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INNOVATIVE OUTPUT OF SME'S IN DEVELOPING COUNTRIES – EFFECTS OF INSTITUTIONAL QUALITY

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ABSTRACT

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Innovation is one of biggest determinants of firm performance and has huge implications for solving issues from climate change to more localised problems. Most of innovation research has focused on what happens inside the firm, while it has left context out of the equation. The impact of institutions, such as local laws and regulations and culture are theorised to impact innovative output of firms.

The research concerns whether institutions, both formal and informal, have impact on innovative output of firms in the developing world. The data comes from World Bank's Enterprise Survey, Worldwide governance indicators and Hofstede's cultural dimensions scores.

The research uses quantitative methods to explore the research questions, namely multilevel modelling. Theoretical part of the study drew from institutional theory and Hofstede's cultural dimensions theory, while the empirical part explored the hypotheses and research questions using multilevel logistic modelling approach.

The results found that country's formal and informal institutions had an impact on firm's innovative output. Quality of formal institutional environment was found to have a negative impact on innovative output, while informal institutions of power distance and individualism had positive impact, masculinity negative impact and uncertainty avoidance had no impact.

Tiivistelmä

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Innovaatiot ovat yksi yrityksen suorituskyvyn tärkeimmistä tekijöistä sekä innovaatiot ovat tärkeitä yhteiskunnan ongelmien ratkaisemiseen ilmastonmuutoksesta paikallisiin ongelmiin. Suurin osa innovaatiotutkimuksesta on keskittynyt siihen mitä yrityksen sisällä tapahtuu, niin että ympäristö, jossa yritykset toimivat on jätetty vähemmälle huomiolle. Instituutioiden, kuten lakien, sääntöjen sekä kulttuurin vaikutukset teoriassa vaikuttavat yritysten innovatiiviseen tulokseen.

Tutkimus koskee sitä, vaikuttavatko viralliset ja epäviralliset instituutiot kehitysmaiden yritysten innovatiiviseen tuotantoon. Tutkimuksen data on peräisin Maailmanpankin Enterprise Surveystä, Worldwide Governance Indicators mittareista ja Hofsteden kulttuuridimensioista.

Tutkimuksessa käytetään kvantitatiivisia menetelmiä tutkimuskysymysten ratkaisemiseen. Tutkimuksen teoreettinen osa perustuu institutionaaliseen teoriaan ja Hofsteden kultuuridimensioteoriaan, kun taas empiirinen osa tutki hypoteeseja ja tutkimuskysymyksiä monitasoisen logistisen mallinnuksen avulla.

Tulokset osoittivat, että maan viralliset ja epäviralliset instituutiot vaikuttivat yrityksen innovatiiviseen tulokseen. Virallisen institutionaalisen ympäristön laadulla todettiin olevan negatiivisia vaikutuksia yritysten innovaatiotulokseen, kun taas epävirallisista instituutioista valtaetäisyydellä ja individualismilla oli positiivinen vaikutus, maskuliinisuudella negatiivinen vaikutus ja epävarmuuden välttäminen ei vaikuttanut innovaatioon.

List of abbreviations

General

SME – Small or Medium Enterprise
MNE – Multinational Enterprise
RBV – Resource-based view
IBV – Institution-based view
R&D – Research & Development
FDI – Foreign direct investment
NIS – National Innovation System
WTO – World Trade Organization
IPR – Intellectual Property Rights
WBES – World Bank Enterprise Survey
IMF – International Monetary Fund
WB – World Bank
BRIC – Brazil, Russia, India and China
MINT - Mexico, Indonesia, Nigeria, and Turkey
PIGS - Portugal, Ireland, Greece, and Spain
BASIC - Brazil, South Africa, India and China
GDP – Gross Domestic Product
PPP – Purchasing Power Parity

Statistics

PCA – Principal component analysis
ICC – Intraclass correlation coefficient
MLM – Multilevel model
ML – Maximum Likelihood
FIML – Full information maximum likelihood
REML – Restricted Maximum Likelihood
VIF – Variance Inflation Factor
OR – Odds Ratio

World Governance Indicators

VA – Voice and Accountability
PS – Political Stability and Absence of Violence
GE – Government Effectiveness
RQ – Regulatory Quality
RL – Rule of Law
CC – Control of Corruption

Hofstede dimensions

PDI – Power Distance Index
IDV – Individualism vs. Collectivism
UAI – Uncertainty Avoidance
MAS – Masculinity vs. Femininity
LTO – Long-term orientation vs. Short-term orientation
IND – Indulgence vs. Restraint

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1 Introduction

1.1 Background

During the late 20th and early 21st century we have seen the integration of many developing countries in to the global economy. In recent years the world has seen a slowdown of global economic growth, but fortunately most developing countries are expected to grow a good two or three percentage points faster than developed countries (IMF, 2019). A most relevant case in point is probably China, which has emerged from completely agrarian economy into an industrialised nation in a span of 35 years (Wen & Wolla, 2017). China is not alone, though, also Vietnam has rapidly industrialised with large investments in infrastructure and human capital (Vanham, 2018). Vietnam, like China, understood that infrastructure and better institutions are a pre-requisite for growth (Wen & Wolla, 2017). And these countries are not alone, the share of developing economies is constantly growing in the world, while the share of developed economies as measured by GDP has fallen (World Bank, 2019c). This means that developing countries are becoming bigger players in the globalised world. Yet, for developing countries growth is often a pre-requisite for poverty reduction. One of the best understood ways to bring growth about is innovations, essentially doing things in new and better ways. Innovations also help the world to prepare for climate change (Lalit & Kalanki, 2019) and coming up with solutions for problems that humanity will face is a crucial part of saving lives.

We can then conclude that innovation, especially in developing countries, has vast possibilities in bringing up living standards, such as in the case of trickle-up innovations that seem to be arising from the developing world (Guillen, 2017). One of the main drivers of new innovations are small and medium enterprises that play a key role in poverty reduction in the developing world, accounting over 90% of all firms in these countries (OECD, 2000). From a firm-level perspective, innovation is one of the best determinants of firm performance (Calantone, Cavusgil, & Zhao, 2015) in addition to providing many societal benefits that come from new ways of

doing things. Innovation as one of drivers of economic growth offers paths to catch up with developed countries for many countries that are still developing (Fagerberg, 2013). However, the objectives and mechanisms of innovation are different – it is hard to conceive that it would be important to develop new technologies or services like AirBnb and Über for a country that still struggles with problems of infrastructure or high child mortality. Rather, as OECD (2012) stresses that countries need innovation that reflects their objectives, such as incremental innovation for low-income countries to adopt foreign technology in order to widen the range of business opportunities for local businesses.

SMEs are more flexible and adaptive than larger organisations, such as MNEs (multinational enterprises) yet they have many weaknesses, such as lack of access to finance and tough competition (Aruna & Al-Mubaraki, 2013). SMEs operating in developing markets also have to face many challenges, such as political shocks, price instability or war and corruption (Gao, Zuzul, Jones, & Khanna, 2017; Xu & Meyer, 2012). Developing countries also lack of good infrastructure and have ineffective institutions that could support growth of firms (OECD, 2004), while most innovative countries including Germany invest heavily in research and development funding for SMEs (Whiting, 2018). SMEs are an important driver of job creation in the developing countries, yet they struggle to get financing (Rubens, 2002). United Nations' deputy secretary-general Amina Mohammed recently stressed in his speech about how the innovations must reach the world's most vulnerable people (United Nations, 2019), who typically live in the developing world.

There are several other reasons why SMEs are strategically important for a national economy: First, they employ more than larger firms. Second, they increase competition and reduce monopoly power of larger companies. Lastly, they help growth of innovative and entrepreneurial skills. (Aruna & Al-Mubaraki, 2013). Yet, despite these reasons, SME innovation, especially in the developing world remains a very poorly studied subject (Zhu, Wittmann, & Peng, 2012). The importance of institutions for firms and economic growth in general has gained attention in recent decades (Marinescu, 2014; Peng, Wang, & Jiang, 2008), yet

the work of understanding and measuring institutions is still at its infancy, despite the fact that they are used to make decisions about foreign aid (Thomas, 2010). Most of the work has focused on understanding formal institutions, with measures of good governance being built. There is another tradition that can be traced back to Max Weber's seminal work The Protestant Ethic and The Spirit of Capitalism (1930), who argued that it was protestant work ethic primarily that gave rise to industrial capitalism and subsequent industrial revolution. The book and the debate that followed cemented the idea that cultural values are important for economic growth. Culture and ethics are integral part of institutions of a country (Scott, 2014, p. 67) and are now understood to play an important part in the innovation process (Smale, 2018). Innovation, in summary, is not an end itself, but rather means to lift the living standards and help the world brace for the challenges that are to come; and that alone makes it worth studying.

1.2 Research problem and research questions

The main aim of this study is to determine how institutions affect the innovative capabilities of small and medium enterprises in developing countries. The research takes inspiration the institutional view of strategy research that has roots on seminal paper by Wright et al. (2005). Another supportive pillar of this thesis comes from work of Calantone et al. (2015), who suggest that innovation capability is the lead determinant of firm performance, which gives another justification for researching innovation. Other views that the thesis draws from include institutional theories from economics and sociology, in order to explain the effect of formal and informal institutions on firm's innovative performance. Hofstede's cultural dimensions theory (Hofstede, 2001; Hofstede, Hofstede, & Minkov, 2010) supplements the institutional theory as a more practical way of researching informal institutions. All of these will be explored in the 2nd chapter. These views together contribute towards the theoretical framework for this thesis. The research question of the thesis forms as:

How do national institutions affect the innovative output of SME's in developing countries?

1.3 Limitations and scope of the study

The choice of the topic of this thesis places several theoretical and empirical limitations. The main focus will be innovative activities of small and medium enterprises and institutions, which will be studied through a lens of developing countries business environments. The focus on developing countries leaves developed countries out of the scope of this research and sets certain limitations on what kind of innovation we expect to see to happen in the firms. Namely, the innovation will be studied in the broadest sense so this thesis does not answer questions about novel new-to-market or radical innovations that we expect to see in the developed countries.

The datasets used will also place limitations on this study. World Bank Enterprise Survey is one of the most comprehensive questionnaires that has been widely used for researching firm-level data, however it only collects data from low- and middle-income countries, thus developed countries that are classified as high-income by World Bank are naturally going to be out of focus. The empirical study will also only focus on SMEs so that leaves large firms (>100 employees) out of the scope of this research. The thesis adopts one of the most recent waves of WBES from 2013-2015, which unfortunately leaves a lot of countries out of the scope that would have been desirable to be included, however it is not desirable to take a cross-sectional approach from too many years apart.

Additionally, the thesis will be using country-level data from Worldwide Governance Indicators compiled by Kaufmann et al. (2011) and Hofstede's cultural dimensions (2001). These place a limitation together how many countries can be analysed statistically as all the countries have to be found from the three datasets together. To supplement the data World Bank provides also information on income

group classifications on country-by-country basis. As the focus is on such a small number of countries, the results are necessarily not comparable to other countries. The use of measures also place limitations. One informal institution often studied is social capital, which is unfortunately left out of the study.

1.4 Structure

This thesis will have a following structure. Chapter 2 will present the theoretical foundations and past research related to the key topics. First, key definitions and concepts related to developing world and innovation will be discussed. After that institutional theory and impact of institutions on innovation are explored. In Chapter 3 methodology for this study will be presented along with introduction of data, variables and methods.. In Chapter 4 results of the statistical tests will be presented in detail. Chapter 5 will focus on discussion around the results, issues relating to theoretical and empirical components of the thesis and suggestions for future research. Chapter 6 will provide a summary of the research with no new information given.

2 Theoretical background and past research

This chapter will present the relevant theories for this thesis. The main goal of the following literature review is to construct an analytical framework that will guide the research. This thesis is positioned on the fields of strategy research and innovation studies. Both are multidisciplinary fields that lean to other relevant fields, such as sociology and economics, so it is in the nature of the field to have citations from various fields of study. Firstly, the core concepts and definitions are discussed and explained, then the relevant theories on institutions and culture and the impact of institutions on firm-level innovation are reviewed.

2.1 Developing countries and innovation

Innovation is seen as one of the best ways bring long-term-economic growth (Alam, Uddin, & Yazdifar, 2019a) and one of the strongest determinants of firm performance and success (Calantone et al., 2015). Before discussing theories related to innovation and institutions it is useful to clarify the reasons why small and medium enterprises and developing countries are worth studying, and what they exactly mean in a context of innovation.

2.1.1 Taxonomy of developing countries

There are various terms to describe countries that are not developed countries. The vocabulary and study of developing countries is also packed with abbreviations such as BRIC, MINT, PIGS, BASIC and so on. The literature of developing countries can also initially seem confusing, given various terms associated with non-developed countries: Emerging markets, developing markets, emerging economies and so on. Many of these countries are heterogenous, meaning they differ in many diverse ways, yet they have some traits in common.

Developing countries are countries that are often associated with high rates of poverty, unemployment, low literacy rates, high inflation and high interest rates (Ur

Rehman, 2016). Xu and Meyer (2012) list additional characteristics that non-developed countries typically have: Markets are generally more inefficient, and contain information asymmetries, state-controlled firms are often part of the competitive landscape, network-based behaviours are more common due to cultural norms and rules, and finally, firms face higher uncertainty when making strategic decisions due to changes in government and institutions. For firms, developing countries are often a lot harsher business environment to operate in. Generally, the lack of human capital, networking capabilities and resources are the biggest internal obstacles that firms operating in developing countries face (Zanello et al., 2016).

It is important to know that countries that fall under the umbrella term *developing countries* can be heterogenous. While the above traits are a crass generalization, they are not to be taken as a fact that applies to each country; every country is different – a topic we will explore further in the next part. The term developing countries might seem like a synonym with *emerging economies*, which are a subset of developing countries, or sometimes classified entirely differently as the in-between stage. Emerging economies are developing countries that satisfy the criteria of rapid pace of economic development and government policies that favour adoption of free-market system. (Hoskisson, Eden, Lau, & Wright, 2000).

A more appropriate and more analytical approach is provided by World Bank that is widely used in the literature of strategy research and makes it suitable for this thesis as well (Hoskisson, Wright, Filatotchev, & Peng, 2013; Zanello et al., 2016). World Bank classifies countries into four categories: low income (LIC), lower middle income (LMIC), upper middle income (UMIC) and high-income countries (HMIC). I will be using The World Bank classification in this thesis, and thus the term developing countries will exclusively refer to three lowest income groups; low income and middle income countries, while developed countries will exclusively refer to high income countries (Fantom & Serajuddin, 2016). World Bank uses GNI per capita as a measure for classification with $995 or for LICs, between $996 and $3,895 for LMICs, between $3,896 and $12,055 and over $12,055 for HICs (World Bank, 2018). Using the World Bank definition and taxonomy provides a second

important benefit: when researching institutions having a broad definition that allows many countries, and thus many institutional environments into the study.

2.1.1 SMEs in developing countries

Research currently shows that SMEs play a pivotal role in commercialisation of new technology, yet they face challenges due to their smaller size and lack of resources compared to larger firms (Tambunan, 2008). The research on innovativeness of SMEs has suffered from a too strong focus to developed countries, while SMEs in developing countries have not received much attention. (Zhu et al., 2012).

The classifications for SME's can be fairly confusing as regional differences exist. In Europe company is considered to be an SME if it has 100 or less people working for them according to the country classification, while in Vietnam it is 300, while in China the numbers are even bigger. (OECD, 2004). For the sake of consistency and relevancy with past research that uses Enterprise Survey, classification provided by Enterprise Survey methodology will be adopted in this thesis (World Bank, 2019d). Firm is considered to be small if it has 1-19 employees, medium with 20-99 employees and large with over 100 employees. Having such a definition will allow the research to be comparable to other research with World Bank Enterprise Survey methodology.

2.1.2 Innovation

Before there were any direct measures of innovation, proxies such as R&D investments were used (Nieminen & Lehtoranta, 2015). Innovation in the developing countries is quite different from innovation in advanced economies. In the developed world it is associated with strong R&D inputs, national innovation systems and operating at the forefront of technology frontier, while in the developing world innovation often consists of imitation and incremental innovation as theorised by Michael E. Porter (1990). This seems to be because firms in the

developing world lack adequate resources to embark on costly R&D projects, but also many firms are operating far away from the technology frontier, with little to no connected links to basic research stemming from universities (Gorodnichenko, Svejnar, & Terrell, 2010). The belief that firms in developing countries seek incremental innovations instead of radical innovations seems to be true according to available research. (Bogliacino, Perani, Pianta, & Supino, 2010; P. J. A. Robson, Haugh, & Obeng, 2009; Zanello et al., 2016). Additionally, innovations in developing countries are often not innovations with global impact, or what we are accustomed to associate with innovation. Rather, innovations often may not have initially impact for a country or the world, but they are new for the company. (Zanello et al., 2016). These innovations are called new-to-firm innovation and play much greater role in developing countries (Ayyagari, Demirguc-Kunt, Maksimovic, Demirgüç-Kunt, & Maksimovic, 2011). While these types of innovations are seldom something that has earth-shattering impact for the society, they are nonetheless important for the firm itself. Introducing new products is essential for survival of firms, and provides ways for the firm to diversify and adapt to new markets or changing conditions (Krammer, 2019), which makes it worth researching.

This brings us to the definitions of innovation, which in this thesis is defined broadly due to the above fact that the definition must account for new-to-firm innovation and incremental innovation that happens in the developing world (Zanello et al., 2016)The appropriate definition needs to be also measurable by statistical means to be valid. This thesis will adopt a definition of innovation as it is defined in the Oslo Manual 2018 (OECD/Eurostat, 2018). The Oslo Manual 2018 (OECD/Eurostat, 2018) definition innovation is useful to cite here in its entirety due to the precise grammar and wording used:

> *An innovation is a new or improved product or process (or combination thereof) that differs significantly from the unit's previous products or processes and that has been made available to potential users (product) or brought into use by the unit (process).*

The above definition is broad enough and accounts for new-to-firm innovations, adoption of new technology, it can be used so to measure firm's product

innovation, though this will also include services that are counted as firm's product line (Nieminen & Lehtoranta, 2015). Process innovation is not discussed in this research, as the process for bringing them about is different and would broaden the research undesirably. The definition is also adopted to use in Enterprise Surveys (World Bank, 2019b), though it should be noted the drawbacks of the definition make it impossible to differentiate types of innovation and it says nothing about novelty or social impact. The reason why the Oslo Manual definition is widely used in research, is that it is measurable, unlike others some generic definitions of innovation provided. In the definition the term unit is any actor that partakes in the innovative activity. Such a short definition does not come without its shortcomings as it will be somewhat open to interpretation by what the term *significantly* means in the context, especially for any respondents who partake in the surveys (OECD/Eurostat, 2018; Rogers, 1998).

2.2 Theories of institutions

As briefly mentioned, the institutional environment differs from country to country. The reason for choosing institutions as a particular interest was that many institutions have often been ignored in the economic analysis due to intellectual tradition of economics focusing only on economic relations between rational actors (Keizer, 2007), such as firms, organizations and individuals. This has left the context in which actors operate in out of scope. In developed countries formal institutions are often taken for granted and seen as invisible background conditions. (Peng, 2001). However in the developing countries the importance of these supporting formal institutions is clear once they are absent (Peng et al., 2008). The two primary schools of thought regarding institutions in innovation literature come from Douglass North (1990) and William Scott (2014), both views are discussed next.

2.2.1 Definition of institutions

A commonly used definition of institutions is given by Douglass North (1990, p. 5), who defines institutions as *rules of the game* in a given society. His definition does not imply only formal rules, that come from laws and regulations, but also how people are expected to behave, so it encompasses norms and culture as well. As it is, institutions as a whole encompass both formal rule-based institutions but also informal institutions. (North, 1990, pp. 4–5). A denser and more encompassing definition of institutions is given by William Richard Scott, (2014, p. 56), who defines institutions as *regulative, normative, and cultural-cognitive elements that, together with associated activities and resources, provide stability and meaning to social life*.

2.2.2 History of intellectual thought

In social sciences there are diverging schools of thought through which institutions are studied. The two primary ones which concern institutions effect on organisations are new institutional economics and neoinstitutional theory from sociology. The first view is represented by research of Douglass North (1990) and it primarily focuses on how rational economic actors operate in the context of institutions, using the lens of neoclassical economics. Meyer and Peng (2016) and North (North, 1990, pp. 7–8) explain that this view sees institutions more of as incentive-structures in a society. In other words, institutions shape the incentives that various economic actors face.

This thesis concerns not how institutions change over time, but rather what the institutional mechanisms are that shape firm's decision to innovate. New institutional economics stresses transaction costs, uncertainty and competition, while neoinstitutional theory from sociology stresses institutional change, interaction of regulative, normative and cognitive pressures and institutional dualism (Meyer & Peng, 2016). Though modern neoinstitutional scholars also emphasise how organisations and individuals innovate and make strategic decisions (Scott, 2014, p. 93). Institutional dualism essentially means that well-meaning changes in institutions often don't have their intended effect while cultural norms and behaviours continue shaping the way things operate; it is seen as a one

of the biggest obstacles for growth in developing countries (Brinkerhoff & Goldsmith, 2005).

A synthesis of economics and sociological views is promoted by and Peng et al., (2008). This view is called institutional view and it concerns firms' strategic choices, such as the decision to innovate in the context of institution. (Meyer & Peng, 2016).

2.2.3 Dimensions of institutions

Douglass North (1990, p. 4) divides institutions into formal and informal institutions. Formal institutions consist of law, regulations and other formal rules that govern the society. Informal institutions refer to culture, norms and ethics, or can be seen as the constraints that people put on themselves (North, 1990, p. 3). In sociology a popular view is neoinstitutionalism that is represented by William Scott (2014). The three pillars are comprised of Regulative, Normative and Cognitive pillars. Regulative processes involve rule-setting, monitoring and sanctioning and these activities are often done by courts or police.

When scholars criticise developing countries for lacking *good institutions* or having *poor institutions*, they mostly refer to lack of these formal regulative institutions, or lack of market-supporting institutions (Chang, 2011; Rodrik, 2000). Second pillar is the normative pillar, which includes values and norms, or in other words the pattern of behaviour that is accepted within the society (Scott, 2014, pp. 64–66). The final cultural-cognitive pillar in words of Scott is "the shared conceptions that constitute the nature of social reality and create the frames through which meaning is made" (Scott, 2014, p. 59-67). According to Tomelin *et al.*, (2018) these three pillars together allow the measurement of the quality of the institutional environment. How formal and informal institutions relate to their respective supportive pillars that they rest upon is shown below in Table 1.

Table 1: Dimensions of institutions. Adapted from Peng *et al.* (2009).

Degree of Formality	Examples	Supportive Pillars

Formal institutions	*Laws*	*Regulative (Coercive)*
	Regulations	
	Rules	
Informal institutions	*Norms*	*Normative*
	Cultures	*Cognitive*
	Ethics	

In Table 2, we can see the three pillars and their mechanisms, logic and indicators. The distinction should be clear.

Table 2: Three Pillars of Institutions. Adapted from William Scott (2014, p. 60).

	Regulative	**Normative**	**Cultural-Cognitive**
Basis of compliance	Expedience	Social Obligation	Taken-for-grantedness Shared understanding
Basis of order	Regulative rules	Binding expectations	Constitutive schema
Mechanisms	Coercive	Normative	Mimetic
Logic	Instrumentality	Appropriateness	Orthodoxy
Indicators	Rules Laws Sanctions	Certification Accreditation	Common beliefs Shared logics of action Isomorphism
Affect	Fear/Guilt Innocence	Shame/Honour	Certainty/Confusion
Basis of legitimacy	Legally sanctioned	Morally governed	Comprehensible Recognizable Culturally supported

In absence of formal institutions, informal institutions often take their place (Peng, 2002).

It is now evident that institutions are much more than simply background conditions. They directly affect the decisions that firm makes (Ingram & Silverman, 2002).

2.2.4 Firms and institutional context

In the institution-based view, the decisions of the firm are not only based on industry conditions and capabilities of the firm, but both formal and informal institutions place a constraint on the firm's strategic decisions (Peng et al., 2008; Scott, 2014, pp. 32–35). Institution-based view can be divided into two core prepositions. One is that firms pursue their goals rationally within constraints of given institutional framework. Second, in absence of formal constraints, the informal constraints of institutions will play a larger role in reducing uncertainty. (Peng, 2014).

Firm's capabilities are also tied to the institutional framework, and for example Goedhuys (2007) ties the low level of human resources and technological capabilities in Tanzanian firms directly to government policies pursued in Tanzania. In summary, institution-based view asserts that firm's strategic choices are a result of complex and dynamic interaction between firms and country's institutions (Garrido, Gomez, Maicas, & Orcos, 2014). Peng et al. (2009) call the institutions as *the third leg that sustains the strategy tripod*, suggesting that when one analyses firm's strategic decisions one should not only concentrate on what happens in the industry, nor what happens inside in the firm, but take also institutional framework into account.

2.3 Formal institutions

Formal institutions, or the rules, laws and other formal constraints, shape the official rules of the game in a society (North, 1990, pp. 4–5). These matter, because they are what firm can do and what they can't and sometimes firms can levy themselves a competitive advantage by virtue of being in a place with more relaxed rules, such as environmental standards (Lin, Gui, Xie, & Liu, 2019).

Another way to look at formal institutions is given by Zhou & Peng (2010). Formal institutions can be reduced to three distinct sub-categories to allow analysing them

in greater detail. They are competition institutions, legal institutions and information institutions and they all play slightly different roles. Competition institutions, as the name implies, govern the market competition, entry to the market. Legal institutions are a requirement for impersonal transactions and weak legal institutions raise transactions costs. Information institutions are laws, regulations and organisations that facilitate making product and firm-related information public for everyone and ensuring its validity. Their main aim is to reduce uncertainty and information asymmetry between market participants, which further reduces transaction costs. (Zhou & Peng, 2010).

There are some key differences between developed countries and developing countries that are worth highlighting. While developed countries generally have good formal infrastructure in place, decent standards of living, high amounts of political freedom and little government intervention to business, this is not the case in emerging and developing countries (Hoskisson et al., 2013; Marquis & Raynard, 2015; Wright et al., 2005). Their regulatory environments are often not transparent, they often have poor or improving standards of living, they have higher risk of political unrest and war and often more government intervention to business. (Marquis & Raynard, 2015). All of these facts contribute to innovative output of firms, as will be discussed next.

2.3.1 Impact of formal institutions on innovation

While institutions play many roles in a society, one of their key economic roles is to reduce uncertainty (Peng, 2014; Peng et al., 2008) and costs and risk (Alam, Uddin, & Yazdifar, 2019b). Interacting with other firms is often very uncertain, and other firms may engage in deceptive practices which results in unintended consequences for the market participant (Scott, 2014, p. 32). According to Douglass North (1990, p. 67) markets require good formal institutions in order to perform well, which developing countries often lack. According to Chadee and Roxas (2013) and Tambunan (2007) well-developed formal institutions act as a deterrent to rent-seeking behaviour. In addition to reducing uncertainty, according

to new institutional economics institutions also provide incentives and support, create a stable environment and reduce transaction costs (Scott, 2014, p. 42,; Williamson, 2000).

According to new institutional economics, one of the most important mechanisms that institutions shape organisational strategy is through transaction costs. They refer to any costs incurring when one participates in the markets. They are the costs of collecting information, enforcing contracts between various actors and decision-making. (Coase, 1960). Douglass North (1990) argues that it is institutions that determine transaction costs. They are also too important to ignore when it comes to understanding institutions in the developing countries (Narayanan & Fahey, 2005). Transaction costs are seen to be results mainly from the limited capabilities of human cognition (Richman & Macher, 2006). Barasa et al (2017) argue that bad institutional environment hampers firm's ability to use their resources, such as R&D, and turn them into innovative output. In Figure 1, adapted from a paper by Chadee and Roxas (2013) one can see logic in how formal institutions have both direct and indirect effects on firm performance; the mediating factor that enhances firm performance is innovation.

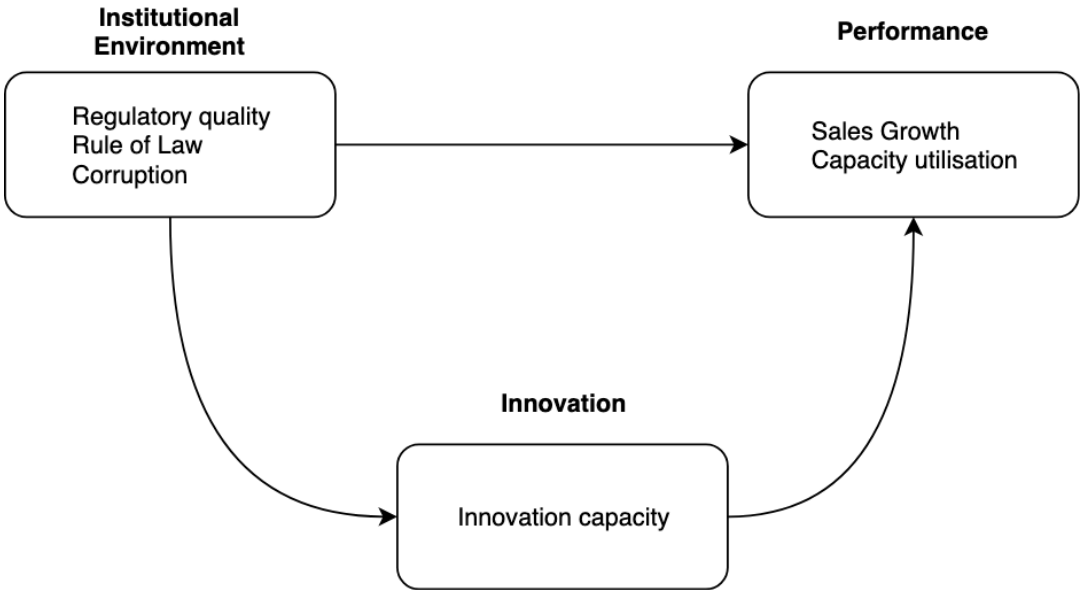

Figure 1: Institutional environment, innovation and firm performance. Adapted from Chadee and Roxas (2013).

Institutional theory and institution-based view has been a theoretical foundation for several empirical studies about firm innovation. For example, Roberto Galang (2012) has used institution-based view to analyse the diffusion of electric ticketing systems in airline industry. His results show a positive correlation between government efficiency (institutional quality) and technology investments, companies operating in countries with low institutional quality were slower at adopting new technology. He suggests that one of the mediating factors was that government inefficiency made contract enforcement more difficult.

Zanello et al., (2016) found several barriers to innovation in their review of the literature. Primary ones were quality of the education system, volatility of the political landscape, weak legal systems, lack of financial resources, lack of infrastructure and cultural and linguistic distances. Some scholars suggest that democracy is more appealing for foreign investors when deciding to invest in the country, yet it is more likely that it is not the type of government that matters, but predictability of political outcomes, such as taxation (Richman & Macher, 2006). Zhu, Wittmann and Peng (2012) have used institution-based view as a framework to study innovativeness of SMEs in China. They found fairness of the competition, rules and regulations, access to finance, tax burden and lack of public support systems as top barriers to development and innovation in their survey.

Ahn and York (2011) surveyed Malaysian biotechnology firms and found support for the institution-based hypothesis along with resource-based view. Chadee and Roxas (2013) analysed firms from Enterprise Survey in Russia and found that poor institutional environment harms building innovative capacity of the firm. Zhang, Wang, Zhao and Zhang (2017) analysed companies in China and found that supportive institutions have a positive impact on innovative activities. Barasa et al. (2017) have analysed how institution affect the use of firm-level resources in East African countries. They found that institutional quality positively affects to the use of firm-level resources and thus has a positive impact on innovation output and input.

Srholec (2011) using multilevel modelling approach found that quality of institutional conditions predict firm's likelihood to innovate. He found that especially tax system, inflation, basic education and political system were important for innovation. Goedhuys, Mohnen and Taha (2016) found that corruption has a 'greasing the wheels' effect on innovation when using data from Egypt and Tunisia. According to their hypothesis corruption works as a tool to reduce the bureaucratic red tape, making it beneficial to firm performance. Lee & Law (2016) have found that quality formal institutions positively impact innovation using patent data. With these theoretical views and empirical evidence in mind, the first hypothesis can be drawn.

Hypothesis 1: *Firm's innovative output is positively related to quality of formal institutions.*

2.4 Informal institutions

Informal institutions are the cultural-cognitive and normative pillars of institutions (Stephan, Uhlaner, & Stride, 2015). While formal institutions are the human-devised constraints on human activity, informal institutions come from culture and cognition and learned ethical norms (North, 1990, pp. 36–39, 67). The informal institutional environment is much of a less studied subject than formal institutional environment and research into it has historically been rare (Becheikh, Landry, & Amara, 2006).

2.4.1 Hofstede's cultural dimensions

One of main frameworks to study the cultural-cognitive and normative pillars is Geert Hofstede's study of cultural dimensions (Alexander, 2012; Garrido et al., 2014). Culture, values and ethics are a proxy for informal institutions (Khan, Hussain, & Iqbal, 2017). Hofstede originally suggested four cultural dimensions

as described in Culture's Consequences (2001), that have later been upgraded to six dimensions using the research of Michael Minkov (Hofstede et al., 2010).

The cultural dimensions can be seen as preferences over one state of affairs over another. The measures are not to be used for stereotyping people in a certain country, but rather they represent statistical averages of a given society (Hofstede, 2001, p. 14). Logically this leaves room for regional differences to exist inside a country. Hofstede himself views that culture is relatively unchanging on a short term, so new measures do not have to be collected on a yearly basis (Hofstede, 2001, pp. 11, 36). Even though Hofstede's concepts are based on data collected solely from IBM, he stresses that the scores a reflection of national culture (Hofstede, 2001, p. 83). The scores range between 0-100 on Hofstede measures, with 50 often being in-between point where values over 50 are seen as high and values under 50 as low (Hofstede et al., 2010, pp. 93–94). Analyses show that average country has intermediate values and the cultural dimensions are not highly correlated with each other, meaning that each of the Hofstede measures actually measures separate dimension (Garrido et al., 2014). The dimensions are Power Distance Index (PDI), Masculinity versus Femininity (MAS), Uncertainty Avoidance Index (UAI), Long Term versus Short Term Orientation (LTO), Indulgence versus Restraint (IND) and Individualism versus Collectivism (IDV). These will be discussed next. This thesis will focus on four original measures due to lack of data for two newest measures, PDI, UAI, MAS and UAI. These are described in detail below.

Power distance index (PDI) according to Hofstede (Hofstede, 2001, pp. 83–84) is the measure of *interpersonal power or* influence that manager has on their employee, as it is understood the less powerful of the two. Countries that score high on power distance index are accepting of the fact that power is distributed inequitably and accept the hierarchical order, while countries that score low do not accept it and seek to equalize the distribution of power (Hofstede, 2001, pp. 79–84). Low power distant countries also believe in equality, while high power distant societies believe that those who hold power are entitled to privileges (Hofstede, 2001, p. 98). In organisations these differences show as more centralised

organisations, more supervisory personnel and more reliance on formal rules in higher PDI societies (Hofstede, 2001, pp. 107–108).

Individualism versus collectivism (IDV) refers to how individual relates to the social groups around them. Individualist countries are often market economies, while collectivist countries favour state capitalism or state socialism; thus the markets see less competition in collectivist countries generally. (Hofstede, 2001, p. 251). Firms in high individualism countries generally operate differently from collectivist countries. In collectivist countries firms' employees often favour their in-group when making hiring decisions, employees are less committed to organisations, people work less hours, and employees are less often dismissed for poor performance. (Hofstede, 2001, pp. 244–245).

Masculinity versus femininity (MAS) is third of Hofstede's original measures. It relates to average differences between sexes. Countries that score high are seen as masculine, while countries that score low are seen as more feminine. (Hofstede, 2001, pp. 279–281). Masculine societies emphasise competition, success and personal achievements, while feminine societies with low scores prefer cooperation and modesty. At work feminine cultures exhibit as lower stress, resolution of problems through problem-solving instead of denying the issue, more women in the management and preference for smaller companies (Hofstede, 2001, p. 318).

Uncertainty avoidance (UAI) should not be confused with risk avoidance (Hofstede, 2001, p. 145). Uncertainty avoidance measures the amount how much people are willing to accept uncertainty and ambiguity. Countries with low scores prefer maintaining the *status quo*, while countries that score high prefer to change the status quo and accept changes in the society, such as adopting new technologies, people in low UAI countries are also generally happier, have less work stress and better well-being (Hofstede, 2001, pp. 159–161). At work high UAI countries manifest as people being more loyal to employer, more formalised structures and higher belief in specialists (Hofstede, 2001, pp. 169–170).

2.4.2 Impact of informal institutions on innovation

Informal institutions also play a large role in determining the innovative success of firms as well as formal institutions. Some cultural traits and values shape one's likelihood to succeed as entrepreneur (Kreiser, Marino, Dickson, & Weaver, 2010). This is often called entrepreneurial orientation and dimensions that are theorised to influence it are innovativeness, risk-taking and proactiveness. (Kreiser et al., 2010). This thesis draws from the work of Scott Shane (1993) and Hofstede (2001) and Hofstede, Hofstede & Minkov (2010) to build a theoretical framework in order to explain how informal institutions affect innovation of firms. Scott Shane's (1993; 1995)work leans to Hofstede's cultural dimensions theory to explain a firm's decision to engage in innovative activities. As national culture is fairly stable even over long term, norms can have a significant influence on firm behaviour even when formal institutions have developed to be efficient. Zhou and Peng (2010) point out Japan as an example, where relational transactions are still fairly common even today. According to economic sociology the culture of entrepreneurs and organisations is directly influenced by their surrounding culture (Granovetter, 1985). This view is echoed by Scott Shane (1993), who has researched the impact of culture on innovation using Hofstede's dimensions.

Hofstede's cultural dimensions directly relate to innovation performance of firms. Most of research about national culture and innovation has been conducted by Scott Shane (1993; 1995). Even though the research is about national levels of innovation, the main operational mechanism how culture affects innovation rates is through people and organisations. Shane (1993) theorises that institutional theory provides the answer why cultural traits influence innovation: Organisations are a reflection of cultural values, and in societies that accept uncertainty, are individualistic and non-power distant, it could be easiest to promote organisational values that in turn promote innovation. In mediating effects to innovation, Kreiser et al. (2010) have found that national culture influences risk-taking and proactiveness of SMEs when studying economies of Australia, Sweden, Costa Rica, Norway, Indonesia, and the Netherlands.

High power distance in countries can be problematic for innovations, as it can prevent sharing of information, which innovation relies on (Hofstede, 2001, p. 108). Challenging authority and status quo spurs creative thinking (Kaasa & Vadi, 2010). From this we can draw our first hypothesis relating to Hofstede measures.

Hypothesis 2a*: Firm's innovative output is negatively related to cultural dimension of power distance index.*

Individualism. People in individualist cultures place emphasis on personal accomplishments (Chen, Podolski, & Veeraraghavan, 2017). Individualist societies also place more emphasis on individual freedom and outward orientation (Shane, 1993). Following Shane's logic, highly individualistic cultures allow more decision-making freedom for managers, which translates to better innovative performance for firms. A lot of ideas also happen in individuals and often individualistic societies give people freedom to try out their new inventions (Kaasa & Vadi, 2010). In individualistic societies innovations also happen mainly outside existing networks and highly individualistic countries see more patents granted (Hofstede, 2001, p. 244). Chen et al. (2017) have found when analysing firms that individualism is positively associated with firm's innovative outcomes. The next hypothesis can be drawn:

Hypothesis 2b*: Firm's innovative output is positively related to cultural dimension of individualism versus collectivism.*

Masculinity. With respect to Hofstede's dimension of masculinity, Shane (1993) argues that innovative managers are driven by financial rewards and prestige, which are masculine values. He draws the conclusion that masculine societies will be more innovative than feminine societies. However, in contrast to his reasoning, this thesis follows more contemporary evidence and theory that suggests this is not the case. Following reasoning proposed by Kaasa and Vadi (2010) the reasoning behind how masculinity affects innovation is that feminine cultures have less conflict, more trust and support, which helps with coping with uncertainty. Feminine cultures also prefer to work through problems through co-operation and

problem solving, instead of denying an issue exist, which may contribute to finding solutions to problems and therefore innovating more (Hofstede, 2001, p. 318). Therefore we can draw:

Hypothesis 2c: *Firm's innovative output is negatively related to cultural dimension of masculinity versus femininity.*

Uncertainty avoidance. In countries with lower uncertainty avoidance, innovators feel less constrained by rules and regulations and new innovations are more welcomed, while in higher UAI countries generally see less trademarks and are more resistant to new technologies (Hofstede, 2001, pp. 167–171). Uncertainty avoidance has also been empirically found to deter technology adoption (Syed & Malik, 2014).

Hypothesis 2d : *Firm's innovative output is negatively related to cultural dimension of uncertainty avoidance.*

2.5 The conceptual model

Now that all of hypothesis relating to institutions have been drawn, we can build a conceptual model. The conceptual model includes an extra step, which will be presented later in 3rd chapter in greater detail. The extra step relates to measure of World Governance Indicators, which are used to measure formal institutional quality.

All of the hypotheses and conceptual model for the study are shown below in Figure 2. The hypothesised relationships between different institutional measures and the construct of innovation are also shown in the figure denoted with either (+) or (-). The figure also shows the multi-level approach in the study, which will further be discussed in the Chapter 3.5.

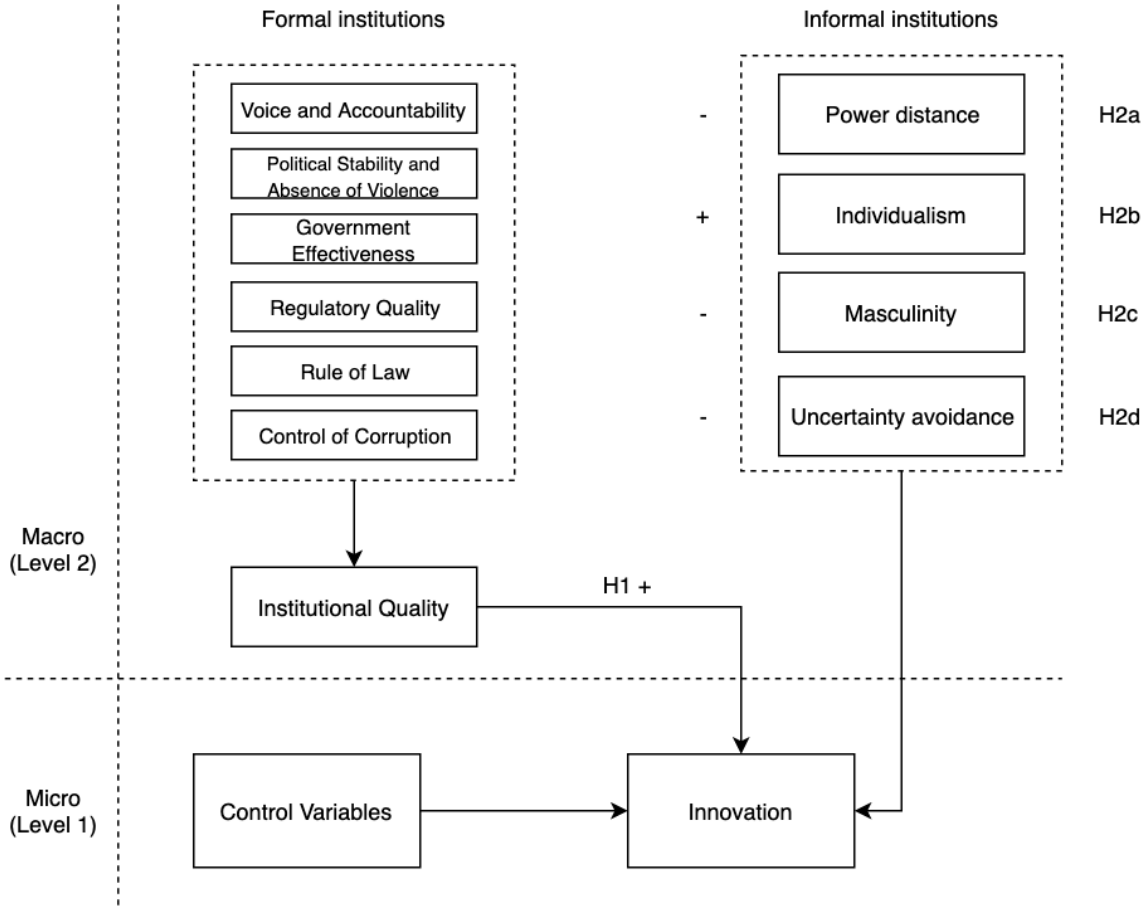

Figure 2: Conceptual model and hypotheses.

3 RESEARCH METHODS

The difficulty of bridging the gap between theoretical foundations of institution-based view and the empirical study of institutions and how they affect firm's strategic choices is a well-known issue (Garrido et al., 2014). In this the different measures of institutions and innovation will be explained. It is crucial to review different measures and find a best-suited measure for theory and justify their use using empirical evidence.

