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Cultural Impacts on National Innovativeness

Links between the GLOBE Cultural Dimensions and the
GII and IUS Innovation Indexes



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Abstract

The working paper at hand assumes that differences of innovativeness of different countries can be explained to a certain extent by cultural differences. Thus, the paper deals with the research question of which cultural dimensions have an influence on national innovativeness. Previous research mainly uses the Hofstede-dimensions to describe cultural differences and often focuses on single parameters to describe national innovativeness (e.g. number of patents per capita). This paper, instead, uses the dimensions of the GLOBE-study which builds on the findings of Hofstede but is more up-to-date and comprehensive and uses two innovation indexes – the Global Innovation Index (GII) and the Innovation Union Scoreboard (IUS) – to describe national innovativeness.

The authors use correlation analysis to find relationships between the GLOBE-dimensions and the innovation indexes. They find positive correlations of innovativeness (both indexes) to Future Orientation (practice scale), Gender Egalitarianism (value scale), Human Orientation (value scale) and Uncertainty Avoidance (practice scale) as well as negative correlations to In-Group Collectivism (practice scale), Future Orientation (value scale) and Uncertainty Avoidance (value scale). Some of the findings are contrary to existing hypotheses, e.g. only a weak negative correlation of Power Distance to one of the indexes. Furthermore the findings show significant differences between practice scales and value scales, especially concerning Future Orientation and Uncertainty Avoidance which deserve further examination.

Overall it can be concluded that culture has an impact on national innovativeness. The different cultural dimensions of the GLOBE-study show a multi-faceted interrelationship between culture and innovation. To come to a concise answer for the question which dimensions affect national innovativeness in which way additional research will be necessary.



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1. Introduction

Schumpeter (2006, 2008) was one of the first who argued that innovation – respectively the introduction of a new production function or the new combination of production factors – and not the accumulation of capital leads to economic growth. This does not mean economic growth in a strictly linear way, but as a wave-like curve of overlapping business cycles as the economy needs time to adapt to the consequences of the innovation. For Porter (1990, p. 73) “A nation’s competitiveness depends on the capacity of its industry to innovate and upgrade”. Meanwhile innovation is widely recognized for its positive contribution to sustainable growth as it fosters competitiveness, productivity, and the creation of new jobs according to the OECD (2013).

The Oslo Manual of the OECD (2005, p. 46) proposes the following definition for innovation: “An innovation is the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organisational method in business practices, workplace organisation or external relations”. A narrower definition based on the second edition of the Oslo Manual just includes technological product and process innovation. Nevertheless the definition for innovation of the OECD contains completely new products or processes and the improvement of existing products and processes. Process innovations include new or improved production methods as well as methods of delivery (OECD 2005, p. 49). The process which leads to an innovation comprises processes of invention, product development, and introduction (commercialization or implementation), and can be defined as “a process that begins with a novel idea and concludes with market introduction” (Freeman & Engel 2007, p. 94).

Utterback (1996) has shown for several different industries that product and process innovation follow a general pattern over time: After a high rate of product innovation and the development of a dominant design of the product the rate of product innovation slows down while the rate of process innovation increases. After that also the rate of process innovation decreases and both product and process innovation only proceed in incremental steps until a discontinuity occurs which starts the cycle anew.

The discontinuity either occurs as an introduction of a new technology with a significantly improved performance or in the form of a disruptive innovation. According to Christensen (2003, 2011) the usual development trajectory for a product is to increase its performance, and the product innovation usually has a higher performance than the existing product which is being substituted. Contrary to that a disruptive innovation underperforms the existing product, but it has a good enough performance



to satisfy the demand at the lower end of the market and, thus, enters the market at the lower end. Additionally disruptive innovations usually offer extra advantages such as simplicity, convenience, affordability and accessibility (Anthony 2012, p. 148). So the progress due to the usual development trajectory leads to a better performance of existing products (e.g. higher productivity). The progress due to a disruptive change leads not only to the creation of new markets and/or new industries, but also to more possibilities for consumers who can now afford or have access to products which they previously couldn't.

Innovativeness or innovative capability can be defined as the conditions which “need to be created for a system to continuously – not just intermittently – induce innovations” and “which can relate to individuals, companies, networks and teams and to whole societies as a multidimensional construct with many levels” (Trantow, