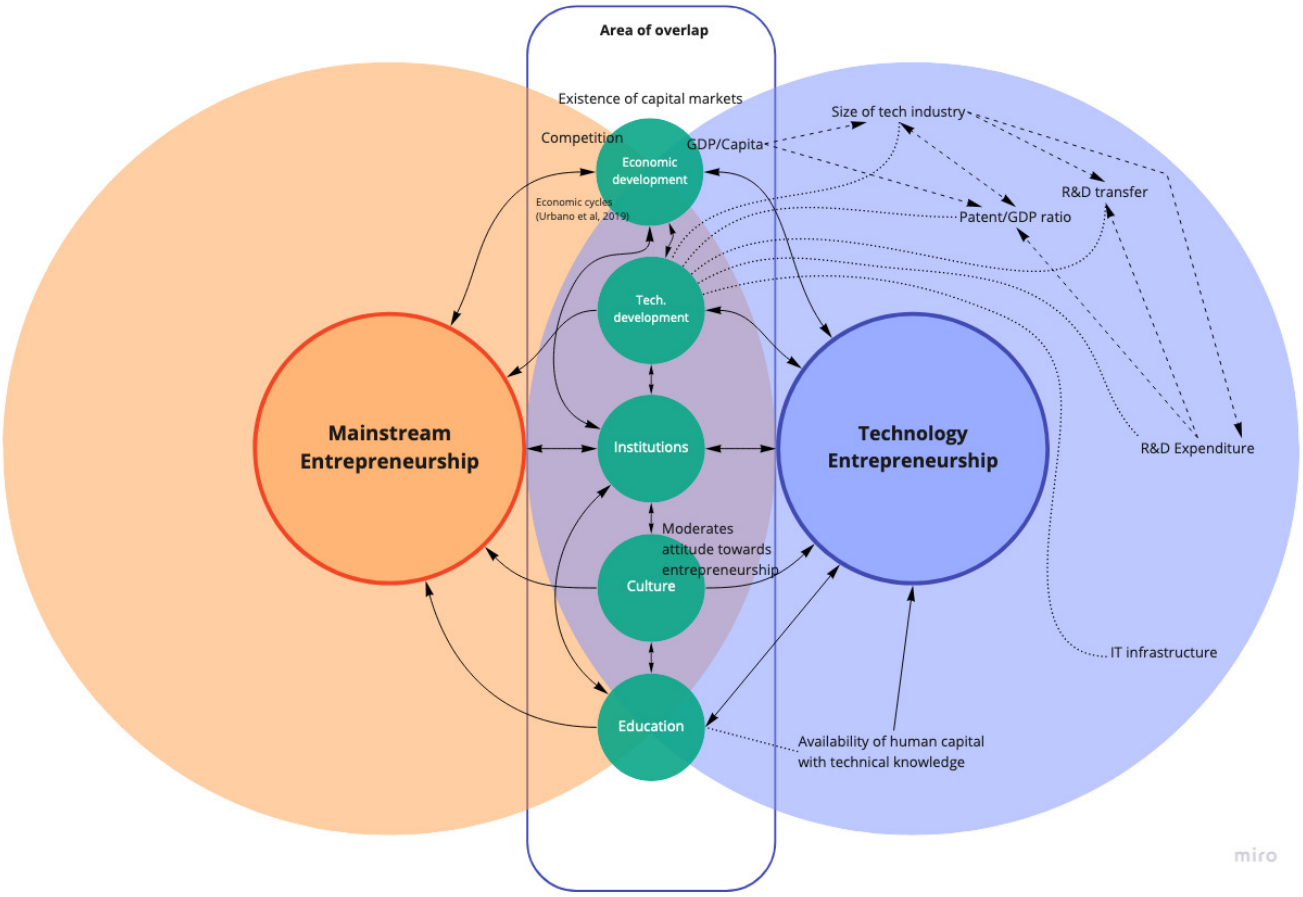

Figure 5.2 Landscape of ME, TE, influencing variables and elements, showing overlap, reciprocity and potentially missing variables and elements

Another recommendation for future research is the creation of a TE index. This must be done to better analyse TE. One way to do this would be, to firstly clearly delineate what TE is, and what is not TE. Secondly, what constitutes TE, or what are the elements that make up TE must be researched, and a method must be found to measure these. Additionally, the weight of these elements must be determined. The weighted elements could be summed to create an index for TE. An additional regression analysis on the total sample of 46 countries could assist in this, as well as in more precisely determining the relationship between the influencing variables and the levels of TE and ME, and whether some of them lose their relationship. In addition to the comparison between Q1 and Q4, as suggested by Prof. Haruyama, Q1 (low ME, high TE) and Q2 (high ME, high TE), as well as Q2 (high ME, high TE) and Q4 (high ME, low TE) can be compared to each other to explore either ME or TE in isolation.

As for the idea of an 'ego index'; cross-country comparisons for future research on what is seen as innovative could be rather interesting and possibly explain the differences in (perceived) innovativeness that the data showed and some of the data that was deemed odd. Determining this will increase the quality of data and benefit cross-national comparisons of TE.

The influence of *culture* on TE remains somewhat unclear. Based on the results and the interviews with Prof. Haruyama and Dr. Enserink, I would lean towards TE following the *dissatisfaction approach* and ME the *social legitimation approach.* However, this conclusion cannot be fully drawn, as it is also possible that the national culture *determines* the approach in a country, meaning that entrepreneurs (ME and TE) in a country with an averse national culture to entrepreneurship generally follow the *dissatisfaction approach*, whereas in a culture with a positive attitude towards entrepreneurship, entrepreneurs generally follow the *social legitimation approach.* Further obscuring the picture is the fact that Q1 (low ME, high TE) clearly showed high levels for individualism and long-term orientation, possibly indicating a specific cultural profile suited to TE. Additionally, the models of national culture might lead to oversimplifications and stereotypes, and similar sub-groups across nations might show more similarities than a sub-group to an overall country. A way to research this would be to create an 'average' cultural profile conducive to TE and compare those to the specific cultures in a country. To verify for the *dissatisfaction approach,* the individual traits that entrepreneurs exhibit can be compared to the average traits in a country.

Lastly, repeating this research in a few years could be interesting, as Prof. Haruyama suggested that Japan would have increased its ME in a few years. At the same time, if currently implemented policies are taken into account, research can be set-up to determine whether the policies were successful, taking into account not just the amount but quality of TE efforts as well

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APPENDIX A: GEM DATA THE NETHERLANDS AND JAPAN (CHAPTER 4)

		2020		2019		2018		2017		2016		2015		2014		2013	
GEM data	Variable description	The Netherlands	Japan	The Netherlands	Japan	The Netherlands	Japan	The Netherlands	Japan	The Netherlands	Japan	The Netherlands	Japan	The Netherlands	Japan	The Netherlands	Japan
TEAyy	Percentage of all respondents (18-64): involved in a nascent firm **{SUBOANW}** or young firm **{BABYBUSO}** or both (if doing both, still counted as one active person). TEA is slightly lower than total of BABYBUyy and SUBOANyy. **[TOTAL ENTREPRENEURIAL ACTIVITY (TEA) INDEX]**	11,48	6,48	10,38	5,35	12,29	5,34	9,92	4,68	11,00	5,30	7,21	4,80	7,27	3,83	9,27	3,72
TEAyyJOB	Percentage of respondents *within* TEA: expecting 10 or more jobs 5 years after the business has started (or 5 years from now on if the business is already operational – in that case an extra requirement is that job growth is at least 50%). [HIGH JOB EXPECTATIONS]	9,21	20,67	15,32	26,77	6,67	19,39	9,84	24,80	11,83	14,41	15,74	20,17	8,01	26,09	8,50	35,24
TEAyyNT1	Percentage of respondents *within* TEA: reporting that they use the *very latest* technology, not available one year ago **{SUNEWTEC, OMNEWTEC}**	X	X	X	X	4,33	23,92	7,98	13,36	7,66	12,20	13,61	13,73	10,85	13,13	11,14	8,18
TEAyyNT2	Percentage of respondents *within* TEA: reporting that they use new technology, not available since 1-5 years **{SUNEWTEC, OMNEWTEC}**	X	X	X	X	14,09	26,18	15,32	29,21	15,98	28,21	23,30	38,10	16,63	19,32	15,38	21,66
TEAEDHI	Percentage of respondents *within* TEA: *with at least post secondary education* .	38,38	63,40	36,93	71,40	35,50	68,39	32,50	62,53	0,33	59,90	0,14	0,59	0,36	0,70	0,41	0,61
teanewpr	Percentage of respondents *within* TEA: reporting that product is new to all or some customers	X	X	X	X	35,13	50,53	35,26	46,28	42,09	53,77	41,75	37,58	39,88	47,40	44,08	55,47
teanewmk	Percentage of respondents *within* TEA: reporting new market (few/no businesses offer the same product)	X	X	X	X	50,20	39,00	48,15	37,23	49,95	28,47	44,16	31,45	50,62	36,06	50,14	27,91

APPENDIX B: PATENT/GDP RATIO CALCULATION THE NETHERLANDS AND JAPAN

Patent/GDP is calculated as Triadic Patents divided by GDP.

	Triadic patents (OECD)		GDP in billions ($) (World Bank/IMF)		Patents/GDP Ratio	
	The Netherlands	Japan	The Netherlands	Japan	The Netherlands	Japan
2013	1138,74	17651,01	876,924	5156	1,29856179	3,42339216
2014	1288,32	17615,23	890,891	4850	1,44610283	3,63200619
2015	1115,76	17606,52	765,265	4389	1,45800474	4,01151059
2016	1136,78	17489,07	783,528	4923	1,45084796	3,55252285
2017	1095,86	17779,82	831,81	4876	1,31744028	3,64639459
2018	1091,21	18644,76	913,597	4995	1,19441066	3,73268468
2019			907,051	5065		
2020			912,242	5050		

APPENDIX C: ME AND TE LEVELS ADDITIONAL COUNTRIES (CHAPTER 5)

		2018		2017		2016		2015		2014		2013		Average	
COUNTRY	**CTRYALP**	**ME**	**TE**	**ME**	**TE**	**ME**	**TE**	**ME**	**TE**	**ME**	**TE**	**ME**	**TE**	**ME**	**TE**
Argentina	AR	9,11	0,055	5,97	0,111	14,51	0,711	17,74	0,597	14,41	0,730	15,93	0,575	12,9450	0,46302577
Australia	AU			12,21	0,930	14,56	1,577	12,79	1,697	13,14	1,268			13,1750	1,36804675
Brazil	BR	17,88	0,002	20,30	0,002	19,56	0,012	20,98	0,044	17,23	0,025	17,31	0,000	18,8767	0,01419864
Bulgaria	BG	6,00	0,032	3,70	0,352	4,84	0,613	3,46	0,138					4,5000	0,28374947
Canada	CA	18,71	3,068	18,75	2,656	16,72	1,718	14,72	1,925	13,04	1,461	12,19	1,836	15,6883	2,11064541
Chile	CL	25,06	4,793	23,80	4,689	24,18	5,646	25,93	5,379	26,83	6,684	24,33	4,184	25,0217	5,22926795
China	CN	10,39	2,648	9,87	1,679	10,29	2,058	12,84	2,278	15,53	0,260	14,02	0,714	12,1567	1,60616058
Colombia	CO	21,19	0,878	18,68	0,239	27,35	0,403	22,67	5,716	18,55	6,942	23,71	1,120	22,0250	2,54977516
Croatia	CR	9,61	2,099	8,91	1,482	8,41	2,439	7,69	2,226	7,97	1,831	8,27	1,752	8,4767	1,97125007
Ecuador	EC			29,62	0,059	31,83	0,102	33,56	0,385	32,61	0,235	35,97	0,360	32,7180	0,22831227
Egypt	EG	9,84	1,903	13,25	2,207	14,30	1,816	7,39	2,502					11,1950	2,10704964
Estonia	EE			19,38	1,713	16,16	1,551	13,14	2,533	9,43	1,515	13,11	1,339	14,2440	1,73011498
Finland	FI					6,71	0,508	6,59	0,426	5,63	0,395	5,29	0,433	6,0550	0,44062519
France	FR	6,13	2,250	3,92	6,956	5,32	1,655			5,34	2,408	4,57	0,888	5,0560	2,8315311
Germany	DE	4,97	1,550	5,28	0,762	4,56	0,654	4,70	1,148	5,27	0,645	4,98	0,623	4,9600	0,89682716
Greece	GR	6,35	0,462	4,82	0,473	5,70	0,464	6,75	0,256	7,85	0,548	5,51	0,532	6,1633	0,45589686
Guatemala	GT	27,52	2,349	24,75	1,470	20,07	0,325	17,71	0,624	20,39	0,341	12,28	0,050	20,4533	0,85967534
Hungary	HU					7,94	0,899	7,92	0,645	9,33	0,929	9,68	0,366	8,7175	0,70988445
India	IN	11,42	1,529	9,28	0,610	10,59	0,590	10,83	1,039	6,60	1,149	9,88	0,373	9,7667	0,8816881
Indonesia	ID	14,09	0,121	7,47	0,217	14,08	0,149	17,67	0,114	14,20	0,275	25,52	0,079	15,5050	0,15920958
Iran	IR	9,71	0,670	13,32	0,715	12,79	0,504	12,93	0,435	16,02	0,123	12,32	0,383	12,8483	0,47146698
Ireland	IE	9,64	4,739	8,93	2,476	10,88	4,892	9,33	4,693	6,53	2,446	9,25	1,755	9,0933	3,50033299
Israel	IL	12,65	1,309	12,78	0,513	11,31	1,527	11,82	1,294			10,04	1,924	11,7200	1,31322433
Italy	IT	4,18	0,555	4,28	0,969	4,42	1,937	4,87	0,385	4,42	0,676	3,43	0,704	4,2667	0,87096614
Japan	JP	5,34	1,914	4,68	1,782	5,30	0,891	4,80	1,236	3,83	1,447	3,72	1,628	4,6117	1,48313364
Kazakhstan	KZ			11,32	1,595	10,15	0,875	11,00	0,911	13,72	1,054			11,5475	1,10865353
Korea	KO	14,65	1,010	12,98	0,536	6,69	1,537	9,25	0,841			6,85	0,401	10,0840	0,86495718
Latvia	LV			14,15	0,840	14,19	0,781	14,11	0,914			13,25	2,408	13,9250	1,23561334
Luxembourg	LU	10,72	2,567	9,05	3,073	9,19	1,891	10,18	1,233	7,14	2,712	8,69	2,111	9,1617	2,26443913
Malaysia	MY			21,60	2,136	4,70	0,040	2,93	0,056	5,91	0,000	6,6	0,135	8,3480	0,4735269
Mexico	MX			14,14	0,873	9,63	0,168	21,01	0,095	18,99	0,223	14,83	0,039	15,7200	0,27972991
Morocco	MO	6,65	0,534	8,76	0,613	5,56	1,319	4,44	0,810					6,3525	0,8189568
Netherlands	NL	12,29	0,217	9,92	0,389	11,00	0,588	7,21	1,071	9,46	0,444	9,27	0,498	9,8583	0,5345929
Panama	PA	13,83	0,042	16,18	0,223	13,20	0,218	12,80	0,075	17,06	0,103	20,64	0,213	15,6183	0,14550517
Peru	PE	22,39	0,207	24,60	0,510	25,14	0,601	22,22	0,424	28,81	0,192	23,38	0,174	24,4233	0,35145955
Poland	PL	5,24	0,042	8,85	0,117	10,66	1,405	9,21	0,967	9,21	1,750	9,28	1,489	8,7417	0,9617845
Portugal	PO					8,15	0,770	9,49	0,557	9,97	0,808	8,25	1,676	8,9650	0,95284859
Puerto Rico	PR	11,61	1,514	10,63	1,247	10,32	0,789	8,48	0,101	10,04	0,382	8,28	0,197	9,8933	0,70502275
Qatar	QA	8,52	3,462	7,43	9,488	7,85	4,105			16,38	4,191			10,0450	5,31164816
Russia	RU	5,55	0,321			6,27	0,134			4,69	0,253	5,75	0,215	5,5650	0,23080947
Slovakia	SK	12,12	1,597	11,80	1,732	9,45	1,656	9,64	2,585	10,90	3,526	9,52	1,346	10,5717	2,07402947
Slovenia	SL	6,37	0,787	6,85	1,372	8,02	1,932	5,91	0,931	6,33	1,273	6,45	1,605	6,6550	1,31646903
South Africa	SA			10,96	3,058	6,91	2,641	9,19	2,937	6,97	2,834	10,59	4,881	8,9240	3,27026661
Spain	ES	6,39	0,261	6,19	0,342	5,23	0,347	5,70	0,262	5,47	0,676	5,21	0,408	5,6983	0,38276394
Sweden	SW	6,82	1,191	7,29	0,242	7,58	0,545	7,16	0,848	6,71	1,344	8,25	0,747	7,3017	0,81954018
Switzerland	SU	7,37	1,900	8,47	1,196	8,21	1,367	7,31	1,340	7,12	0,477	8,18	0,409	7,7767	1,11485849
Taiwan	TW	9,48	1,679	8,56	2,071	8,24	0,801	7,30	0,848	8,49	2,842	8,16	2,528	8,3717	1,79481161
Thailand	TH	19,68	0,956	21,62	3,721	17,24	0,570	13,74	0,627	23,30	0,307	17,66	1,321	18,8733	1,25012423
United Kingdom	UK	8,24	0,780	8,40	0,900	8,80	1,775	6,93	1,399	10,66	0,945	7,14	1,042	8,3617	1,14015423
Uruguay	UY	15,70	1,112	14,74	0,839	14,11	1,260	14,28	1,923	16,08	2,973	14,08	1,345	14,8317	1,57532351
USA	US	15,59	1,967	13,64	2,332	12,63	2,510	11,88	1,824	13,81	2,421	12,73	1,818	13,3800	2,14541733
Vietnam	VI			23,27	0,502			13,65	0,270	15,30	0,265	15,35	0,763	16,8925	0,4501792
Average														11,6563	1,3098

APPENDIX D: OUTLIER IDENTIFICATION (CHAPTER 5)

Outliers were identified with the Median Absolute Deviation method, as found on:
https://en.wikipedia.org/wiki/Median_absolute_deviation
https://docs.oracle.com/cd/E17236_01/epm.1112/cb_statistical/frameset.htm?ch07s02s10s01.html

	Country	ME (Average)	Relative median	
1	Italy	4,266666667	5,7025	
2	Bulgaria	4,5	5,469166667	
3	Japan	4,611666667	5,3575	
4	Germany	4,96	5,009166667	
5	France	5,056	4,913166667	
6	Russia	5,565	4,404166667	
7	Spain	5,698333333	4,270833333	
8	Finland	6,055	3,914166667	
9	Greece	6,163333333	3,805833333	
10	Morocco	6,3525	3,616666667	
11	Slovenia	6,655	3,314166667	
12	Sweden	7,301666667	2,6675	
13	Switzerland	7,776666667	2,1925	
14	Malaysia	8,348	1,621166667	
15	United Kingd	8,361666667	1,6075	
16	Taiwan	8,371666667	1,5975	
17	Croatia	8,476666667	1,4925	
18	Hungary	8,7175	1,251666667	
19	Poland	8,741666667	1,2275	
20	South Africa	8,924	1,045166667	
21	Portugal	8,965	1,004166667	
22	Ireland	9,093333333	0,875833333	
23	Luxembourg	9,161666667	0,8075	
24	India	9,766666667	0,2025	
25	Netherlands	9,858333333	0,110833333	
26	Puerto Rico	9,893333333	0,075833333	
27	Qatar	10,045	0,075833333	
28	Korea	10,084	0,114833333	
29	Slovakia	10,57166667	0,6025	
30	Egypt	11,195	1,225833333	
31	Kazakhstan	11,5475	1,578333333	
32	Israel	11,72	1,750833333	
33	China	12,15666667	2,1875	
34	Iran	12,84833333	2,879166667	
35	Argentina	12,945	2,975833333	
36	Australia	13,175	3,205833333	
37	USA	13,38	3,410833333	
38	Latvia	13,925	3,955833333	
39	Estonia	14,244	4,274833333	
40	Uruguay	14,83166667	4,8625	
41	Indonesia	15,505	5,535833333	
42	Panama	15,61833333	5,649166667	
43	Canada	15,68833333	5,719166667	
44	Mexico	15,72	5,750833333	
45	Vietnam	16,8925	6,923333333	
46	Thailand	18,87333333	8,904166667	
47	Brazil	18,87666667	8,9075	
48	Guatemala	20,45333333	10,48416667	
49	Colombia	22,025	12,05583333	
50	Peru	24,42333333	14,45416667	Outliers
51	Chile	25,02166667	15,0525	
52	Ecuador	32,718	22,74883333	

MAD Calculations	
Lowest value	4,26666667
Median	9,96916667
Maximum value	32,718
MAD	3,3625
3xMAD	10,0875
Upper limit	13,45
Lower limit	-6,725

	COUNTRY	TE (Average)	Relative median	
1	Brazil	0,014198641	0,943117902	
2	Panama	0,145505172	0,811811371	
3	Indonesia	0,159209579	0,798106964	
4	Ecuador	0,228312273	0,729004271	
5	Russia	0,230809466	0,726507077	
6	Mexico	0,279729914	0,677586629	
7	Bulgaria	0,28374947	0,673567073	
8	Peru	0,351459546	0,605856997	
9	Spain	0,38276394	0,574552603	
10	Finland	0,44062519	0,516691353	
11	Vietnam	0,450179198	0,507137346	
12	Greece	0,455896856	0,501419687	
13	Argentina	0,463025772	0,494290771	
14	Iran	0,471466981	0,485849562	
15	Malaysia	0,473526905	0,483789638	
16	Netherlands	0,534592898	0,422723645	
17	Puerto Rico	0,705022753	0,25229379	
18	Hungary	0,70988445	0,247432093	
19	Morocco	0,818956796	0,138359747	
20	Sweden	0,819540179	0,137776364	
21	Guatemala	0,85967534	0,097641203	
22	Korea	0,864957176	0,092359367	
23	Italy	0,870966141	0,086350402	
24	India	0,881688104	0,075628439	
25	Germany	0,896827163	0,06048938	
26	Portugal	0,952848585	0,004467958	
27	Poland	0,961784501	0,004467958	
28	Kazakhstan	1,108653528	0,151336985	
29	Switzerland	1,114858493	0,15754195	
30	United Kingd	1,140154226	0,182837683	
31	Latvia	1,235613343	0,2782968	
32	Thailand	1,250124225	0,292807682	
33	Israel	1,31322433	0,355907787	
34	Slovenia	1,316469028	0,359152485	
35	Australia	1,368046754	0,41073021	
36	Japan	1,483133636	0,525817093	
37	Uruguay	1,575323505	0,618006962	
38	China	1,606160582	0,648844039	
39	Estonia	1,730114985	0,772798441	
40	Taiwan	1,794811609	0,837495066	
41	Croatia	1,971250066	1,013933523	
42	Slovakia	2,074029471	1,116712928	
43	Egypt	2,107049643	1,1497331	
44	Canada	2,110645407	1,153328864	
45	USA	2,145417333	1,18810079	
46	Luxembourg	2,26443913	1,307122587	
47	Colombia	2,549775155	1,592458612	
48	France	2,831531103	1,87421456	
49	South Africa	3,270266613	2,31295007	Outliers
50	Ireland	3,500332985	2,543016442	
51	Chile	5,229267952	4,271951409	
52	Qatar	5,311648163	4,35433162	

MAD Calculations	
Lowest value	0,014198641
Median	0,957316543
Maximum value	5,311648163
MAD	0,521254223
3xMAD	1,56376267
Upper limit	2,085016893
Lower limit	-1,042508447

Outliers were determined to be Peru, Chile, Ecuador, South Arica, Ireland and Qatar.

APPENDIX E: CORRELATION COEFFICIENT AND P-VALUE

Correlation coefficient and p-value were calculated with excel formulas, as found on: https://www.educba.com/p-value-in-excel/

	ME	TE
ME	1	
TE	0,07088799	1

p value calculation			
r	deg_freedom(n)	t	p-value for correlation
0,070887989	46	0,471403643	0,639580733

APPENDIX F: Q1 AND Q4 DATA (CHAPTER 5)

			2018													
			Economic development		Technological development						Institutions				Education	Culture
	ME	TE	GDP (USD)	GDP per capita (USD)	Triadic patent family	Patents/GDP	R&D expenditure	Mobile broadband subscriptions	Fixed broadband subscriptions	R&D transfer (GEM)	Government policies: support and relevance (GEM)	Government policies: taxes and bureaucracy (GEM)	Government entrepreneurship programmes (GEM)	Commercial and legal infrastructure (GEM)	Tertiary education (GEM)	Cultural and Social Norms (GEM)
Q1																
France	5,056	2,831531103	2,78959E+12	41572,48501	1915,3618	0,68660953	2,193429611	88,5	43,26	2,87	3,59	3,2	3,41	3,18	75,81	2,85
Luxembourg	9,161666667	2,26443913	70885325883	116597,2956	36,6068	0,51642282	1,1731288	93,3	36,83	3,07	3,34	3,2	3,74	3,18	61,7	2,89
Slovakia	10,57166667	2,074029471	1,05475E+11	19364,62	11,152	0,10573122	0,84	86,1	27,69	1,96	1,5	1,79	2,06	3,21	43,43	1,75
Croatia	8,476666667	1,971250066	61375222347	15014,08502	9,8269	0,16011184				1,79	1,69	1,34	2,02	2,24	28,18	1,72
Taiwan	8,371666667	1,794811609	6,092E+11	25026	517,773	0,84992285	3,352			3,08	3,6	3,34	3,31	3,43	68,16	3,39
Slovenia	6,655	1,316469028	54137142149	26104,10279	9,709	0,17934083	1,946518554	77,9	29,36	2,61	2,64	1,99	2,95	2,99	56,91	2,25
United Kingdom	8,361666667	1,140154226	2,85732E+12	42992,80372	1677,1692	0,58697354	1,730882364	99,6	40,02	2,55	2,06	2,98	2,43	3,08	65,25	2,98
Switzerland	7,776666667	1,114858493	7,35889E+11	86388,405	1274,548	1,73198404		99,58	46,24	3,26	2,86	2,88	3,42	3,43	61,83	2,76
Average			9,10484E+11	46632,47465	681,5183375	0,60213708	1,872659888	90,83	37,23333333	2,64875	2,66	2,59	2,9175	3,0925		2,57375
Q4																
Guatemala	20,45333333	0,85967534	73208583759	4478,424646						1,98	1,48	2,19	1,91	2,83	7,61	3,02
Brazil	18,87666667	0,014198641	1,91695E+12	9151,445253	71,0681	0,03707359				2,12	1,78	1,45	2,08	2,69	9,71	2,1
Vietnam	16,8925	0,450179198	2,45214E+11	2566,447487												
Mexico	15,72	0,279729914	1,22235E+12	9686,514244	25,501	0,02086229	0,307124319	70,9	14,74	2,54	2,74	2,3	3,05	2,69		3,38
Panama	15,61833333	0,145505172	64928300000	15544,73352						1,98	1,79	2,05	2,58	2,11	35,38	2,78
Indonesia	15,505	0,159209579	1,04227E+12	3893,86	0,466	0,0004471				3,3	3,79	3,3	3,41	3,45		3,92
Argentina	12,945	0,463025772	5,17627E+11	11633,49801	13,0937	0,02529564	0,501220517			2,7	3,79	2,24	3,19	3,05	32,8	3,21
Iran	12,84833333	0,471466981	2,94357E+11	3598,483454						1,95	2,29	1,82	1,8	2,17	71,24	2,48
Average			6,72113E+11	7569,175826	27,5322	0,02091966	0,404172418	70,9	14,74	2,367142857	2,522857143	2,192857143	2,574285714	2,712857143	31,348	2,984285714

			2017													
			Economic development		Technological development						Institutions				Education	Culture
	ME	TE	GDP (USD)	GDP per capita (USD)	Triadic patent family	Patents/GDP	R&D expenditure	Mobile broadband subscriptions	Fixed broadband subscriptions	R&D transfer (GEM)	Government policies: support and relevance (GEM)	Government policies: taxes and bureaucracy (GEM)	Government entrepreneurship programmes (GEM)	Commercial and legal infrastructure (GEM)	Tertiary education (GEM)	Cultural and Social Norms (GEM)
Q1																
France	5,056	2,831531103	2,58874E+12	38685,25849	1978,4136	0,76423778	2,203482785	83,7	42,88	2,98	3,4	3,03	3,24	3,2	87,81	2,63
Luxembourg	9,161666667	2,26443913	64023412340	107361,3069	35,2436	0,55047987	1,268520652	86,1	35,9	3,11	3,05	3,35	3,48	3,39	67,15	2,5
Slovakia	10,57166667	2,074029471	95209000000	17504,211	10,768	0,11309855	0,886	82,8	25,83	1,84	1,94	1,7	1,99	3,14	39,41	1,98
Croatia	8,476666667	1,971250066	55481644098	13451,62495	8,9032	0,16047109				2,04	2,06	1,43	2,21	2,78	22,16	1,8
Taiwan	8,371666667	1,794811609	5,9073E+11	24408	489,223	0,82816684	3,195			2,67	2,48	2,95	3,01	2,77	77,24	3,37
Slovenia	6,655	1,316469028	48469082710	23455,94473	9,1375	0,18852224	1,865396993	70,5	28,92	2,63	2,55	1,84	2,66	2,96	51,07	2,3
United Kingdom	8,361666667	1,140154226	2,66248E+12	40304,72308	1649,7982	0,61964624	1,682585243	88,2	39,44	2,61	2,61	2,74	2,65	3,06	60,75	3,28
Switzerland	7,776666667	1,114858493	7,04479E+11	83352,089	1257,787	1,78541569	3,179	95,5	47,05	3,43	2,9	3,43	3,34	3,29	63,73	3,23
Average			8,51202E+11	43565,39477	679,9092625	0,62625479	2,039997953	84,46666667	36,67	2,66375	2,62375	2,55875	2,8225	3,07375		2,63625
Q4																
Guatemala	20,45333333	0,85967534	71654134379	4454,04815						1,84	1,56	2,08	1,85	2,85	11,11	3,09
Brazil	18,87666667	0,014198641	2,06351E+12	9928,643063	68,6263	0,03325711				1,84	1,87	1,58	1,95	2,58	5,96	2,19
Vietnam	16,8925	0,450179198	2,2378E+11	2365,521615						2,19	1,9	2,4	2,09	2,82	56,35	3,62
Mexico	15,72	0,279729914	1,15891E+12	9287,849587	26,5193	0,02288291	0,328316702	65,7	13,78	2,62	3,18	2,4	3,2	2,99	10,73	2,95
Panama	15,61833333	0,145505172	62202700000	15146,40237						2,15	2,1	2,8	2,69	2,78	37,69	2,85
Indonesia	15,505	0,159209579	1,01562E+12	3837,578	0,473	0,00046573				3,11	3,74	3,42	3,45	3,32	28,44	3,56
Argentina	12,945	0,463025772	6,43629E+11	14613,04182	13,7636	0,02138438	0,556314999			2,56	3,75	1,86	3,17	2,89	44,96	3,1
Iran	12,84833333	0,471466981	4,45345E+11	5520,314782						1,57	2,23	1,28	1,34	1,26	60,81	2,44
Average			7,10581E+11	8144,174925	27,34555	0,01949753	0,44231585	65,7	13,78	2,235	2,54125	2,2275	2,4675	2,68625	32,00625	2,975

			2016													
			Economic development		Technological development						Institutions				Education	Culture
	ME	TE	GDP (USD)	GDP per capita (USD)	Triadic patent family	Patents/GDP	R&D expenditure	Mobile broadband subscriptions	Fixed broadband subscriptions	R&D transfer (GEM)	Government policies: support and relevance (GEM)	Government policies: taxes and bureaucracy (GEM)	Government entrepreneurship programmes (GEM)	Commercial and legal infrastructure (GEM)	Tertiary education (GEM)	Cultural and Social Norms (GEM)
Q1																
France	5,056	2,831531103	2,47129E+12	37037,37419	2043,4295	0,82686902	2,222383891	79,1	41,42	3,01	3,57	3,25	3,32	3,14	81	2,25
Luxembourg	9,161666667	2,26443913	60691483443	104278,391	35,919	0,59182933	1,297860237	82,5	34,77	3,07	3	2,86	3,48	3,48	58	2,44
Slovakia	10,57166667	2,074029471	89655000000	16508,67	9,979	0,11130444	0,791	79,2	24,61	1,96	1,77	1,92	2,06	2,9	39	2,21
Croatia	8,476666667	1,971250066	51601147666	12361,48383	6,5078	0,12611735				1,7	1,73	1,48	2,14	2,56	27	1,82
Taiwan	8,371666667	1,794811609	5,4308E+11	22592	460,302	0,84757678	3,086			2,79	2,63	2,7	3,01	2,78	73	3,11
Slovenia	6,655	1,316469028	44736333522	21663,64341	8,3666	0,18702024	2,00763704	62,2	28,31	2,3	2,45	1,89	2,59	3,05	51	1,98
United Kingdom	8,361666667	1,140154226	2,69325E+12	41048,34966	1583,8061	0,58806554	1,660871344	83,4	38,8	2,27	2,22	2,78	2,39	2,87	55	2,8
Switzerland	7,776666667	1,114858493	6,95601E+11	83073,28	1231,683	1,77067546		97,8	45,68	3,42	3,17	3,19	3,51	3,49	56	3,4
Average			8,31237E+11	42320,39901	672,499125	0,63118227	1,844292085	80,7	35,59833333	2,565	2,5675	2,50875	2,8125	3,03375	55	2,50125
Q4																
Guatemala	20,45333333	0,85967534	66053725049	4173,301666						2,05	1,84	2,18	1,86	3,02	7	3,06
Brazil	18,87666667	0,014198641	1,7957E+12	8710,096774	64,8303	0,03610308				1,84	2,11	1,49	2,06	2,7	6	2,34
Vietnam	16,8925	0,450179198	2,05276E+11	2192,174482											7	
Mexico	15,72	0,279729914	1,07849E+12	8744,515559	24,6837	0,02288726	0,387775993	61,5	13,04	2,5	2,57	2,35	2,94	2,83	22	3,12
Panama	15,61833333	0,145505172	57907700000	14343,98139						2,1	2,09	2,98	2,39	2,53	18	3,11
Indonesia	15,505	0,159209579	9,31877E+11	3562,8163	0,905	0,00097116				2,49	2,77	2,27	2,46	2,4	14	3,24
Argentina	12,945	0,463025772	5,57531E+11	12790,24247	13,0055	0,02332694	0,530192017			2,38	3,3	1,34	2,91	2,67	39	3,08
Iran	12,84833333	0,471466981	4,17984E+11	5253,42656						1,81	2	1,62	1,36	1,85	64	2,1
Average			6,38853E+11	7471,319401	25,856125	0,02082211	0,458984005	61,5	13,04	2,167142857	2,382857143	2,032857143	2,282857143	2,571428571	22,125	2,864285714

			2015													
			Economic development		Technological development						Institutions				Education	Culture
	ME	TE	GDP (USD)	GDP per capita (USD)	Triadic patent family	Patents/GDP	R&D expenditure	Mobile broadband subscriptions	Fixed broadband subscriptions	R&D transfer (GEM)	Government policies: support and relevance (GEM)	Government policies: taxes and bureaucracy (GEM)	Government entrepreneurship programmes (GEM)	Commercial and legal infrastructure (GEM)	Tertiary education (GEM)	Cultural and Social Norms (GEM)
Q1																
France	5,056	2,831531103	2,43821E+12	36638,18493	2298,4988	0,94270009	2,267030775	73,8	40,35							
Luxembourg	9,161666667	2,26443913	57744457955	101376,4966	22,6643	0,39249308	1,302198172	83,8	35,16	3,23	3,15	3,28	3,59	3,6	62	2,48
Slovakia	10,57166667	2,074029471	88468000000	16310,988	8,833	0,09984401	1,162	68	23,49	1,94	2,27	2,08	2,25	3,28	44	2,01
Croatia	8,476666667	1,971250066	49525747504	11781,73479	2,75	0,05552667				1,77	1,82	1,35	1,97	2,6	23	1,62
Taiwan	8,371666667	1,794811609	5,3452E+11	22400	442,847	0,82849472	3			2,47	2,7	2,74	2,51	2,67	72	2,87
Slovenia	6,655	1,316469028	43090173395	20881,76693	6,5333	0,15161926	2,19564741	47,8	27,33	2,29	2,45	1,93	2,75	2,82	54	2,08
United Kingdom	8,361666667	1,140154226	2,93278E+12	45039,23595	1682,5001	0,57368687	1,647495547	83,2	37,88	2,53	2,8	2,54	2,71	3,04	61	3,26
Switzerland	7,776666667	1,114858493	7,0215E+11	84776,14217	1231,683	1,75416042	3,264	99,2	46,36	3,73	3,44	3,49	3,59	3,72	51	3,52
Average			8,55811E+11	42400,56867	712,0386875	0,59981564	2,119767415	75,96666667	35,095	2,565714286	2,661428571	2,487142857	2,767142857	3,104285714		2,548571429
Q4																
Guatemala	20,45333333	0,85967534	62186186576	3994,636913						1,7	1,69	2,02	1,98	2,49	7	2,62
Brazil	18,87666667	0,014198641	1,80221E+12	8814,001418	64,6892	0,03589429				1,79	2,2	1,53	2,07	2,52	7	2,38
Vietnam	16,8925	0,450179198	1,93241E+11	2085,101349						2,33	2,62	2,78	2,14	2,77	40	3,23
Mexico	15,72	0,279729914	1,17187E+12	9616,645558	29,9035	0,02551781	0,429427152	52,9	12,08	2,46	2,83	2,29	3,02	2,83	12	3,03
Panama	15,61833333	0,145505172	54091800000	13630,32287						2,05	1,74	3,32	2,28	2,68	36	3,12
Indonesia	15,505	0,159209579	8,60854E+11	3331,695115	1,667	0,00193645				2,92	3,04	2,7	2,86	2,85	12	3,43
Argentina	12,945	0,463025772	5,94749E+11	13789,06042	11,2333	0,01888745	0,618540979			2,29	1,84	1,35	2,19	2,81	32	2,94
Iran	12,84833333	0,471466981	3,84951E+11	4904,327315						1,78	2,27	1,99	1,35	1,75	58	2,19
Average			6,4052E+11	7520,72387	26,87325	0,020559	0,523984066	52,9	12,08	2,165	2,27875	2,2475	2,23625	2,5875	25,5	2,8675

			2014													
			Economic development		Technological development						Institutions				Education	Culture
	ME	TE	GDP (USD)	GDP per capita (USD)	Triadic patent family	Patents/GDP	R&D expenditure	Mobile broadband subscriptions	Fixed broadband subscriptions	R&D transfer (GEM)	Government policies: support and relevance (GEM)	Government policies: taxes and bureaucracy (GEM)	Government entrepreneurship programmes (GEM)	Commercial and legal infrastructure (GEM)	Tertiary education (GEM)	Cultural and Social Norms (GEM)
Q1																
France	5,056	2,831531103	2,85217E+12	43011,2631	2495,7446	0,87503491	2,27591667	64,7	39,17	2,73	2,99	2,96	3,17	3,06	76	2,14
Luxembourg	9,161666667	2,26443913	66103853237	118823,6484	19,7595	0,29891601	1,264036617	84,2	33,6	2,98	3,41	3,22	3,47	3,5	67	2,56
Slovakia	10,57166667	2,074029471	1,0119E+11	18674,344	7,628	0,07538294	0,878	59,9	21,98	2,13	2,28	2,16	2,26	3,07	39	2,4
Croatia	8,476666667	1,971250066	57639588806	13599,40978	10,0649	0,17461783				2,04	2,15	1,55	2,27	2,9	24	2,02
Taiwan	8,371666667	1,794811609	5,3533E+11	22668	387,663	0,72415706	2,98			2,68	2,71	2,91	2,73	2,65	74	3,26
Slovenia	6,655	1,316469028	49930685013	24214,92207	13,4333	0,26903897	2,3654796	44,3	26,73	2,29	2,13	1,92	2,43	2,71	55	2,06
United Kingdom	8,361666667	1,140154226	3,06552E+12	47452,19914	1678,1617	0,54743113	1,642483553	76,2	36,7	2,2	2,9	2,33	2,62	2,95	54	2,83
Switzerland	7,776666667	1,114858493	7,34397E+11	89684,70758	1179,993	1,60675174		96,4	45,89	3,57	3,08	3,7	3,48	3,51	49	3,4
Average			9,32785E+11	47266,06175	724,056	0,57141632	1,900986073	70,95	34,01166667	2,5775	2,70625	2,59375	2,80375	3,04375		2,58375
Q4																
Guatemala	20,45333333	0,85967534	57852399964	3779,642336						2,09	1,91	2,1	1,87	2,89	5	2,44
Brazil	18,87666667	0,014198641	2,45599E+12	12112,58767	61,0953	0,024876				2	2,4	1,46	2,24	2,5	8	2,36
Vietnam	16,8925	0,450179198	1,86205E+11	2030,278447						2,3	2,93	2,46	2,35	2,93	49	3,13
Mexico	15,72	0,279729914	1,31535E+12	10928,91601	28,34	0,02154558	0,435300906	43	10,72	2,44	2,27	1,87	2,69	2,64	11	2,99
Panama	15,61833333	0,145505172	49921400000	12796,05753						2,35	2,11	2,95	2,52	2,68	27	2,75
Indonesia	15,505	0,159209579	8,90815E+11	3491,637491	0,392	0,00044005				2,63	2,91	2,48	2,57	2,96	20	3,31
Argentina	12,945	0,463025772	5,2632E+11	12334,79825	9,6093	0,01825754	0,592492534			2,49	2,08	1,49	2,7	2,85	36	3,01
Iran	12,84833333	0,471466981	4,32687E+11	5585,525604						2,08	1,75	1,57	1,6	2,15	51	2,25
Average			7,39393E+11	7882,430416	24,85915	0,01627979	0,51389672	43	10,72	2,2975	2,295	2,0475	2,3175	2,7	25,875	2,78

			2013													
			Economic development		Technological development						Institutions				Education	Culture
	ME	TE	GDP (USD)	GDP per capita (USD)	Triadic patent family	Patents/GDP	R&D expenditure	Mobile broadband subscriptions	Fixed broadband subscriptions	R&D transfer (GEM)	Government policies: support and relevance (GEM)	Government policies: taxes and bureaucracy (GEM)	Government entrepreneurship programmes (GEM)	Commercial and legal infrastructure (GEM)	Tertiary education (GEM)	Cultural and Social Norms (GEM)
Q1																
France	5,056	2,831531103	2,81108E+12	42592,93539	2425,5805	0,86286497	2,237025131	55,4	37,8	2,48	3,28	2,99	3,17	3,02	63	2,21
Luxembourg	9,161666667	2,26443913	61739352212	113625,1329	14,675	0,23769281	1,302660068	86,1	32,51	2,78	3,4	3,39	3,61	3,27	64	2,38
Slovakia	10,57166667	2,074029471	98849000000	18260,016	9,638	0,09750225	0,821	50,4	20,49	1,94	1,9	1,94	2,16	2,79	33	1,89
Croatia	8,476666667	1,971250066	58194069434	13674,4178	4,789	0,08229361				2,08	2,19	1,83	2,48	2,7	29	2,02
Taiwan	8,371666667	1,794811609	5,1294E+11	21916	337,083	0,65715873	3,002			2,49	2,7	2,75	2,32	3,42	66	3,61
Slovenia	6,655	1,316469028	48401896808	23496,6025	14,4595	0,29873829	2,564868238	37,9	25,47	2,39	1,91	2,05	2,53	2,82	53	2,23
United Kingdom	8,361666667	1,140154226	2,78325E+12	43401,31053	1828,8839	0,65710345	1,621890475	71,8	35,5	2,53	2,95	2,64	2,65	3,1	64	3,09
Switzerland	7,776666667	1,114858493	7,12748E+11	88109,48675	1117,252			70,5	45,15	3,48	3,44	3,69	3,47	3,55	53	3,31
Average			8,859E+11	45634,48773	719,0451125	0,4133363	1,924907319	62,01666667	32,82	2,52125	2,72125	2,66	2,79875	3,08375	53,125	2,5925
Q4																
Guatemala	20,45333333	0,85967534	52996540704	3522,773706						2,18	2,16	2,11	2,43	3,38	4	2,63
Brazil	18,87666667	0,014198641	2,47281E+12	12300,32482	59,729	0,02415433				2	2,5	1,68	2,28	2,35	8	2,74
Vietnam	16,8925	0,450179198	1,71222E+11	1886,69017						2,54	2,89	2,77	2,5	2,89	57	3,1
Mexico	15,72	0,279729914	1,27444E+12	10725,18359	19,5551	0,01534404	0,425028177	29,3	10,51	2,6	3,03	2,24	3,06	2,72	10	3,08
Panama	15,61833333	0,145505172	45599900000	11889,07056						2,29	2,7	2,83	3,08	2,76	29	3,03
Indonesia	15,505	0,159209579	9,12524E+11	3623,927241	4,444	0,00487001				2,31	2,69	2,22	2,53	3,25	11	3,29
Argentina	12,945	0,463025772	5,52025E+11	13080,25473	7,1761	0,01299959	0,622336145			2,66	1,98	1,54	2,76	3,05	25	3,24
Iran	12,84833333	0,471466981	4,60293E+11	6018,3229						1,93	1,85	1,63	1,54	2,11	51	2,21
Average			7,42739E+11	7880,818464	22,72605	0,01434199	0,523682161	29,3	10,51	2,31375	2,475	2,1275	2,5225	2,81375	24,375	2,915

	Number of universities offering technology majors (2020)	Population (2020)	Universities per 1 million inhabitants
Q1			
France	32	67397582	0,474794481
Luxembourg	1	632275	1,581590289
Slovakia	2	5458827	0,366379077
Croatia	2	4047200	0,494168808
Taiwan	26	23570000	1,103097157
Slovenia	2	2100126	0,952323813
United Kingdom	52	67215293	0,773633465
Switzerland	2	86368960	0,023156467
Q4			
Guatemala		16858333	
Brazil	32	212559409	0,150546147
Vietnam	3	97338583	0,030820256
Mexico	14	128932753	0,108583736
Panama		4314768	
Indonesia	5	2735232621	0,001827998
Argentina	2	45376763	0,044075422
Iran	33	83992953	0,392890104

Hofstede cultural dimensions	Power Distance	Individualism	Masculinity	Uncertainty Avoidance	Long-term Orientation	Indulgence
The Netherlands	38	80	14	53	67	68
Japan	54	46	95	92	88	42
Q1						
France	68	71	43	86	63	48
Luxembourg	40	60	50	70	64	56
Slovakia	100	52	100	51	77	28
Croatia	73	33	40	80	58	33
Taiwan	58	17	45	69	93	49
Slovenia	71	27	19	88	49	48
United Kingdom	35	89	66	35	51	69
Switzerland	34	68	70	58	74	66
Average	59,875	52,125	54,125	67,125	66,125	49,625
Q4						
Guatemala	95	6	37	98		
Brazil	69	38	49	76	44	59
Vietnam	70	20	40	30	57	35
Mexico	81	30	69	82	24	97
Panama	95	11	44	86		
Indonesia	78	14	46	48	62	38
Argentina	49	46	56	86	20	62
Iran	58	41	43	59	14	40