Statistical methods are used in this thesis to test the drawn hypotheses. Hypotheses H1 and H2a, H2b, H2c and H2d are explored using multilevel extension of logistic regression. The structure of the data necessitates the multilevel logistic approach given dichotomous dependent variable and hierarchical data structure with firms nested in groups of countries. The data and methods are explained below in greater detail with a special emphasis on multilevel modelling.

3.1 Data sources and measures

This thesis uses several data sources combined. The Enterprise Survey questionnaire provides a backbone of the research, providing important data regarding firm's innovativeness that is in line with the definition provided by The Oslo Manual 2018 (OECD/Eurostat, 2018) and consistent with the new-to-firm type of innovation that the research questions are interested in.

In this chapter different methods and sources for measuring institutions are presented. There exists a lot of data about institutions, but the difficulty is in finding the right objective measures of them (Garrido et al., 2014; Henisz, 2000). Most measures are focused on formal institutions, which will be the focus of this study as well. There are plethora of methodological issues related to studying something as complex as institutions, so the aim is to find the right constructs for this study.

3.2 Data

This thesis uses a combination of several data sources, including World Bank Enterprise Survey, World Governance Indicators (WGC) and Hofstede cultural dimensions and World Bank databank for country-level measures such as Income Group. They are described in greater detail below.

3.2.1 Enterprise Survey

The first source was World Bank Enterprise Survey project (WBES), which provides various firm-level data, including data about innovations. WBES is a cross-sectional firm-level survey performed by Enterprise Analysis Unit of World Bank. The survey covers 139 countries and 135,000 firms with interviews being done in waves every 3-4 years for each country (World Bank, 2019d, 2019a). The data is available as country-level data or standardised data, of which the latter will be used here. The standardised data will not have specific country-level questions, but rather is standardised to a standardised set of questions that are comparable across countries (World Bank, 2019a).

The method for data collection is interviews with relevant top-level management of the firms and business owners. All the data, including panel data, is publicly available from World Bank website at www.enterprisesurveys.org (World Bank, 2019d). WBES uses stratified sampling methodology with subpopulations based on location, firm size and sector activity. A systematic error may occur from firm's refusal to participate in the survey (World Bank, 2009).

One of more recent waves of Enterprise Survey was done between 2013 and 2015. These years were selected for this research. The data was combined with World Bank country classification data (World Bank, 2019f) based on their respective historical income groups of the year, and countries that were 'High Income' were

filtered out in line with the research questions. These countries for example included Poland, Slovakia and Croatia.

The main question of interest for innovation in WBES surveys is one that has been used in past research (Ayyagari et al., 2011; Barasa et al., 2017; Chadee & Roxas, 2013) to measure product innovation. The question of interest is: *during the last three years, has this establishment introduced new or significantly improved products or services*? In the Enterprise Survey it can be found under label *h1* in each questionnaire. The question is standardised for each country. After cleaning up the missing values, the question has two possible values with "1" being "Yes" and "0" being "No" making it a dichotomous variable. The variable was given name $INNOV$.

In order to account for the direct effect of institutions for innovation, we have to control for effects that we know to affect innovativeness of firms (Srholec, 2011). The primary contribution comes from research and development, which is known to have an effect on innovation. Secondary variable is training, which serves as a proxy for the firm's cognitive resources. Both variables are explained in more detail below.

Firm age is important determinant of innovation. Firm age can be said a measure of business experience, often measured with age of the firm, is seen as a key determinant of innovation, which indirectly measures firm resources as well. The theory goes, that firms that have more experience are better at fostering innovation. Freel (2012) has observed this to be true in small manufacturing firms. Firm age was computed by subtracting establishment year of the firm from the year of the survey, according to example set by Barasa et al. (2017). The variable is a metric variable as it is measured in years. The variable is given name AGE. The variable is grand-mean centred. Level 1 variables can be group-mean centred: In it you score the variables according to their deviations of their mean in their group (country). The approach is widely used, but can increase bias and therefore is not always recommended, despite its heavy use (Kelley, Evans, Lowman, & Lykes, 2017).

Firm size is one of the key determinants of innovation according to Schumpeter. The argument goes that bigger firms have more resources to innovate due to having more resources to innovate, ergo, they innovate more. This has been observed to be the case in many countries (Ayyagari et al., 2011; Freel, 2012). Similar reasoning is used by Martin Srholec (2011) to control firm size. Additionally, the WBES questionnaire asks if firm introduced an innovation, so it stands to reason that larger firms by simple virtue of being larger, would introduce more innovations. The variable is given name $SIZE$.

Legal status of the firm is another control variable that has been previously used in studies (Barasa et al., 2017). Ayyagari et al (2011) has shown that firms that are organised as corporations are more innovative than firms that are not shareholding companies. The original variable from WBES includes six categories, which were recoded into “0”, firm is not a shareholding company and “1”, firm is a shareholding company, respectively. The end result is a dichotomous variable and is given name $LEGAL$.

Firm training. Training question in WBES serves as a proxy for firm’s capabilities to have educated workers, therefore it is included as a control (Barasa et al., 2017). The question in WBES asks if the firm provides ‘formal training programs for full-time employees’. The resulting variable is called $TRAIN$.

Research & Development, or R&D, is one of largest determinants of innovative activities in firms (Barasa et al., 2017; Ritter-hayashi, Vermeulen, & Knoben, 2016; P. J. A. Robson et al., 2009). In the Enterprise Survey it is measured using the question: “During the last three years, did this establishment spend on research and development activities, either in-house or contracted with other companies (outsourced?)”. The answer can take only two possible answers with “1” denoting “Yes” and “0” denoting “No”. The resulting variable is dichotomous and is given name RND.

3.2.2 Governance Indicators

Second set of data comes from World Bank Governance Indicators project that will be used to study formal institutions in a country (World Bank, 2019e). Governance Indicators have six perception-based variables of institutional quality that are widely used in the research (Garrido et al., 2014; Thomas, 2010) They relate to the regulative pillar as identified by Scott (2014) as they explore the country's relationship with laws, rules and regulations and their enforcement. The inclusion of WGI was also ruled by its comprehensive coverage of countries (World Bank, 2019e). The WGI measures have also been associated with the measure of innovation, making them a well-suited choice for the particular research (Marcotte, 2014).

Kaufmann et al., (2005, 2011) have constructed six perception-based indicators that measure the quality of institutions and traditions that are also used in the World Bank Governance Indicators Project. Governance indicators are available for every year from World Bank's website (World Bank, 2019e). The data are constructed based on perceptions of business leaders and other survey respondents. A definition of governance is given by Kaufmann, Kray and Mastruzzi (2011), which is also used in the Governance Indicators Project (World Bank, 2019e). In their definition governance involves both traditions and institutions, which are used to use the authority in a given country. Their definition of governance involves traditions and institutions and how they relate exercise of authority in a country. Institutional quality refers to the quality of said institutions, and in this context, governance is a measure of how well institutions perform.

The measures are Voice and Accountability, which measures freedom of the press, electoral freedom and freedom of expression. Political Stability and Absence of Violence/Terrorism is the perception that country's government would change or be destabilised by undemocratic means. Government effectiveness captures the quality of civil service and public services. Regulatory quality measures to how well the government is able to implement good policies and how well it promotes the development of markets. Rule of law measures the how well

government actors abide by their own policies, such as property rights, courts and the police. And finally, control of corruption measures the perception how much government power is exercised for individual gain. (Kaufmann et al., 2005, 2011).

However, there is a debate in academia over the measures; do they really measure six separate concepts, or just one broad concept of quality of governance. There are claims that the indicators lack construct validity (not measuring what they claim), not having solid theoretical basis, having high intercorrelation and broadly simply measuring perceptions on quality of governance (Czeglédi, 2017; Garrido et al., 2014; Langbein & Knack, 2010; Thomas, 2010). Marcotte (2014) has previously used Governance Indicators as a measure of institutional quality. Elisabet Garrido et al. (2014) have performed a factor analysis on the indicators and suggest high correlation between each indicator. This brings us to our last and final hypothesis, which will be explored with confirmatory principal component analysis to test the hypothesis that the components can be factored into one single structure (Tabachnick & Fidell, 2007, p. 610). However, this will be done as a first task, and if applicable the resulting index will be used to explore the effect of institutions if the index can be constructed as other authors have asserted.

3.2.3 Hofstede cultural dimensions

Lastly, the thesis will use Hofstede's cultural dimensions to measure informal institutions. Cultural dimensions by Hofstede are seen as time-invariant, meaning that cultural dimensions are not expected to change on short term. Hofstede's data set is available from Geert Hofstede's website (Hofstede, 2015). The data used in this thesis uses the newest dataset available, that is also used in Hofstede's books, labelled as "(version 2015 12 08)". The dataset contains calculated variables for all six measures described earlier. There are 112 countries and regions in the data. Most cases are countries, but for example data contains averaged variables for regions such as East Africa, West Africa and Arab countries. However, these were not used as it was found problematic to group together culturally diverse countries as one, but also introducing many countries with same data points would not yield valuable information and dropping these is suitable approach (Murdoch, 2009).

This thesis uses the original version of the dimensions that scores from 0 to 100, downloaded from the website of Geert Hofstede that his book was based on (Hofstede, 2001, 2015).

Hofstede's cultural dimensions that are used to study informal institutions scale from 0 to over 100, where scores under 50 mean that culture's score is low, while over 50 means that culture has a high score on that particular dimension . These were standardized to grand mean in order to enhance interpretation of the results. Grand-mean centring is a widely practiced way to enhance the interpretation of the variables. It is done by subtracting the overall mean of the variable from each score (Sommet & Morselli, 2017). The variables for each of the four dimensions are respectively PDI for power distance index, IDV for individualism versus collectivism, MAS for masculinity versus femininity and finally UAI for uncertainty avoidance.

3.2.4 Data cleanup and organisation

In order to create a dataset usable in multilevel research, all of the data has to be combined into one single dataset. The first part was a rather labour-intensive process of combining non-standardised country names of each of the four datasets to match in order to figure out which countries were usable in the study. The resulting dataset had data from WBES, WGI, Hofstede and World Bank Income group projects. Some additional tasks had to be done, such as changing country names as each of the aforementioned three data sets had different naming conventions for specific countries – all countries and their names were matched according to entries contained in WBES dataset. After data clean-up and recoding of variables the final set of variables were ready to be operationalised. The independent variables of WGI and Hofstede measures had been grand-mean centred for the reason of interpretability of regression. Standardization of variables may additionally help reduce multicollinearity problems in the regression model.

As mentioned, this thesis used WBES wave from 2013 to 2015. Next Hofstede and Governance measures were added to the dataset. Firms that were not SMEs were filtered out from the dataset, that included firms that had employee count of 100 or over. WGI data included measures for 2013-2015 for each country in our sample, but Hofstede measures were available only for 42 countries. To be eligible countries were chosen by their income group – any high-income countries were removed from the data as they did not fit to classification of developing countries. Only 13 countries remained after filtering out countries with no Hofstede measures. Appendix 2 shows initial list of countries in datasets.

Only outliers removed were from manager experience variable, which had two outliers. After dealing with outliers, missing values and country selection based on income groups, 13 countries remained with 14805 observations (firms). Missing values were dealt with listwise basis; firms that had a missing value for any of the variables were removed from the data. Understandably this may introduce a bias and selection effects at a cluster level, but the decision was taken due to low number of missing variables from the observations, and variables being largely categorical. These listwise deletions had to be done to make different multilevel models comparable in order to find out best fitting model. Likelihood ratio test can only be accomplished by comparing models with same amount of observations. Grand-mean centring is recommended when researcher is interested in an effect of level 2 variable on a level 1 variable, which is the case for this thesis. Grand total of 387 values were removed which corresponds to 2.5% of values that were removed listwise basis. According to Hox et al. (2017, p. 307) listwise deletion, where whole entry from all variables is removed, is an appropriate method for missing values in multilevel modelling as long as the missing values do not exceed 5% of the observations.

3.1 Statistical approach

A central theme of this thesis, in accordance with Martin Srholec, (2011) is that innovation is determined by factors operating on different levels. Similar argument

has been put forth Robson, Haugh and Obeng (2009), who view multi-level research as appropriate tool due it being able to reflect complexity of entrepreneurial processes. In this research, we can assert that firm are operating on micro level, while institutions operate on the macro level. This means that the data used is embedded on two levels, or in other words, is hierarchical. This necessitates exploring multilevel modelling as a tool for research questions, instead of regular logistic regression. Before applying multilevel modelling, though, some research questions regarding WGI have to be explored. That will be done using Principal Component Analysis (PCA). Both approaches will be discussed next.

3.1.1 Principal Component Analysis

Confirmatory principal component analysis will be used to assess whether claims of world governance indicators measuring a single construct are valid. Principal analysis of this kind is done using factor analysis, which is a data reduction technique. It attempts to identify the factors that underlie a set of related variables. Principal component analysis is similar to factor analysis, and often produce similar results, though it technically yields components and not factors, are these terms often used interchangeably in the literature (Tabachnick & Fidell, 2007, pp. 609–611).

In principal components analysis, all of the variables will be transformed into linear combinations with all of the variance being used, contrary to factor analysis where only shared variance is used. Generally a good sample size of over 300 is recommended, though it has been suggested by Guadagnoli and Velicer (1988) that sample size may be irrelevant as long as the component has four or more loadings greater than .6.

3.1.2 Logistic regression

Because the dependent variable is dichotomous, or in other words, binary variable with only two outcomes, a regular linear regression is not suitable approach. When we are interested in approaching questions that have a binary response, such as the innovation question in WBES questionnaire a logistic regression is an appropriate tool (Tabachnick & Fidell, 2007, p. 437). In this case commonly used linear models lead to several problems, such as leading to predictions outside the zero and one continuum (Sommet & Morselli, 2017).

There are a few important distinctions between regular linear regression and logistic regression. The main one concerns residuals and assumptions of regression. Linear regression attempts to predict a value, but in logistic regression the aim is to predict a probability of an event; there is no residual term in logistic regression (Sommet & Morselli, 2017), because the observed value can only take two values 0 or 1, therefore following binomial distribution. Therefore, we can abandon the assumption of normal distribution of residuals.

Regular logistic regression assumes that responses are independent of each other – or in other words, it assumes that each response is unrelated to each other, though in hierarchical data the responses would not be independent and this would result in correlated error terms (Tabachnick & Fidell, 2007, p. 444). One solution for this is found from multilevel modelling (Field, 2013, p. 949).

3.1.3 Multilevel modelling

Main theoretical reason to use multilevel modelling is that when the target of the study exists on many levels, it makes sense to use techniques suited to study many levels (Luke, 2004, pp. 4–6). Multilevel modelling is a statistical technique that can handle hierarchical data structures. In the case of this thesis, the theoretical reasons to use multilevel modelling come from the fact that firms (groups of individuals) are nested in countries with their own cultural and socio-political contexts (Luke, 2004, pp. 8–9). Multilevel models are seen as crucial to develop theories of entrepreneurship in the future (Raza, Muffatto, & Saeed, 2018).