			Average														
			Economic development		Technological development						Institutions				Education		Culture
	ME	TE	GDP (USD)	GDP per capita (USD)	Triadic patent family	Patents/GDP	R&D expenditure	Mobile broadband subscriptions	Fixed broadband subscriptions	R&D transfer	Government policies: support and relevance	Government policies: taxes and bureaucracy	Government entrepreneurship programmes	Commercial and legal infrastructure	Tertiary education	Universities offering technology majors (2020)	Cultural and Social Norms
Q1																	
France	5,056	2,831531103	2,65851E+12	39922,91685	2192,838133	0,826386048	2,233211477	74,2	40,81333333	2,814	3,366	3,086	3,262	3,12	76,724	0,474794481	2,416
Luxembourg	9,161666667	2,26443913	63531314178	110343,7119	27,47803333	0,431305654	1,268067424	86	34,795	3,04	3,225	3,216666667	3,561666667	3,403333333	63,30833333	1,581590289	2,541666667
Slovakia	10,57166667	2,074029471	96474333333	17770,47483	9,666333333	0,100477236	0,896333333	71,06666667	24,015	1,961666667	1,943333333	1,931666667	2,13	3,065	39,64	0,366379077	2,04
Croatia	8,476666667	1,971250066	55636236642	13313,7927	7,1403	0,126523067				1,903333333	1,94	1,496666667	2,181666667	2,63	25,55666667	0,494168808	1,833333333
Taiwan	8,371666667	1,794811609	5,543E+11	23168,33333	439,1485	0,789246166	3,1025			2,696666667	2,803333333	2,898333333	2,815	2,953333333	71,73333333	1,103097157	3,268333333
Slovenia	6,655	1,316469028	48127552266	23302,8304	10,2732	0,212379972	2,157591306	56,76666667	27,68666667	2,418333333	2,355	1,936666667	2,651666667	2,891666667	53,49666667	0,952323813	2,15
United Kingdo	8,361666667	1,140154226	2,83243E+12	43373,10368	1683,386533	0,595484461	1,664368088	83,73333333	38,05666667	2,448333333	2,59	2,668333333	2,575	3,016666667	60	0,773633465	3,04
Switzerland	7,776666667	1,114858493	7,1421E+11	85897,35175	1215,491	1,729797467	3,2215	93,16333333	46,06166667	3,481666667	3,148333333	3,396666667	3,468333333	3,498333333	55,76	0,023156467	3,27
Average	8,053875	1,813442891	8,77903E+11	44636,56443	698,1777542	0,601450009	2,07765309	77,48833333	35,23805556	2,5955	2,671375	2,578875	2,830666667	3,072291667	55,777375	0,721142945	2,569916667
Q4																	
Guatemala	20,45333333	0,85967534	63991928405	4067,137903						1,973333333	1,773333333	2,113333333	1,983333333	2,91	6,953333333		2,81
Brazil	18,87666667	0,014198641	2,08453E+12	10169,5165	65,00636667	0,031893065				1,931666667	2,143333333	1,531666667	2,113333333	2,556666667	7,445	0,150546147	2,351666667
Vietnam	16,8925	0,450179198	2,04156E+11	2187,702258						2,34	2,585	2,6025	2,27	2,8525	41,87	0,030820256	3,27
Mexico	15,72	0,279729914	1,20357E+12	9831,604091	25,75043333	0,021506649	0,385495542	53,88333333	12,47833333	2,526666667	2,77	2,241666667	2,993333333	2,783333333	13,146	0,108583736	3,091666667
Panama	15,61833333	0,145505172	55775300000	13891,76137						2,153333333	2,088333333	2,821666667	2,59	2,59	30,51166667		2,94
Indonesia	15,505	0,159209579	9,42327E+11	3623,585691	1,391166667	0,001521748				2,793333333	3,156666667	2,731666667	2,88	3,038333333	17,088	0,001827998	3,458333333
Argentina	12,945	0,463025772	5,65313E+11	13040,14928	11,31358333	0,020025257	0,570182865			2,513333333	2,79	1,636666667	2,82	2,886666667	34,96	0,044075422	3,096666667
Iran	12,84833333	0,471466981	4,05936E+11	5146,733436						1,853333333	2,065	1,651666667	1,498333333	1,881666667	59,34166667	0,392890104	2,278333333
Average	16,10739583	0,355373825	6,907E+11	7744,773817	25,8653875	0,01873668	0,477839203	53,88333333	12,47833333	2,260625	2,421458333	2,166354167	2,393541667	2,687395833	26,41445833	0,121457277	2,912083333

APPENDIX G: INTERVIEW WITH DR.IR. BERT ENSERINK

Transcript of interview with Dr.ir. Bert Enserink, associate professor at the Policy Analysis section of the Faculty of Technology, Policy and Management of Delft University of Technology

Recorded on 13-12-2021, at 16:30 CET (Recording started after 3 minutes)

Dr. Enserink: We were talking about the fact that Japan has much more technical education. That will definitely play a role. Perhaps you should take a look at the history post-World War II and the way that societies have rebuilt themselves. Japan was heavily industrialised, whereas in the Netherlands the focus was foremost on food supply, and we have not been as industrialised as Japan, I believe. We do have a lot of services here, perhaps more than Japan but I am not sure. But if you look at the tech sector specifically, in Japan it will be relatively larger than here.

T. Avé: That is reflected in the number of patents per GDP, that difference is very large. In absolutes it's about 18000 patents versus 1000 here.

The percentage of people working in the tech sector is most likely much higher in Japan than here.

That could very well be. I did not take that into consideration.

That could be an indicator.

That is most likely an important indicator that I have missed, or have not taken into consideration: the size of the tech sector.

The relative size. There could be something there, and that would have a self-reinforcing effect. If your parents have studied, the chances of you studying are much larger. If your parents work in tech, then the chances of you liking tech are much larger. That mechanism is embedded in there. The other thing is that there are cultural theories. Have you looked at the Hofstede cultural dimensions?

Yes, I have looked at those.

If you look at those then it seems that many Asian societies are much more open for new things and new technologies than Western societies.

What dimensions would that be reflected in?

Is that not uncertainty avoidance?

I'm not sure. Japan has a higher score for uncertainty avoidance, does that not mean that they are less open for new things?

Could be. I don't know those numbers. I know that Korea, China, Vietnam etc. all score either very high or very low, I'm not sure. The point is that they are much more tech savvy than we are. When you walk around in China ore Korea, everyone has a phone that is three generations ahead of ours. When I was there 20 years ago, everyone was walking around with earphones, and they still had to be invented here. It indicates that there is something in their culture or spirit that makes people more curious or more playful in experiencing new things.

Yes, I've looked at culture. I looked at what kind of culture would stimulate someone to engage in TE. I found a theory that said, from the Hofstede dimensions, a high level of individualism.

Which we have here in the West.

Exactly, that would indicate that you would be good at entrepreneurship. But I have not been able to confirm that theory. You would think that the urge to distinguish yourself from the rest can be satisfied by becoming an entrepreneur, but I did not find this. And also because Asian countries have a pretty high score for collectivism, which is the opposite end. But what I did see, which is interesting, is that countries that have a high percentage of TE. I mean from an entire mix of countries, that these countries have high levels of individualism and long-term orientation. I am not entirely sure yet what to make of this, but it is an interesting result. Are you familiar with the "dissatisfaction approach" theory of culture and entrepreneurship?

No.

There are several ideas, on one end national culture will direct someone towards entrepreneurship, and the other idea is that entrepreneurs have their own culture because they are dissatisfied with the status quo. So, there is something within them already that drives them towards entrepreneurship. I tend to lean towards that idea, perhaps separate from a national culture, but I'm not entirely sure about it yet.

The national cultures are really stereotypical, actually, so we are stepping away from those. Every now and then they are a convenient coat rack to put things on, and it can come in handy if you know how to offer your business card in Japan, but other than that, the idea that culture is something stable and difficult to change is simply incorrect. If you look back 20 years ago, there was a different culture in The Netherlands than now, as well as in Japan, and we have started to look more alike than we've ever held possible. In that sense I can imagine that entrepreneurs can be more similar than a Dutch entrepreneur and a Dutch official or something like that. You see it in the student population as well, that Japanese, and Chinese, and Indonesian students, and you, are more alike than a Japanese student and a Japanese farmer, or you and a Dutch farmer. To become an entrepreneur, you need a certain drive, and want to distinguish yourself and set goals and achieve those. Those are very characteristic of course.

Yes. Exactly.

If I think of the traditional entrepreneurs, I see a few family members and I think, yes, those are type of people that are like, "I am good at something, and I want to earn money doing that, a lot of money, big house and big car." Whereas the tech entrepreneurs, they have something of wanting to improve something. Not the world per se, but there is some sort of practice they want to improve, which they think will help. They want to solve problems, that is slightly different. Most of them, I think.

No, I think that is the case as well.

[…]

So, the influencing variables that influence TE are technological development, education, and economic development. From a policy standpoint, what could you do with that? If these variables are strongly linked to a high level of TE.

It depends on what you want to do with it. I mean, it's nice to research what this could be related to. But if you say, I want policy recommendations, you need to know what the problem is you are working with. Do we need to become like Japan? Or should there be more tech entrepreneurs, and what would that be good for? […] As a counterargument, we should rather increase the number of health entrepreneurs. I think we have more need of those currently. […] But why should we need more tech entrepreneurs?

Well, there's not really a reason for that. It depends on what you want. I mean, if The Netherlands has those ambitions…

Do we have those ambitions? I just don't know.

Oh, well I think the ambition is somewhat there. They want to increase their investment in startups etc.

Is there a policy for that? You could check that, just on a website.

As far as I know, since recently.

Alright, well I mean you need to have some sort of justification for the social relevance of your research question. If the ministry of economic affairs has a policy that they're not really doing much with, it could be nice3 to say, "look we have formulated some policy goals, but your website does not indicate clearly what we should do or how we should go about it", and then your research gives first direction to that. That could be nice. So, if we say that these factors are important, then we should make sure that more people get into tech education, or that everyone has mandatory math classes, or something like that. You can start coming up with thins.

Yes. I'm not exactly sure what kind of policies there are currently. I know there is some sort of fund, but I'm not entirely sure.

You can verify that pretty easily, just do a Google search. That sort of policy information is available online.

And what if we say that The Netherlands has those ambitions?

Aha. Well, based on your findings, what do you think?

Well, economic development would be a good one, but The Netherlands is a well-developed country, economically, so it would be hard to come up with something to improve that. Education seems pretty clear, have more people do a technical study, or send more students abroad to do technical studies which are less available here. My guess is that they do that in Israel. And technological development, that one is a bit difficult. You could try to get more R&D from abroad, meaning, to have large companies establish themselves here to increase the size of the entire industry.

But as a tech company you're not going to The Netherlands because there aren't enough people with a tech background. Right? I mean, that is precisely the problem. Because you have to create an environment where those sorts of people are present first.

Yes.

One of the arguments for attracting so many foreign students is that we hope that some of them stay and get a job in tech here. So, you could do something along the lines of 'how do I get more students interested in tech?'. You can do that by paying special attention to it at high school. You see that happening already. And more women in tech helps as well, especially if they go into ICT etc. So, I think that there is potential on the side of education. But you could also think about special regulations for startups. There are some already, but you can expand those. For example, if you have a company that launches a new product, that you are exempt from taxes for five years or something like that, I don't know you have all kinds of funds for this.

[…]

Incubators are another mechanism which generates a kind of flywheel whereby small companies help each other through the difficult period. That is another method. You can see it at almost all universities, they have a

YES!Delft, YES!Eindhoven, YES!Twente. I'm sure they're named differently, but it's just another mechanism that helps with something like that. You could also do it at HBO-MBO level, that kind of institutional help. They help with housing, and they have administrative support, and you name it. It removes several barriers that complicate starting a company. The moment you have to hire staff and implement HR policy when you've never done that; it's a huge task. But, if there is a service that does that for you, you're more willing to hire people. So, reducing the hassle is another one.

Yes.

Make it easier to start your own company.

Yes. Alright.

So, what else? I wouldn't now, what else. If you look at policy, yes, subsidies, removing barriers, hassle, education, yes, do you know any more?

No, I think we are pretty much on the same page concerning the things that should happen. Let's see I had a list somewhere. I think you've mentioned everything I had on that list. […] Indeed, more collaboration between universities and industry…

Yes?

No, that's it, I think. What's interesting, in the case of Ireland, it's a tax haven of course, but they also have high levels of TE, so that could also help in some sort of way.

And what if you think about international collaboration? Would it help, or not, to create international networks? I have a former student that started a tech company. He lived in Delft, he's moved to Portugal now, but he worked with many programmers that were based in Hungary and Romania. So, he had a company, that was virtually in Delft, but the work was happening elsewhere. You see that a lot of course, outsourcing. Is there some aspect there that could be interesting to you?

But would you look at it from an EU-regional standpoint?

I don't know, I'm just saying something. [laughs]

Yes, me neither. [laughs]

I'm just thinking, 'what do I know in that area', and in The Netherlands it was too expensive to hire programmers who could work that long on the product. So, they came from abroad.

Well, if you're talking about access to people with technical skills, then yes, of course.

If you don't have enough people with technical skills in The Netherlands, you have to get them from somewhere else. That's why we get foreign students to The Netherlands, and why we outsource software development.

Time's almost up, but what if you look at the other side of the story? It doesn't have to be Japan, but for example, say country X, how can they improve other forms of entrepreneurship? Meaning ME.

How can Japan sell more jeans?

Yes.

[laughs] Do they need that?

Personally, I don't think so, but it might be fun to think about.

It's probably just me, but I'm in the phase where I think that we need to live more frugally, and use less resources etc. So, we should buy less and consume less. Perhaps a service-based economy is less bad than a production-based economy. I'm not sure. But we'll always need entrepreneurs, otherwise there will be no innovation. We shouldn't

stand still either. But the tech entrepreneur is a subcategory within the entrepreneurs; there are many people who want to become entrepreneurs or are forced to become entrepreneurs because they need an income. If you look at the entire developing world, Asia, Afrika, everyone is an entrepreneur. Because everyone in the countryside needs to find something to provide, selling whatever they find. So, almost everyone has that entrepreneurial spirit. But what distinguishes the tech entrepreneur from the normal entrepreneur, it's that specific knowledge. That they can do, or understand something, that others can't. So, I think the question of how to stimulate mainstream entrepreneurs is a less relevant question than how to facilitate tech entrepreneurs.

Alright, got it. I think, especially in the example of Japan, it is correct. Because in a well-developed economy [with many job opportunities], the need for entrepreneurship, to open a café, or sell jeans, it kind of fades because of the comfort.

I'm not sure what you're saying now is correct, because if I look around here, I only see new cafes opening.

*Yes, true, but in comparison to Asia, the ratio, or the percentage is much lower here.**

Ok, that could be, I don't know.

[…]

Well, the half hour is over, I enjoyed the conversation, it was very valuable.

Good.

**Note: the example of cafes and jeans-sellers was a little awkward. The point was that there is less need-based entrepreneurship in Japan because of the economic opportunities (i.e., jobs), than in developing countries in Asia or Africa. It could be that things such as cafes and jeans shops might be opened out of 'passion', or 'want', rather than need-based.*

APPENDIX H: INTERVIEW DR.IR. ELS VAN DAALEN

Transcript of interview with Dr.ir. Els van Daalen, associate professor at the Policy Analysis section of the Faculty of Technology, Policy and Management of Delft University of Technology

Recorded on 17-12-2021, at 16:30 CET

T. Avé: The purpose of this interview is to have a brainstorm session with an expert and discuss the results of my thesis, and what the possible implications for policy. Did you have time to review the documents that were in the email?

Dr.ir. van Daalen: Yes, I've reviewed those.

Alright, in that case, what do you think? Do you have any questions about its content?

It's not entirely clear to me what your question is. I see that you differentiate between TE and ME. You look at what influences the number of technology entrepreneurs, and if you want to stimulate that you should do something with the economic environment, or technology policy or something, as well as education. What are you looking for exactly?

Looking at the results, and suppose that The Netherlands wants to increase the level of TE, knowing that economic development, technological development, and education are good for that, what could I do on a policy-level to direct or encourage that? That's the question.

[…]

With policy issues and policy measures there is a problem owner, and the problem owner is usually a ministry or something like that. So, one ministry comes up with policy, and you'd have to look at that. So, you brought up three types of policy measures right, economic, technological, and education. Then what I'm thinking is, for education it will be The Ministry of Education. Next, what type of policy is it about? Is it about simulating technical education? Or is it about stimulating education of technology and entrepreneurship combined, or do you just want to have more people studying technology? How do you see that?

What I was thinking is that, not the entrepreneurship education is good, but specifically a higher level, and even more specifically technical education.

Yes, so then the question becomes, "how do you stimulate more people to study technical subjects?". There are always different types of policy measures, I don't know them by heart, but you have financial law, information etc. So, you can ask yourself, what can I do financially, what can I do in terms of laws, and what could I do concerning information provision to stimulate that.

Do you have any idea what it could be in those three areas?

Well, for example, technical universities always received a little more funding per student. For a while, there were also talks about having ICT students pay lower tuition fees. So, you can think of certain policy measures so that people will choose to study more technical majors. And you could also give other universities less funding; meaning, you would distribute the entire educational budget differently, if you would like. There were also a lot of advertisements for a while to stimulate more girls to study technical fields. They made sure to include role models in those advertisements, those kind of things. It costs a little less, but it is also perhaps less effective.

This is exactly what I'm trying to get from this conversation, these sort of ideas. This is incredibly helpful.

You could look up what type of policies there are. There is financial etc. There are 6 different types or something. Per type you can think of, what ministry could change something, or what did they do in the past that is comparable. That is education for example. And if you look at technology and economy, you would perhaps end up at, I'm not sure, [The Ministry of] Economic Affairs. And that economy, it depends what type of economic development influences TE.

Yes, that was a bit difficult because I only looked at GDP per capita. So, to say that you will just increase GDP per capita like that is quite difficult.

Yes, so you can't really guide it like that. Technology policy is a new area, I'm not familiar with the details, but I'm assuming that [The Ministry of] Economic Affairs can stimulate technology policy. For example, a ministry, not sure which one but I'm assuming Economic Affairs and Climate, provide some funding for start-ups at the TU Delft, so this is a mechanism that stimulates start-ups at technical universities. So, that could be a different group. So, you have The Ministry of Education and Culture or something, and you also have [The Ministry of] Economic Affairs and Climate, and I think that Economic Affairs has technology policy in their portfolio as well. So, they will do subsidies as well, and you can do competitions or something like that. That's on a national level, but for example the municipality of Delft, they also have a policy to stimulate that companies settle there etc., but I'm not sure whether those are things that are directly related to your results.

Perhaps not Delft itself. Well, perhaps at the level of, more university and industry collaboration. But, also bringing more tech companies to The Netherlands, that could perhaps help as well. Because the idea of knowledge spillover also greatly stimulating, and I think if there are more patents floating around in the country, then there is obviously more opportunity to use those. Perhaps, that's another thing, to bring more R&D to The Netherlands.

Yes, the question then becomes who, or what sort of ministry does that, perhaps also Economic Affairs and Climate, I'm not sure, you could check their website, and look for how R&D is stimulated and if they've had certain tax policies. The Ministry of Finance can also take tax measures, those sorts of things.

That seems to help a lot, which is what you see in Ireland. The TE level is very high there, but it's also a tax haven [for (big) tech companies].

Yes, that could be because of the tax environment, but you're not fully in control concerning the tax climate. So, I find it difficult to be more specific than this. […] I hope this was helpful for you.

Yes. This has been greatly helpful for me, so thank you very much. […]

Appendix I: Interview with Prof.Dr.ir. Shinichiro Haruyama

Transcript of interview with Prof.Dr.ir. Shinichiro Haruyama, supervising professor of *entrepreneurship* and *total design of information and communication systems for ubiquitous society* at the Graduate School of System Design and Management of Keio University, Tokyo, Japan.

Recorded on 23-01-2022, at 10:00 CET (18:00 JST)

(Recording started after 5 minutes)
Professor Haruyama: There are four quadrants, Q1, Q2, Q3, and Q4. When you compared TE and ME, you chose only Q1 and Q4. Why did you choose Q1 and Q4?

T. Avé: Because […] in that sense it was similar to the comparison between The Netherlands and Japan, where one country had high ME/low TE, and the other low ME/high TE.

Ok, I see.

[…]

So, you compared Q1 and Q4, and you could see differences of many aspects, like economic, technological development, and so on. That's good, but the other choice you could have made is; if, for example you compare Q1 and Q2, both Q1 and Q2 have high technology entrepreneurship. Q1 includes Japan, and Q2 includes, for example United States. So, if you compare Q1 and Q2, you could do some analysis only about the difference of mainstream entrepreneurship. That's what I thought.

You are completely right, I missed that.

And similarly, if you compare Q2 and Q4, for example USA in Q2, and I guess Brazil in Q4? BR is Brazil?

BR is Brazil, yes.

Then, if you compare Q2 and Q4, you can find something about the difference of technology entrepreneurship. Because that's the only difference between Brazil and the USA. So, you could have done that kind of comparison. But I think you compared Q1 and Q4, because Japan is in Q1 and The Netherlands is in Q4, is that right?

Yes, The Netherlands would have been, almost, Q4. But the idea was to have a similar comparison to when I compared The Netherlands to Japan.

Ok, I see, yes, I understand. In The Netherlands there are technologically very advanced companies like Phillips, so I did not think there would be big difference between Japan and The Netherlands [in TE]. But, as you have done some analysis, I am also surprised that Japan has higher Patent/GDP ratio and technology education. So, I'm a little bit surprised.