In practice 50 is a good sample size for clusters; one that does not lead to biased estimates and second-level standard errors (Maas & Hox, 2005), though problems persist when using country-level variables due to lack of available country-level data. The chosen wave of WBES data from 2013 to 2015 combined with other sources resulted to 13 countries in the final dataset (n = 13), which may affect estimation bias. Despite the potential issues with this approach, it is more desirable to use multilevel modelling rather than using regular logistic regression and thus abandoning the hierarchical data structure and ignoring the group variance (Robson & Pevalin, 2016, p. 26). This approach may raise estimation biases when interpreting results from country-level variables (Hox et al., 2017, pp. 215–216).

Multilevel modelling comes with its own set of assumptions and idiosyncrasies. One is that the terms ‘fixed’ and ‘random’ have a different meaning than one is typically used to. In multilevel modelling fixed effects are the regression coefficients that estimate the relationship of dependent and independent variables from the entire population, while random effects are randomly varying parameters across higher level units.

In the case of this thesis, the use of multilevel model is an extension of binary logistic regression, where the dependent variable has only two values (0 and 1). The logistic multilevel regression will be used to estimate the probability of success of the event – in this case, the chance of product innovation happening in a firm. It was chosen to go with a logit model for this specific study, even though the results with probit models are very similar. Logit model results are easier to analyse, especially when it comes to multilevel modelling (Hox et al., 2017). For the aforementioned reasons multilevel logistic models are an appropriate tool of choice.

In summary, logit version of multilevel regression will be used, calculated using maximum likelihood estimation method; this allows the study of dichotomous dependent variable (Guo & Zhao, 2002). Other potential and alternative methods will be discussed further in chapter 5.

4 Results

Results of the statistical tests will be viewed in this chapter. First, principal components analysis for WGI variables, then descriptive statistics for all of the other variables, including newly created variable from the PCA. And finally, results of multilevel logistic regression are reviewed.

4.1 Principal component analysis

A confirmatory principal component analysis was performed on the six WGI variables, as suggested by several authors (Garrido et al., 2014; Langbein & Knack, 2008, 2010), suggesting that world governance indicators measure a composite measure called *quality of governance*. The variables heavily correlate with each other, making PCA a possible avenue of study. The correlations can be seen in Appendix 1. The PCA was appropriate given Kaiser-Meyer-Olkin measure of sampling adequacy was .89, which was over the recommended .6 and Bartlett test's p-value was below recommended value of 0.05, which supported computing a component from the correlation matrix. The results are in line with previous research and suggest that all six measures do broadly measure the same general idea of *institutional quality*.

One single factor explained around 81% of the variance with eigenvalue over 1. This figure is in line with previous findings when using PCA to compute an index from WGI (Chiu & Emara, 2016). The scree plot suggests that we should retain values before the graph turns horizontal, also suggesting one component. A Horn's parallel analysis was conducted as well as it has become a norm to compare it in addition to other tests. Parallel analysis compares the eigenvalues from PCA to randomly generated eigenvalues of a data of similar sample size. Only component exceeded the corresponding criterion value, thus supporting retaining one component in line with other tests. The full statistical results of PCA can be found from Appendix 1. Only pattern matrix is reported as structural matrix held the same

values. The results of this analysis provide additional support in using World Governance Indicators as one variable instead of original six separate variables.

Finally, only one component was extracted an computed into a new variable that was be used in the regression analysis. The extracted component was grand-mean centred for the use of logistic multilevel regression.

In the line with previous research it can be concluded that world governance indicators do measure the same underlying construct that from now on can called as *quality of institutions*. The new variable is given name WGI.

4.2 Descriptive statistics

4.2.1 Innovation

Dependent variable was explored using frequency tables. There are 14,908 observations in firms nested in thirteen countries. Of general population approx. 68% of firms did not introduce a new product in last three years, while approximately 32% did introduce a new product.

However, there are significant country-level differences that should be noted before interpreting regression results. While most countries are closer to the mean, Turkey, Malaysia and Indonesia stand out. Their respective percentages were 10.97%, 5.72% and 8.82%, much further away from the grand mean. The results are shown in Figure 3 below. It's worth noting that no country exceeded 42%, therefore the scale of the graph is adjusted accordingly.

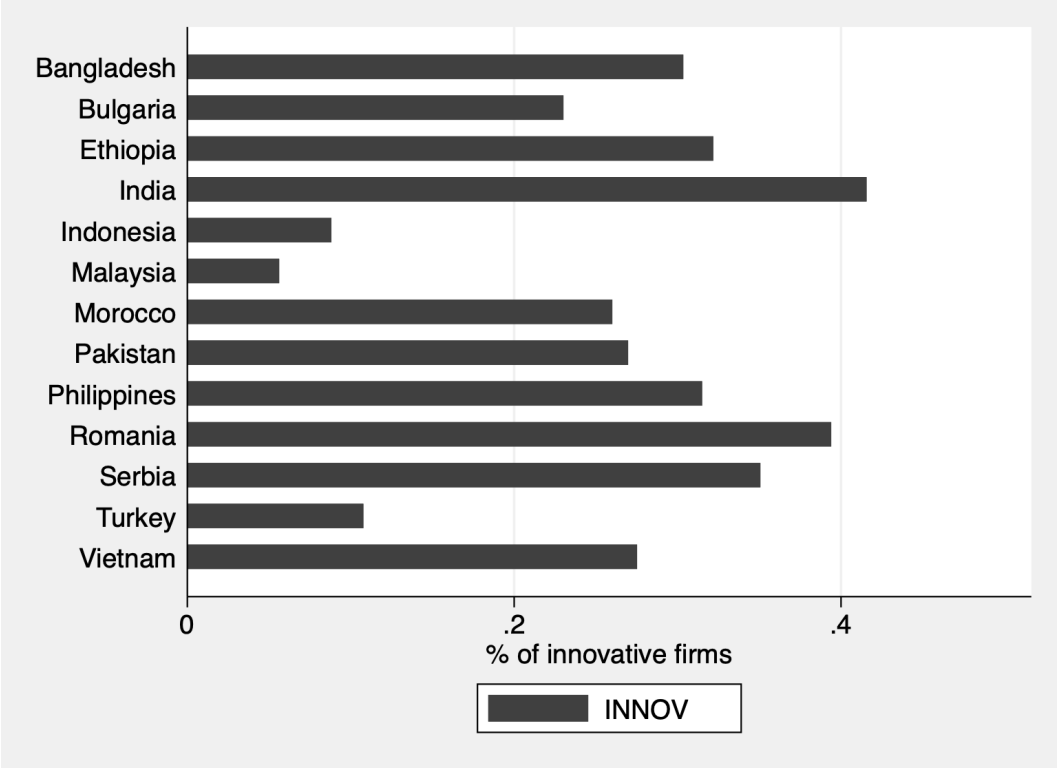

Figure 3: Dependent variable, innovation. % of innovative firms by country.

The data showed no indication what was the cause of this effect. The WBES questionnaires were explored to see if the differences arose from the way question *h1* about innovation was phrased, but there were no differences among the countries. There could be differences in how different cultures interpret the meaning of *new or significantly improved* in the question. These issues are explored in next chapter in greater detail.

4.2.2 Firm-level control variables

Some firm level variables were utilised as control variables. They were RND, LEGAL, TRAIN, SIZE and AGE. Of these AGE was only non-dichotomous variable. Table 3 below lists frequency tables for the dichotomous control variables, while Table 4 lists summary statistics for the AGE variable which was an interval variable, for which relevant statistics are shown.

Table 3: Frequency tables for control variables

		Frequency	Percent	Cum.
RND	No	11,799	79.7	79.7
	Yes	3,006	20.3	100
TRAIN	No	10,412	70.33	70.33
	Yes	4,393	29.67	100
LEGAL	Other	11,740	79.3	79.3
	Corporation	3,065	20.7	100
SIZE	Medium	7,800	52.68	52.68
	Small	7,005	47.32	100

Table 4: Summary statistics for variable AGE

Variable	Obs	Mean	Std. Dev.	Min	Max	Skew	Kurtosis
AGE	14805	0.00	12.575	-18.150	121.850	1.645	7.498

4.2.3 World Governance Indicators

Before discussing the WGI factor score, it is useful to look again what the original WGI scores held. What we can infer from them is that most countries in the sample did not have particularly good governance, if one keeps in mind that the original scales average from -2.5. to 2.5.

Below is the mean for the WGI component variable that was calculated using PCA. When interpreting regression coefficients it is useful to keep in mind factor score and what it means. Most of the countries' scores place somewhere around 0 to 0.5 on *quality of institutions*, meaning that their institutional makeup is slightly better than average of the sample.

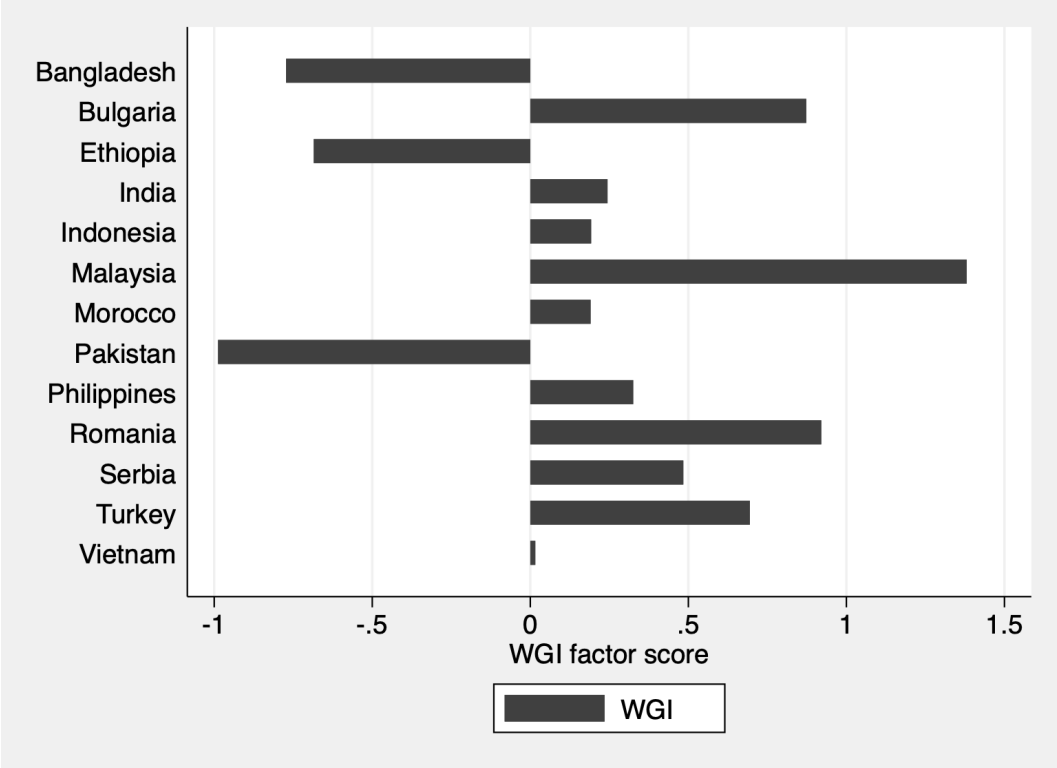

Figure 4: WGI factor scores for countries in the dataset.

WGI factor scores range from -.99 to 1.4. Countries that one would have expected to score low on quality of governance are at the bottom, namely Pakistan, Bangladesh and Ethiopia, while countries that are more at the proximate to western or European societies score higher. This may be a result of innate western bias in the governance indicator as some scholars (Chang, 2011) claim. Yet, there exists a good variation in the scores to account for different institutional contexts for the study.

4.2.4 Hofstede dimensions

Hofstede measures as mentioned range from zero to hundred. In the sample in this study the countries include Bangladesh, Bulgaria, Ethiopia, India, Indonesia, Malaysia, Morocco, Pakistan, Philippines, Romania, Serbia, Turkey and Vietnam.

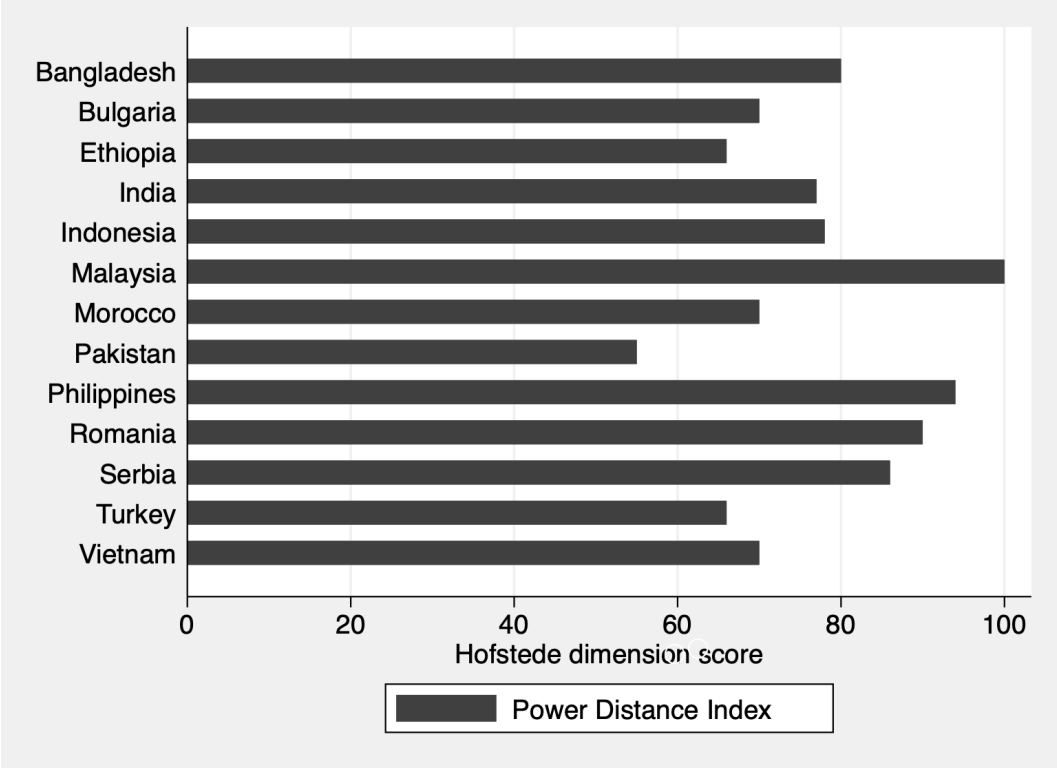

Figure 5: Hofstede dimensions' values in sample countries: Power distance index.

On PDI scale Malaysia scores highest, 100 (highest possible value of any countries, even ones not included in sample), while lowest is Pakistan with value of 55, indicating a hierarchical culture, but not as much as Malaysia. All of the countries in the sample are hierarchical cultures. The mean for all countries is 76.