I see, alright, interesting.

Because I thought The Netherlands was also very advanced in terms of technology.

That's interesting, because I had the image that Japan was more technologically advanced.

Yes, that's correct [Japan is technologically more advanced]. My thinking as to why mainstream entrepreneurship in Japan is not so strong is because Japan is very strong in technology, so many companies are focusing on the technology "seeds" first, and then they try to find the "needs" of people.

I'm sorry, what is a seed?

I see, do you know the difference between "seeds" and "needs"? Some good technology invention, that's a "seed". And many Japanese technology companies have their own unique "seeds", their own technology innovations. That's good, but many of those companies are not good at coming up with the service that people need. So, even though companies in Japan have very good technologies they are very weak in finding the solution or "needs" of people. That is my impression. On the other hand, for example, Facebook in The USA; the service is very simple, it is connecting people using some IT technology. It's so simple, and the technology seems to be so easy, at least to me, but they found that kind of "need", and that is why Facebook became so big. That is a big difference.

I see, ok, interesting, is that also a reason why Japan has less mainstream entrepreneurship than The Netherlands?

Prof: That's my impression, yes. There are many new mainstream entrepreneurship venture companies in Japan as well, but it is not dominant, and they don't become huge international companies.

Right, I see. So I am quite curious because one of my conclusions was that in terms of economic development, when you look at the developing world, let's say some country in Southeast Asia, where there might not be as much economic opportunity, people are, sort of, forced into ME, whereas in countries, where there is more economic comfort, that need to venture into ME disappears, because of the availability of regular jobs for example, and people having a higher level of education and then having the opportunity to go into those jobs. With Japan being both highly educated and economically well-developed, do you think that also has some influence on the levels of ME and TE?

I see. I have another opinion on your comment. The Japanese people are very highly educated and the standard of life is very high, but if there is a new service which everybody wants. then everybody here would be very happy to use that kind of service. But, this does not happen as big as in The Netherlands or The USA. That's not because people in Japan are not happy with the current product or service but it is because the environment to start a new venture is not as good as in The USA or in The Netherlands. The environment includes investors; there are lots of rich banks, but the bank and investors are different. Venture capitalists are very different from banks. So, there are not as many venture capitalists in Japan as in The USA, or in The Netherlands, I guess. Another big problem, well, it's not a problem per se, but there are so many huge companies in Japan. For example, Toyota, or Sony, Honda; many big companies. And there are lots of employees who are happy with getting a very big salary. That high salary and stable job discourages them to start a venture company. So, the existence of many big, good companies in Japan, prevents, or discourages people to start new ventures. It's not a big problem, but I believe it's a problem. I'm hoping that more and more people in Japan start new companies. Even if they are working at companies, they should spin out and start venture companies. Because, even in Japan, a very stable and rich country, there is lots of new opportunity, just like developing countries, like Malaysia or Indonesia. So, there is lots of opportunity, but most of the highly educated Japanese people don't try it.

That is very interesting. With opportunities do you mean both ME and TE, or specifically one of them?

I think both; both ME and TE. For the last several years, the situation seems to be changing gradually. That's because the law is changing little by little. So, now more and

more Japanese people are starting a second business. They work at one company on weekdays and start their own company and do the business on weekends. That's a very good trend. That's been happening for the last few years. So, that's one thing. And because the economic situation has been very good the last few years, and stock prices are very high now. So, many people have extra money, and more people are becoming investors, so that is also very good. The situation seems to be changing, people are also willing to invest in new ideas now. If you draw this graph [ME/TE scatterplot], maybe 5 years from now, Japan may be going to the middle line.

So, the general attitude towards entrepreneurship is changing, is that also visible culturally maybe? Do you think there are cultural indicators for that as well?

About the business environment, as I said it is getting better gradually. But, other cultural aspects, for example the attitude of especially old people, not many [old] people are willing to spin out from the company and start a business. This attitude [among old people] still remains [largely] unchanged, but more and more young people are willing to start companies, even in Japan. Also, about education, it is still not good. I mean, in terms of technology education, like physics and electronics and so on, the level of education is very high in Japan, that's good. But the problem is that in Japanese high school, or even in universities, they don't put much emphasis on discussion or debate or creativity and those kind of things. It's improving a little bit but I guess it's not as good as in The Netherlands. Maybe you know that Japanese people are not good at discussions or debate; that kind of mindset. Kids grow up without discussions, that is a big problem.

People like to have discussions here in The Netherlands.

Yes, I believe so. I think it's different in European countries.

[…]

In Japan, as you know, politeness and obeying elderly people, that kind of traditional culture still remains. That is good in one sense, but if people only obey their elders, nothing will [ever] change. That kind of culture is difficult to change quickly.

So, what you are saying is that Japanese people are less prone to creating new ventures. Are you surprised then by the high level of technology entrepreneurship?

Yes, you said that the number of patents in Japan is 18 times that of The Netherlands?

Yes, the extremely high number of patents could also come from these big companies, like Toyota and Mitsubishi etc. So, I was wondering, do you think there is lots of opportunity for knowledge spillover for start-ups to capitalise on the high number of patents, or do you think they are separate?

I think there are lots of opportunities in Japan. Many companies file for many patents, but most of those patents are sleeping. They file for patents, but they don't use those patents for their products. I think there are even companies in Japan to find sleeping patents and make use of those patents. Even I file for patents, but most of my patents are sleeping. So, after your research, you'd think you can say that Dutch companies should file for more patents, but it is not that easy. I guess Philips files for many patents each year, but it is not good enough. You have to have, hundreds, thousands of companies; each of those filing for many patents.

So, do you think the number of patents has an influence on TE, or do you think it doesn't? Because, as you said, they could take the sleeping patents or search for other things.

Yes, I agree, and I think it is very natural to think that the number of patents and technology entrepreneurship are very closely related. I agree.

Do you think I have missed any variables? Since I looked economic development, technological development, institutions, education, and culture. Do you think I missed certain variables, that influence the level of technology entrepreneurship, for Japan specifically? Maybe the size of the technology industry, or things like that?

One thing which I'd like to know is the government regulations. There are many, many regulations in Japan. Do you know Uber?

Uber? Yes.

Uber is prohibited in Japan. That's because the government wants to protect the taxi driver. Those kinds of restrictions prevent new ventures [and services] to even start. So, I'd want to know if there is a big difference, and if the regulations in The Netherlands are not as severe as in Japan. That may make a difference.

Well, here they also tried to block Uber, because of the taxi drivers. But here they disobeyed and kept going. So, Uber is still present here.

Oh, really? [laughs] I think if the Uber people disobey in Japan, they would be arrested. So, those kinds of very strict restrictions happen in every service. That's a big problem. […] And, as you said, the number of technology companies in Japan; the industry size is huge. The size also plays a big role. If you can compare the size of the industry, that can be another parameter.

[…]

I am curious, I think you've already kind of mentioned it, but what is your opinion on the state of technology entrepreneurship in Japan? Do you feel that there is a lot, do you think there is too little, what is your view on this? From my results, it seems like there is a lot, but I'm wondering what your view is on this.

There are lots of Japanese technology companies that are still very strong. For particular industries, many Japanese companies are still number one in each particular industry. But, there are huge companies that are incredibly successful, especially American companies, like Microsoft, that have such huge success. And Japanese people are wondering, "why can't we do something like Microsoft and Google and so on?". We are not good at universal services, meaning worldwide. One reason is language. Most Japanese people are not good at English. Another reason is that technology people are not good at marketing. They don't see the true needs of users. They cannot foresee the true future needs. So that is another reason why Japanese technology companies are not good. Every technology company in Japan is trying very hard, even now. People are not giving up. But neighbouring countries like China, Taiwan, Korea, are doing very well. In some industries they are doing much better than Japan, like semiconductor memory, PC hardware. Even hardware, for example PC notebooks; Taiwan and Korea are much bigger and much better than Japan now. So, many people are worried. There are many, hundreds, thousands of small ventures doing mainstream entrepreneurship in Japan, but they are not big; they remain small. So, it does not become world news and you don't see many Japanese mainstream companies in the news. Those exist, but it's not as big as other countries' mainstream entrepreneurship.

That's interesting, because my supervisor also said there might not be as much technological innovation here [The Netherlands] but that people are very good at service-based ventures, which ties into what you said, because a service is something someone would need. If Japanese people are not as good at determining the need, that would make sense actually. One Last question I'm curious about, if you don't mind? What is the collaboration between universities and industry like there? Here at the university you have an incubator for start ups as well and TU Delft invests, and they have these labs which they are trying to create ventures out of as well, so I'm wondering what the collaboration in Japan is like.

There is an incubation office even in Keio university. Many professors use this service to start new companies. There are more than 100 professors starting companies through Keio University. I myself started a new company and I also have research collaboration with several companies right now. My company is very small, but many other companies are started by Keio professors, so we have that kind of activity going on.

And what about students, as well?

There are not many students that start companies when they are still students. But, for example, I teach an entrepreneurship course. And in fact, this fall semester I taught that course, and more than 50 students registered for that course. Many of them are willing to start a company. In fact, in this fall semester one student started a company, even during the semester. They are very eager, but not many actually start a company [while studying]. But after they graduate, I hear that some people have started their own companies. There are about 70 students who get a master's degree and graduate. Among 70 students, maybe one, two, or three people start a company each year. It's not that many, but there are some.

Would those companies be technology related, or would they be a coffee shop for example?

The student that just started company is still a student. Her new company is more like mainstream entrepreneurship, but she is not an engineer.

[During the last part of the interview, we discussed the details of the company of this student, as well as the details of the company professor Haruyama started two years ago]

I won't take any more of your time, sorry for taking so long.

Oh, I enjoyed the discussion with you. Your analysis is very interesting, especially the comparison between Q1 and Q4.

Thank you, I enjoyed the discussion as well.

I hope my comments help your research

Definitely, they were very helpful. It will be a really valuable addition to my research, so thank you very much.

I'm glad to hear that.