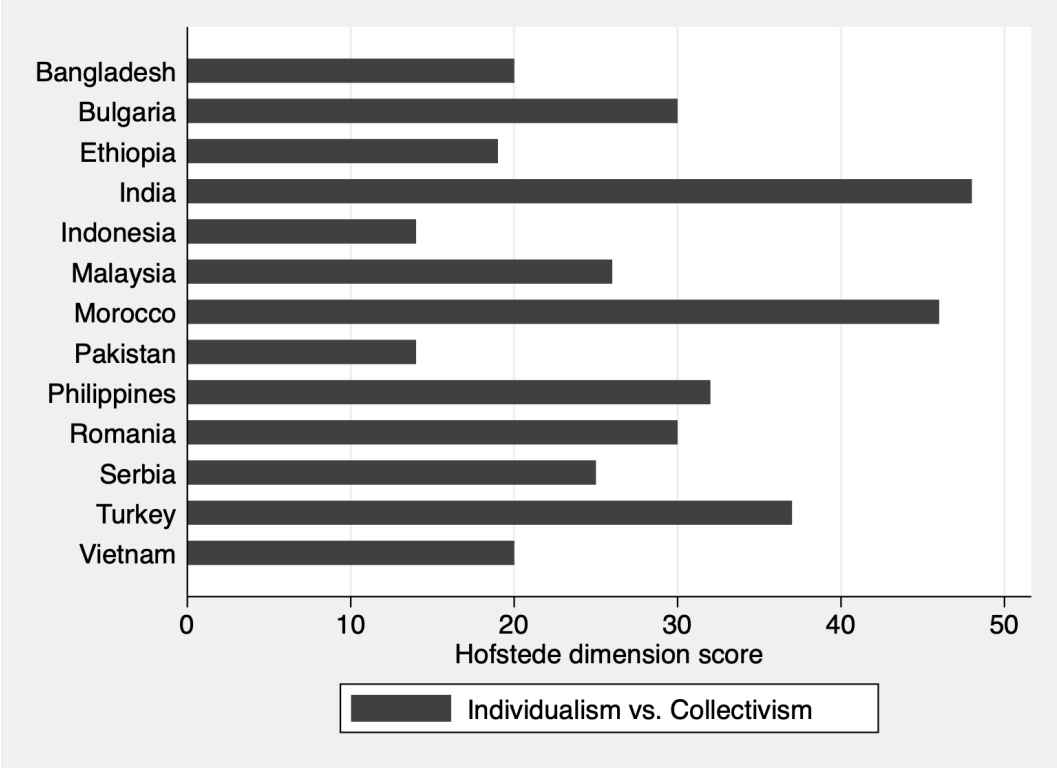

Figure 6: Hofstede dimensions' values in sample countries: Individualism vs collectivism.

In Individualism and collectivism, as we remember lower scores indicate more collectivist culture and higher scores more individualistic. India is the most individualistic culture in the sample, with a score of 48, while Pakistan and Indonesia score lowest with score of 14. The mean for all countries is 35.

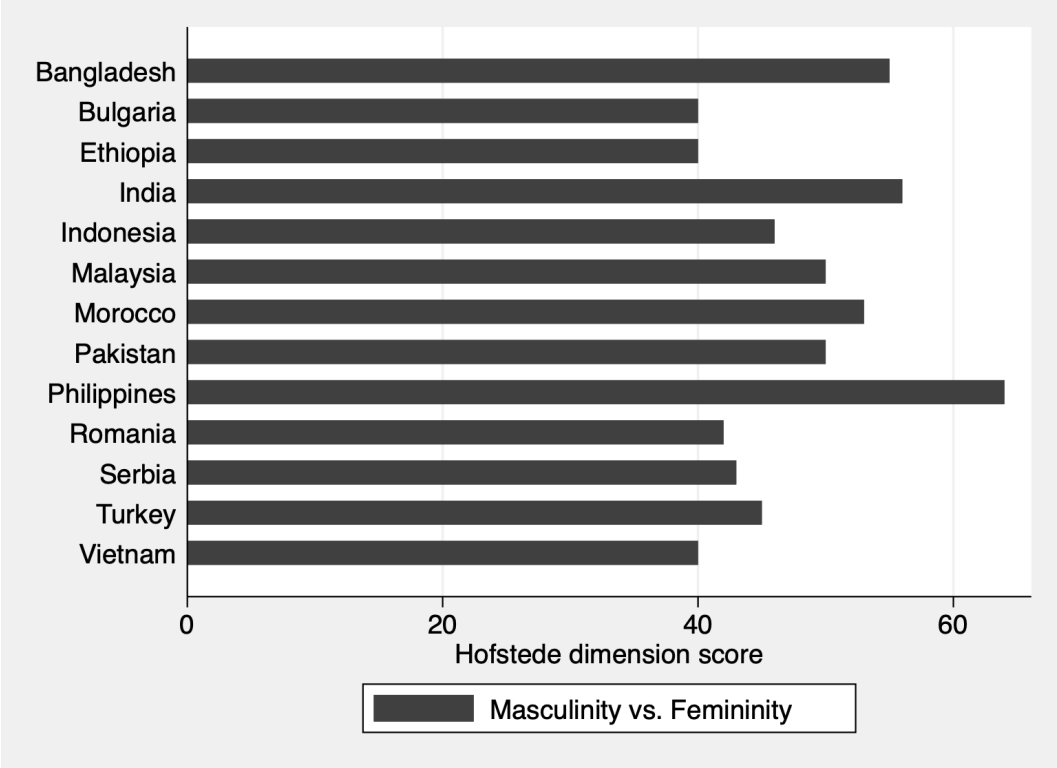

Figure 7: Hofstede dimensions' values in sample countries: Masculinity vs femininity.

Masculinity and femininity similarly range from 0-100, with under 50 seen as more feminine cultures and over 50 seen as more masculine. Philippines is most masculine in the sample with a score of 64, while other countries are more or less in-between with Vietnam, Ethiopia and Bulgaria scoring 40. The mean for all countries is 51.

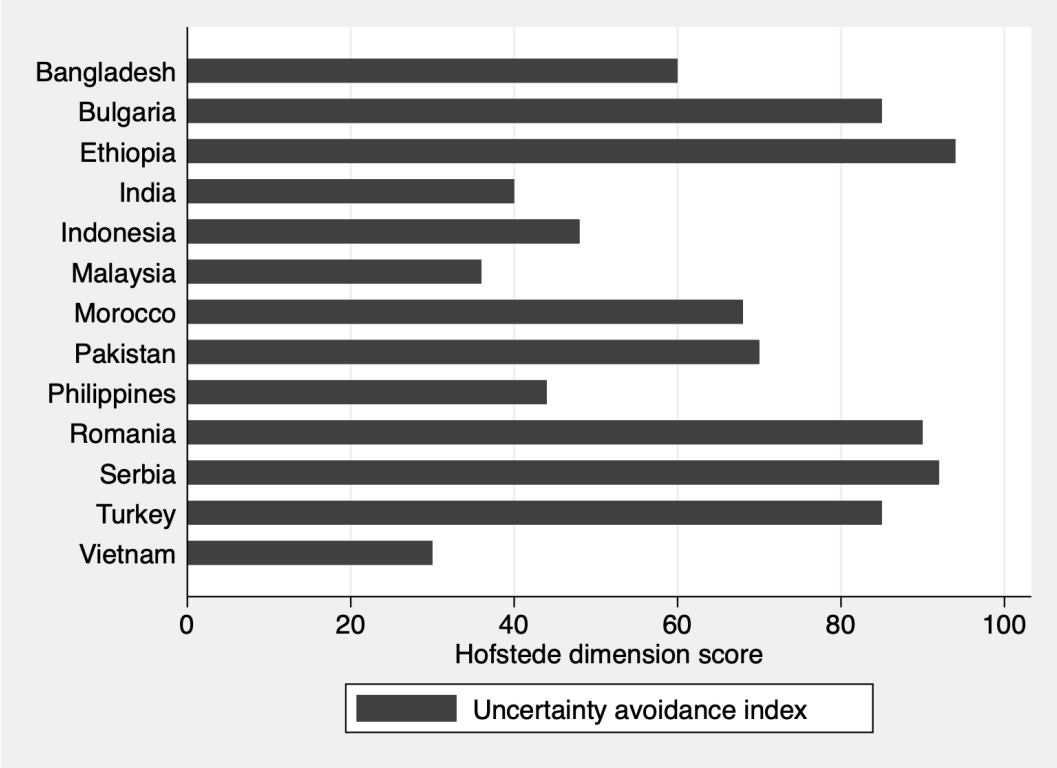

Figure 8: Hofstede dimensions' values in sample countries: Uncertainty avoidance index.

In uncertainty avoidance index we have most variation with values ranging from 30 to 94. Vietnam scores lowest with 30, while Ethiopia scores 94 with the highest score. The mean of the scores is 52.

As can be inferred from the bar graphs and summary statistics of Hofstede dimensions, there would be greater need for variation of the scores in the study. There is some variation, but ideally one would like to see scores all the way from close to zero to close to hundred to allow the proper range of cultural outcomes to enter the study. Yet, the research is constrained by available recent data and one must suffice with the current dimension scores.

4.3 Logistic multilevel regression

The modelling was done using the STATA 15 software for OS X. Stata uses full maximum likelihood estimation with numerical integration when calculating multilevel logistic regression models, as will be discussed in the next chapter this is an important issue to take into consideration when engaging in multilevel modelling. The model was built using a common approach suggested by (Luke, 2004, pp. 24–27) of starting with null model and building towards more complex one. Similar approach has been suggested by other scholars (Sommet & Morselli, 2017). The method works by first by adding level-1 predictors, and then adding level-2 after first model is confirmed to be fit.

4.3.1 Diagnostics

As a precaution, multicollinearity between level-2 independent variables was checked as it increases standard errors of regression coefficients, or in simpler terms, it may make some variables statistically insignificant when they should be significant (Shieh & Fouladi, 2003). Full collinearity diagnostics are found from Appendix 3 for each independent and control variable. However, the diagnostics showed no multicollinearity that one should be worried about as all VIF values were under 5.

4.3.2 Model 1: Null model

The unconditional, or null model was calculated to confirm that the data is eligible for multilevel modelling (Hox et al., 2017, p. 275; Sommet & Morselli, 2017). The null model only contains an intercept and country-level effects, where β_0 is the intercept that is common for all the countries, and the random effect u_{0j} is different for each country. The assumption is that the random effect follows normal distribution with variance σ^2_{u0}.

(1)

$$\log\left(\frac{\pi_{ij}}{1-\pi_{ij}}\right) = \beta_0 + u_{0j}$$

The most relevant diagnostic statistic for the null model is the ICC, or the Intraclass Correlation Coefficient, which may range from 0 to 1. ICC is calculated with formula below, where $\mathrm{var}(u_{0j})$ is the level 2 group variance and $\pi^2/3$ is the standard logistic distribution (Sommet & Morselli, 2017).

(2)

$$\mathrm{ICC} = \frac{\mathrm{var}(u_{0j})}{\mathrm{var}(u_{0j}) + (\frac{\pi^2}{3})}$$

ICC of 0 would indicate that the observation do not depend on membership of countries, while ICC of 1 indicates that observations only vary between clusters (Sommet & Morselli, 2017). The null model does not return Wald chi-square test as there no predictor variables. However, a likelihood ratio test is conducted which shows that the null model performs better than a simple logistic model that does not take group-level variation into account. The results from calculating the ICC of the null model suggest the use of multilevel modelling with ICC of 0.135247 at confidence interval of 95%; this means that 13.5% of the total variance is accounted by countries. In other words, 13.5% of the of innovation in firms can be explained by country-level differences, and 86.5% can be explained by within-country differences, such as firm's capabilities. According to criteria by around 0.10 ICC is a medium effect for organisational research (0.05 is small, while 0.20 is large), which also favours the use of multilevel modelling (Peterson, Arregle, & Martin, 2012).

The null model also returns the log-odds of -1.168 shown for the Intercept β_0, shown in the table 4, which can be turned into an odds-ratio of 0.311, which are the overall odds of firm engaging in innovative activities; we have to remember when interpreting odds ratios that the reference group is 0, 'no innovation'. These

results favour the use of multilevel modelling for this data, despite the low amount of groups (n=13). It is useful to remember here that multilevel modelling would have been a chosen approach due to the nature of nested data, though we should be careful from drawing conclusions due to low amount of countries in the sample, as the results may be biased due to the small sample. The issues with this are explored further in the next chapter.

4.3.3 Model 2: Random-intercept model

The second model, intercept-only model, adds firm-level explanatory variables that serve as control variables in the study. Following the protocol of building model from simple to more complex this is a valuable intermediate step to set a baseline for the model. The firm-level variables added as intercepts are RND, TRAIN, LEGAL, AGE and SIZE. The model is fitted as below in the equation 3.

(3)

$$\log\left(\frac{\pi_{ij}}{1-\pi_{ij}}\right) = \beta_0 + \beta_1\mathrm{RND}_{\mathrm{ij}} + \beta_2\mathrm{TRAIN}_{\mathrm{ij}} + \beta_3\mathrm{LEGAL}_{\mathrm{ij}} + \beta_4\mathrm{AGE}_{\mathrm{ij}} + \beta_5\mathrm{SIZE}_{\mathrm{ij}} + \mathrm{u}_{0j}$$

The likelihood ratio test is used to compare the model to the null model. Likelihood ratio is calculated using the deviance of the models. The formula for LR test is below. It will be used to compare the fitness of all models in the study. What it says is that are the added parameters important for the model. The likelihood ratio test is significant at p<.001 with likelihood ratio statistic of 1737.57 meaning that the intercept-only model fits the data better and the second model is preferable to the null model.

(4)

$$\mathrm{LR}\ \chi^2\ (1) = deviance\ (model\ a) - deviance\ (model\ b)$$

4.3.4 Model 3: Contextual model

The next model is called contextual model, and it adds contextual effects, or level 2 country variables. Generally one would consider here whether there are theoretical reasons to consider random slopes, but there were no theoretical reasons to suggest testing them as level-1 predictors act only as control variables and research questions do not involve having them to vary across groups (Peugh, 2010). Instead this thesis concerns of contextual variables; it is especially interested in how country-level variables, such as Hofstede measures and WGI index can explain country-level variation in innovativeness of firms. The firm is fitted as below, now with country-level contextual variables, but otherwise extension of the previous model. The equation is described below in equation 4.

(5)

$$\log\left(\frac{\pi_{ij}}{1-\pi_{ij}}\right) = \beta_0 + \beta_1\mathrm{RND_{ij}} + \beta_2\mathrm{TRAIN_{ij}} + \beta_3\mathrm{LEGAL_{ij}} + \beta_4\mathrm{AGE_{ij}} + \beta_5\mathrm{SIZE_{ij}} + \beta_6\mathrm{WGI_j} + \beta_7\mathrm{PDI_j} + \beta_8\mathrm{IDV_j} + \beta_9\mathrm{MAS_j} + \beta_{10}\mathrm{UAI_j} + u_{0j}$$

The likelihood ratio test is used to compare the model to the previous model with no contextual, or country-level variables. The likelihood ratio test statistic is 13.74 with a $p<0.05$, and we can infer that contextual model fits the data better than the previous model with no contextual variables. The third model is the most parsimonious of the three models tested and explains the observed data the best. The odds ratios with 95% confidence interval are reported for the final model in Table 5. They will be explored variable-by-variable basis below.

Table 5: Econometric results

Model	(1)	(2)	(3)
Fixed Effects			
Level 1			
Intercept	-1.168***	-1.408***	-1.296***
	(0.203)	(0.212)	(0.178)
RND		1.686***	1.686***
		(0.047)	(0.047)
TRAIN		0.492***	0.494***
		(0.043)	(0.043)
LEGAL		-0.210***	-0.198***
		(0.070)	(0.071)
AGE		0.005***	0.005***
		(0.002)	(0.002)
SIZE		-0.184***	-0.182***
		(0.041)	(0.041)
Level 2			
WGI			-1.516***
			(0.374)
PDI			0.053***
			(0.018)
IDV			0.057***
			(0.018)
MAS			-0.070**
			(0.031)
UAI			0.010
			(0.007)
Between-country variance	0.525***	0.555***	0.183***
	(0.212)	(0.225)	(0.783)
Log likelihood	-8736.466	-7867.682	-7860.811
Maximum likelihood	1059.01	629.94	150.05
Level-1 firms	14,805	14,805	14,805
Level-2 countries	13	13	13

Note: Binomial multilevel regression with logit-link function.
Maximum likelihood estimation. Values reported are coefficients. Standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

4.3.5 Model selection and interpretation

Next the coefficients and with them the results from variables can be interpreted. Coefficients are the reported log odds of an event happening. However, log odds are somewhat esoteric and difficult to interpret even for scholars. In order to interpret coefficients they should be turned from log odds into odds ratios, which greatly simplifies their interpretation, though some scholars prefer interpreting log odds directly.

Odds ratios can be viewed as the probability of an event happening – in this case the probability of product innovation happening in a firm. Odds ratios can be calculated directly from coefficients using any advanced statistical software. The odds ratios for variables for the final model are shown below in table 5 under the header OR. The fact that variables had been grand-mean centred affects the interpretation of the results, which should be kept in mind when looking at the results tables. A second issue to keep in mind that odds ratios are interpreted with regards to variable's reference category, which for dichotomous control variables here is 0 (innovation not happening in a firm), while 1 denotes event existing. For size reference category 0 is small.

Table 6: Odds ratios for dependent and control variables

Innovation	OR	Std error	z	P>z	[95% Conf. Interval]	
RND	5.3970	0.255	35.63	0.000	4.919	5.921
TRAIN	0.6102	0.026	-11.40	0.000	0.560	0.664
LEGAL	0.8203	0.058	-2.79	0.005	0.714	0.943
AGE	1.0047	0.002	3.05	0.002	1.002	1.008
SIZE	0.8332	0.034	-4.49	0.000	0.769	0.902
PDI	1.0540	0.019	2.93	0.003	1.018	1.092
IDV	1.0592	0.019	3.13	0.002	1.022	1.098
MAS	0.9328	0.029	-2.26	0.024	0.878	0.991
UAI	1.0100	0.007	1.47	0.141	0.997	1.023
WGI	0.2195	0.082	-4.05	0.000	0.105	0.457

No hypotheses were drawn for firm-level effects as they served as a control variables. Research questions in this thesis did not concern firm-level predictors either. However, it is useful to summarise their effects as they relate to past research and serve as a useful sanity check about the model.

Odds ratio of the research & development variable, RND, is 5.40. This indicates that the odds for a company that engages in research and development efforts to be innovative are 5.40 times as great as for companies that do not engage in R&D. In other words, engaging in R&D increases the odds of innovating by a factor of 5.4. This effect was statistically significant at $p<0.01$. The results are expected based on previous research.

Odds ratio of $TRAIN$, indicates the odds of engaging in innovative activities for firms that train their staff are 0.61 as great for companies that do not train their staff. This effect was also statistically significant ($p<0.01$). The results are also expected.

Odds ratio of $LEGAL$, indicates the odds of engaging in innovative activities for firms that are stock companies of any type are 0.820 of the odds for firms that are not stock companies. In other words being a stockholding company decreases the

odds of being innovative by 18%. This effect was statistically significant (p<0.01). The effect was opposite of assumed.

Odds ratio of AGE. As this variable is continuous and not binary, the interpretation differs slightly from the rest. The odds ratio for this variable is 1.00 (rounded), meaning that there is almost equal probability (or 50/50 chance) that innovation happens when age changes. This effect was statistically significant (p<0.01).

Odds ratio of $SIZE$, indicates the odds of engaging in innovative activities for firms that medium and not small is 0.882. In other words being a medium company decreases the odds of being innovative by 11.8%. This effect was statistically significant (p<0.01).

The main interest of this thesis has been effect of institutions and culture, on the innovation activities of the firm. Of these variables, all the effects with exception of uncertainty avoidance index were statistically significant.

In respect to odds ratio for WGI. The odds ratio for this variable is 0.2195, meaning that one point increase in World Governance Indicator index decreases the odds of firm being innovative by a factor of 0.2195. This effectively means that higher the institutional quality as measured by the WGI, the lower the odds of firm being innovative. This effect was statistically significant (p<0.01). The repercussions of this essentially mean that institutional quality is inversely correlated with firm being innovative. The effect is further analysed in the next chapter. This results in rejecting hypothesis *H1*.

Odds ratio of PDI is 1.053. This is a very small effect. This means that the odds of firm innovating increase by a factor of 1.053 as one unit of PDI increases; the more accepting of hierarchy the society is, the more likely the firms are to be innovative. This is also close to 1 and can be interpreted as PDI not having a significant effect on innovativeness of a firm. The effect is statistically significant. This results in rejecting hypothesis *H2a*.

Odds ratio of IDV, 1.059. This is a very small effect. This means that one unit increase in individualism dimension (indicating more individualist culture) increases the odds of firm being innovative by a factor 1.059. The effect was statistically significant. This results in accepting the hypothesis *H2b*.

Odds ratio of MAS is 0.932. This is a very modest effect. This means that one unit increase in masculinity dimension (indicating more masculine culture) decreases the odds of firm being innovative by a factor 0.0932. Effectively this means that the more culture is driven by recognition of rewards, success and competition, the lower the odds of a firm being innovative, or in other words, feminine culture fosters innovative companies, yet the effect is not very strong. The effect was statistically significant at ($p<0.05$). This results in accepting hypothesis *H2c*.

Odds ratio of UAI was close to 1, indicating almost equal chance of innovation happening with the change of the variable. The 95% confidence interval shows that the odds ratio falls somewhere between 0.99 and 1.02 – indicating that we cannot rule out that that the true odds ratio is exactly 1. The effect was not statistically significant at the lowest significance level with $p>0.1$. There are no further conclusions to be drawn from these odds. This results in rejecting hypothesis *H2d*.

The difficulty in interpreting comes from understanding what constitutes as one unit change in the real world scenario. In statistical terms interpretation is relatively straightforward: In the case of WGI, we can interpret the lowest amount of -1.15 as worse institutional quality and 1.2 as better institutional quality, given that these scores were calculated from sample of all countries in the data. Due to relatively low number of countries and lack of developed countries in the sample, however the conclusions we can draw are limited.

With Hofstede measures similar conclusions can be inferred from the results. With regards to power distance index – all original values were over 50 so all societies were somewhat hierarchical by their nature. Likewise most countries scored high on masculinity vs femininity, indicating that they were more masculine. With

regards to uncertainty avoidance and individualism the data had more variation. These issues affect drawing strong conclusions from the results. The summary of results in respect to hypotheses drawn earlier can be seen in Table 6 below.

Table 7: Summary of results

Hypothesis	**Result**
H1: Firm's innovative output is positively related to quality of formal institutions.	*Rejected*
H2a: Firm's innovative output is negatively related to cultural dimension of power distance index.	*Rejected*
H2b: Firm's innovative output is positively related to cultural dimension of individualism versus collectivism.	*Accepted*
H2c: Firm's innovative output is negatively related to cultural dimension of masculinity versus femininity	*Accepted*
H2d: Firm's innovative output is negatively related to cultural dimension of uncertainty avoidance	*Rejected*

5 Discussion

In this chapter some issues affecting the research are discussed. First, the results and their implications are discussed. The second, reliability of the research. Third and finally, some issues related to choice of measures are discussed, then issues related to statistical and multilevel modelling, including the choice of software and estimation methods that are important decisions for any research deciding to do multilevel modelling.

5.1 Significance of findings

Most of the hypotheses about institutional conditions were approved, with an exception results concerning formal institutional quality and uncertainty acceptance. The most significant effects came from masculinity and WGI, masculinity effect essentially says that feminine cultures boost innovation through the means of cooperation. For firms who want to be innovative this says that they should possibly aim to reduce the importance of rewards and stress more cooperation in their organisational culture. The results from other cultural dimensions showed miniscule effects, but that were in line with previous research. They mostly suggest that firms should focus on reducing in-group favouritism and have better hierarchical structures, though the effects were so small that it suggests that firms are more than welcome to ignore the existence of national culture on these fronts. However, for firms to be simply aware of the culture that surrounds them and their effects on innovation may be able to come up with strategies for mitigating the harmful parts of the culture that reflects on organisation, such as trying to reduce hierarchies.

The opposite of expected results from World Governance Indicators are sobering. Firms who strive to be innovative do not necessarily need to pay so much attention to institutional conditions or where they are located, but rather should focus on their own resources and competencies that seem to matter a great deal more. For any countries that wish to take lessons from the found results, and for example boost

their firms' innovative performance, the results not allow drawing any clear recommendations. Though if one is to follow the logic of the results, the lesson may be that liberalising institutions is not a necessary path to take. Yet, the results are mixed with previous research, indicating that a great deal of more research and larger sample sizes are needed before one make any sort of statistical generalisations.

5.2 Reliability and validity of the research

The main issue affecting reliability of this research is the small sample size of countries (n=13), despite the high amount of firms in the study (n=14805), though the analysis was done carefully and model was built to be as parsimonious as possible there are severe issues to consider and the suspected replicability of this research is questionable. There was a risk of Type I error (detecting a false positive) due to the low amount of countries in the study, though most of the results were inconclusive. The use of available measures and data severely restricted the type of research that was possible using statistical methods. Yet, the conditions were not fulfilled that were hoped to be; model including the country-level variables was not much better at fitting the data than a model without them. A small sample size also could have yielded some correlation problems, such as 0.7 correlation between WGI and GDP PPP per capita variables, of which latter was left out of the model due high correlation and VIF value of 20 which would have raised serious problems with standard errors. The correlation in such a small sample size could be a coincidence, which is why increasing the sample size in the future research would be first priority. Another suggestion would be to run a robustness check where RND was utilised as the dependent variable and how well institutions would explain investments in R&D as a proxy for innovation. Unfortunately, this was out of the scope of this thesis.

World Governance Index showed a negative effect on innovative activities of firms in this study and the third of Hofstede measures used in the study confirmed the hypotheses, yet the effects were very small. The main difference to previous

research that a lot of innovation studies using Hofstede measures had been done using national innovativeness index in primarily developed countries. These two distinctions make comparing the results somewhat problematic. Developed countries by default tend to be more innovative than developing ones; the infrastructure, national R&D spending, innovation systems, infrastructure and host of other factors allow firms to be more innovative.

This study does not focus on novel new-to-market innovations or innovations happening at the technology frontier, but rather more basic innovations of imitation and incremental innovation happening far away from the technology frontier. With regards to WGI results, respecting patent laws, trademarks and host of other regulations may be problematic for companies that wish to adopt technology. Likewise, it is probable that some dimensions of the original WGI measures may in fact aid innovativeness and the effect depends of their strength. Second, as discussed before, the type of innovation measured is broad-based innovation, which may not be similarly affected by quality of formal institutions, and some authors have actually suggested that lack of formal institutions may drive firms to be more innovative and use informal institutions. However, due to all of them being severely correlated with each other they were not explored in-depth as the results would have been problematic to interpret.

5.3 Empirical matters

As argued by Peng, Sun, Pinkham, Chen (2009), one of the key issues currently facing the institution-based view is the need to develop better measures of institutions. The currently reviewed available for formal institutions are approximations and mostly measure the institutions based on how market-facing they are, while the theoretical underpinnings from institutional theory are largely missing from the measures (Chang, 2011; Thomas, 2010). This is why it is worth discussing the selected measures used in this research. Both formal and informal institutions have many pillars and dimensions in institutional theory (Scott, 2014). However, the use of governance indicators and Hofstede's dimensions does not

necessarily fully capture the full extent of either (Jones, 2007; Thomas, 2010). There are also several problems with using WBES data for the study, which are discussed below.

5.3.1 Available measures: firm-level measures

While the use of WBES surveys for measuring innovation was justified, there are a few issues worth highlighting with the approach of using the questionnaires as valid measures. First, the nature of innovation. WBES questionnaire about innovation corresponds to definition provided in the Oslo Manual, though the nature of innovation in the manual has received criticism for being too broad and inclusive, meaning it does not for example distinguish between radical and incremental innovation (Nieminen & Lehtoranta, 2015) Stephen Roper (1997) has similar criticism to use of surveys to measure innovation; that they are not reliable evidence of technological or commercial significance of the invention. Admittedly issues are faced with using patents or trademarks as a proxy as well, where for example small number of patents account for most of the value accounted by them (Keller, 2004)

There are other measures, such as patent data available, but they do not take into account the nature of innovation in the developing world very well, or where lack of enforced property rights may discourage patenting of new inventions (Papageorgiadis, Alexiou, & Nellis, 2016). Likewise, similar issues are encountered with control variables that were operationalised, such as the variable for R&D. Asking questions from managers if the firm engaged in R&D projects says nothing about intensity nor the value of the projects, which makes comparing firms somewhat difficult. It is a dubious assumption that all R&D projects should be treated as equal, and taking into account the level of R&D spending in the firm would be perhaps provide more explanatory power. All things considered, Enterprise Surveys are a solid measure for developing countries.

In the thesis it was desirable to account for as broad definition of innovation as possible. As the case is with patent data, there are several limitations to measuring innovations using survey data (Bertrand & Mullainathan, 2001). In this case the Enterprise Survey resorts to subjective self-report data and can be subject to bias. The bias can occur from the way questions are phrased, or as a result of cultural or language differences. The questions relating to firm bringing new product to market are relatively straightforward to understand, but misunderstandings may occur in the defining 'new or improved', which is subjective assessment that the person interviewed has to make and some of the variation in the data may be a result of differences in understanding what constitutes as a significantly new product. Likewise, modesty in certain cultures may also bias the answers. Non-response bias is a common issue with any type of surveys (Bańkowska, Osiewicz, & Pérez-Duarte, 2015). To conclude, WBES provide an insight into firm's innovative performance, though research using them as a tool should be aware of their limitations and possible biases that come from using surveys as a tool.

5.3.2 The problem of measuring institutions

Bridging the gap between understanding institutions from a theoretical perspective and directly measuring them is a well-understood problem in the field (Langbein & Knack, 2010; Mohamed, 2017; Peng et al., 2009; Thomas, 2010). Even though Enterprise Survey includes questions about perception of the business environment (institutional quality), it was not advisable to use it as it could be subject to bias (Bertrand & Mullainathan, 2001). Many measures of formal institutions have been created. The popular measures include Economic Freedom Index by Heritage Foundation, political constraints index suggested by Henisz (2000) Corruption Perceptions Index and finally Worldwide Governance Indicators project by Kaufmann et al. (2011).

The measures are divided often to formal rules-based measures and perceptions-based measures, of which perceptions-based measures are found to have been more reliable (Barasa et al., 2017). Each of the aforementioned measures is more

or less valid way to measure institutions, though they have been found to measure very closely related constructs (Garrido et al., 2014; Langbein & Knack, 2010). Yet there is a problem with all measures of institutions: that they do not capture the full characteristics of institutions that they purport to measure and rather measure outcomes instead of institutions (Ali, 2016, pp. 5–7). Yet, as it stands there exist no better measures for institutional quality than ones that are available, thus the decision to include WGI was due to their popularity as a measurement tool (Garrido et al., 2014; Gisselquist, 2014).

Just like any other measures of institutions, the Worldwide Governance indicators are not without a fault of their own. First, they measure institutions on a country-level, though what they fail to provide is the heterogeneity of institutions inside a nation. Different firms may have different perceptions of the institutional environment and the business environment may help to explain better some decisions that they make. It is impossible to get fully objective measures, but perception of firms would partially help to explain the reasons why they make decisions that they do. The measures used have also been criticised for having a bias towards *liberalized institutions* and the use of institutional composites, such as WGI, is questionable when measuring institutional quality as they leave out many important facets of institutions and only focus on ones that promote economic growth (Chang, 2011). WGI as measurement tool have been criticised for lacking transparency in their measures, measuring too broad concepts, being imprecise and being impossible to compare over years (Langbein & Knack, 2010; Thomas, 2010; Voigt, 2013).

As for the criticism that they measure *the same broad concept* (Langbein & Knack, 2010), though Kaufmann (2010) has responded to the criticism by asserting that just because the measures are correlated with each other, does not make it true that they measure the same thing – Kaufmann (2010) responds that it *would be like concluding that data on years of schooling and earnings somehow are not valid measures of education and income simply because there is a correlation between the two*. Different regional indicators that measure variation of institutional quality inside a country could solve this specific issue and is something for the future

research. Likewise, governance indicators may not capture the full story of institutional quality. With regards to construct validity as a criticism (Thomas, 2010) towards WGI as a measure. The main points that she raises are that they measure changes in perceptions to governance instead of institutions, and second one that they do not have construct validity, meaning they do not measure what they claim to measure.

Kaufmann *et al.* (2009) have responded to Thomas' criticism by saying that her points about criteria for construct validity are moot and that anyone, including Thomas are entitled to construct their own and better measures if they so wish. To conclude the discussion about WGI, Stefan Voigt (2013) is right when he says that we need better measures of institutions, ones that capture the inter-connectedness of different formal institutions, rule of law and judiciary. Though, one should not only focus on researching institutions through a lens of quantitative research as Mary Shirley (2013) writes in her rebuttal to Voigt – we should also focus on other methodologies to provide answers on how institutions matter, such as case studies and field experiments.

Measuring informal institutions quantitively is equally complex task as measuring formal ones. One should keep in mind that there exists many other measures for informal institutions that have gained popularity. Some alternatives for Hofstede for studying informal institutions and culture are for example, GLOBE Project (Global Leadership and Organizational Behavior Effectiveness), Busenitz scale and Inglehart and Associates World Values Survey (1997). However, the use of the aforementioned measures was explored initially, but decision to include Hofstede was partly made due to practical reasons; Hofstede data was available for most countries included in the 2013-2015 WBES wave. The decision was bolstered by the popularity and usage of Hofstede measures, being simply the most popular and well-studied of all the measures with a solid theoretical foundation linking it to institutional theory (Scott, 2014, p. 69) with solid linkage to innovation research (Shane, 1993). Though there are many things around informal institutions that Hofstede's measures simply do not have an answer for, for example what was left unexplored was how informal institutions could bolster

social capital and affect innovativeness of firms (Rauf, 2009), and many more ways that culture could possibly affect to innovativeness.

The cultural dimensions by Geert Hofstede have received criticism since 1980's when he published the first edition of his Culture's Consequences (Wu, 2006). The reliability and validity of Hofstede's work has been questioned, meaning they don't measure what they claim to measure and the research has not been successfully replicated (Blodgett, Bakir, & Rose, 2008), though they are generally accepted as a valid and reliable measures of culture (Garrido et al., 2014). The masculinity vs femininity dimension also has received criticism for not measuring femininity directly, but rather Hofstede assuming that the femininity is opposite of masculinity (Shi & Wang, 2011). One large weakness of Hofstede's measures is that he measured the cultural values only in one firm – IBM, meaning his sample was not randomly selected and second it only accounts for average values of managers in one single firm (Efrat, 2014). Also, a lot of cultural practices echo the words of Karl Polanyi – *we know more than we can tell*, and using surveys as a tool to measure culture may not capture full extent of cultural traits that may only appear through actions of individuals in a given context. One issue previously raised by Scott Shane (1993) is that a longnitudal study about innovation would be much more preferable, an opinion again echoed by Ha-Joong Chang (2011) when discussing the research into formal institutions. Unfortunately Hofstede measures are not available as a time series data, which necessitates a cross-sectional approach when using them. Hofstede's argument that cultural values do not change over time is also problematic according to many scholars. Peng et al. (2009) have argued that there exists a need to develop better measures in order to study institutions, this is especially important for informal institutions, where Hofstede and GLOBE projects show negative correlation in the measures that are meant to measure the same thing (Garrido et al., 2014). Work is being done in institutional theory as well, and the call for more direct and better measures has been heeded (Mohamed, 2017).

5.3.3 Multilevel modelling

A sample size issue was brought up in earlier with this research using 13 groups to explore primarily fixed effects of the model. There is no denying that use of only so few countries is problematic at best. There is a suggestion (Hox et al., 2017, p. 34) that far fewer groups is indeed sufficient when the interest lies in primarily fixed effects (in this case country level effects, which are all fixed effects), yet increasing sample size of countries would be desirable in the future research as the limited number of countries does not allow sufficient variety of measures.

Country level measures are appropriate when the data is available, but there is a lot of institutional and cultural variation within country borders, so in the future it could be feasible to take regional level variation into account, which would entail collecting data by oneself as no such cultural measures yet exist. Peterson *et al*. (2012) suggest that what we consider as characteristics of a nation, also show meaningful differences within the nation and researchers should focus on them more.

One suggested approach that may reduce the bias resulting from sample size problems is using Bayesian estimation instead of maximum likelihood or restricted maximum likelihood. It is suggested (Bryan & Jenkins, 2016; Stegmueller, 2013) that this may reduce parameter estimate bias and help with convergence problems. Yet, in order to boost predictive power of the model a larger sample size of groups would be desirable. Additionally, use of visualization techniques as suggested by Bowers and Drake (2005) may aid with the research.

The main drawback of logistical multilevel modelling using full maximum likelihood is that it is very computationally intensive process and the model fitting time increases greatly as number of parameters and variables increases. This is the case especially when adding random slopes to the model. Reason is that it is an iterative process where computer has to estimate starting values and then continually seek to find improved values in order to produce better estimates (Hox et al., 2017), but also because STATA uses numerical integration for this process. This kind of time frames impose a limit on the amount of variables that the equation

can have, as the calculation simply becomes too burdensome to compute in reasonable time.

An answer to aforementioned issues may lie in using a different software for multilevel modelling, such as MlwiN (University of Bristol, 2017) that can also be run as a STATA command, which reportedly uses different algorithms and speeds up the time for model to converge noticeably. However, these calculations were done on STATA on OS X using the melogit function and there was no option to explore other software and their purported impact for the fitness of the model. For the future researchers interested in multilevel modelling it may be worth it to explore software especially tailored for multilevel models.

6.3 Future research

The research on formal institutions seems to be still in its infancy, and the future work should focus on building better measures with validity and reliability, yet the work on these have just begun. The use of Hofstede measures for measuring culture can also cause issues, and some scholars have started to measure both Hofstede and GLOBE together to get more accurate answers (Garrido et al., 2014), and when data is available for each country from both datasets, it would be an interesting, albeit time-consuming approach. The future work into institutions and culture and their impact on innovation should take regional differences among institutions and culture more into account as suggested by Peterson *et al* (2012), which would also reduce the problem of group sample sizes in multilevel modelling, yet such measures do not yet exist. Alternatively, mixed methods research using both qualitative and quantitative research together could illuminate the impact of institutions more, given the difficulty in quantifying institutional variables.

Another avenue for future research would be using time-series data and comparing the results to cross-sectional analyses done in the past, as suggested by (Chang, 2011). The cross-country analysis mostly involves countries that are deemed to be in the Low- or Middle-Income groups according to World Bank Classification.

Another exciting avenue for future research would involve comparing developed and developing countries in order to better appreciate how institutions matter for the firm with wider range of institutional environments taken into the analysis. Analysing only institutions in developing countries makes the variables lack variation, but bridging the gap between different types of innovation primarily happening in the firms would require careful choices for dependent variable and careful choice of controls.

6 Conclusions

This thesis has explored the quality of institutions as determinant of innovation. As the theory suggests, the interplay between culture, formal institutions, firm's capabilities and innovation performance is a complex issue that is not easily studied using statistical approach. The measures of institutions that exist are adequate for the analysis, but there is a great need to develop better measures of institutions. Additionally, innovation is a complex process and the findings in this thesis mostly relate to innovation in its broadest form; it does not say anything about novelty of the innovations and there are reasons to suspect that a lot of the innovation covered here refers to imitation.

The findings suggest that national culture does not play an important role in the innovation process measured by any of the Hofstede measures. Masculinity seems to play the greatest role, with feminine cultural traits contributing to innovativeness. Uncertainty avoidance played no role whatsoever, while firms in individualist and power distant societies were slightly more innovative and they had a slight influence on the innovative performance. However, due to small sample size and method of analysis the findings should be taken with caution.

Formal institutional quality as measured by *market friendly* policies seem to play a larger role in the innovation process, though their effect was contradictory to the previous research and quality of institutions seemed to reduce the probability of firm engaging in innovation.. The findings also reaffirm what has been known in the field of innovation research, that investment in research and development is a very strong determinant of innovation and that firm's capabilities matter. Of these capabilities surveyed, it was training of staff that was seen as an important predictor of innovation performance.

There is much more to explore in the topic of institutions and firm performance and this thesis has barely scratched a surface. One of empirical contributions of this thesis may be seen as reaffirming the use of multilevel statistical modelling as a

valid tool over regular single-level regression. The thesis also highlights the problem of using countries as level two variables, as finding data to match is extremely difficult. However, we can expect these issues to get better in the future. To conclude, this thesis has adopted a multidisciplinary approach and hopefully it has managed to do justice to all of the theories and evidence presented in it. What is clear that widely cited phrase by Williamson (2000) that “institutions matter” still rings true, though what remains unclear how they matter and to what extent, but progress is happening on the front.

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APPENDICES

Appendix 1: Principal Component Analysis

Bartlett test of sphericity

Chi-square = 538.643
Degrees of freedom = 15
p-value = 0.000
H0: variables are not intercorrelated

Kaiser-Meyer-Olkin Measure of Sampling Adequacy
KMO = 0.887

Variable	smc
VA	0.7075
PS	0.544
GE	0.9212
RQ	0.8628
RL	0.9465
CC	0.8824

Factor	Eigenvalue	Difference	Proportion	Cumulative
Factor1	4.9776	4.52616	0.8296	0.8296
Factor2	0.45144	0.17397	0.0752	0.9048
Factor3	0.27747	0.08483	0.0462	0.9511
Factor4	0.19263	0.13142	0.0321	0.9832
Factor5	0.06121	0.02157	0.0102	0.9934
Factor6	0.03964	.	0.0066	1

Pattern Matrix

Variable	Factor1	Uniqueness
VA	0.8815	0.2229
PS	0.7873	0.3801
GE	0.9591	0.0802
RQ	0.9217	0.1504
RL	0.9735	0.0523

CC	0.9293	0.1364

Parallel Analysis for Principal Components

PA Eigenvalues Averaged Over 1 Replication

	PCA	PA	Dif
1	4.977603	1.364009	3.613594
2	0.4514426	1.256186	-0.8047433
3	0.2774684	1.084525	-0.8070562
4	0.1926335	0.8925006	-0.6998671
5	0.0612126	0.7941836	-0.732971
6	0.0396398	0.6085958	-0.568956

Appendix 2: Descriptive statistics and histograms

Frequency Table for variable Innovation

New Products Introduced in last 3 years

Yrs	Freq.	Percent	Cum.
No	10,165	68.18	68.18
Yes	4,743	31.82	100
Total	**14,908**	**100**	

Frequency Percentages for Innovation

Country	Year	Grouping	Innovation (No)	Innovation (Yes)
Bangladesh	2013	Lower middle income	69.65	30.35
Bulgaria	2013	Upper middle income	76.98	23.02
Ethiopia	2015	Low income	67.91	32.09
India	2014	Lower middle income	58.50	41.50
Indonesia	2015	Lower middle income	91.18	8.82

Malaysia	2015	Upper middle income	94.28	5.72
Morocco	2013	Lower middle income	74.09	25.91
Pakistan	2013	Lower middle income	73.33	26.67
Philippines	2015	Lower middle income	68.52	31.48
Romania	2013	Upper middle income	60.64	39.36
Serbia	2013	Upper middle income	64.94	35.06
Turkey	2013	Upper middle income	89.03	10.97
Vietnam	2015	Lower middle income	72.47	27.53
Total			**68.18 %**	**31.82 %**

Firm spent on R&D

	Freq.	Percent	Cum.
No	11,884	79.72	79.72
Yes	3,024	20.28	100
Total	14,908	100	

Factor of six WGI scores – measures by country.

	WGI Score
Bangladesh	-0.9369158
Bulgaria	0.70846182
Ethiopia	-0.8495928
India	0.07974951
Indonesia	0.02784377
Malaysia	1.2160974
Morocco	0.02609917
Pakistan	-1.1524382
Philippines	0.16090861
Romania	0.75589937
Serbia	0.31947106
Turkey	0.52988482

Vietnam	-0.1488254

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	11437	66.9	66.9	66.9
	Yes	5651	33.1	33.1	100.0
	Total	17088	100.0	100.0	

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
PDI	17088	-3.16450	1.93203	.0000000	1.00000000	1.000
IDV	17088	-1.56506	2.58123	.0000000	1.00000000	1.000
MAS	17088	-3.16837	3.46213	.0000000	1.00000000	1.000
UAI	17088	-1.24582	1.91142	.0000000	1.00000000	1.000
WGI	17088	-1.59497	3.46309	.0000000	1.00000000	1.000
Valid N (listwise)	17088					

During Last Fiscal Year, Establishment Spent On R&D (Excl Market Research)?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	13718	80.3	80.3	80.3
	Yes	3370	19.7	19.7	100.0
	Total	17088	100.0	100.0	

Formal Training Programs For Permanent, Full-Time Employees In Last Fiscal Yr

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	11707	68.5	68.5	68.5
	Yes	5381	31.5	31.5	100.0

	Total	17088	100.0	100.0	

Legal Status Of The Firm

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Other	12081	70.7	70.7	70.7
	Shareholding company	5007	29.3	29.3	100.0
	Total	17088	100.0	100.0	

Appendix 3: Regression results and diagnostics

Variable	VIF	1/VIF
mas	4.05	0.24701
zwgi	3.73	0.268113
idv	3.41	0.293212
pdi	3.31	0.302278
uai	1.66	0.603624
Mean VIF	3.23	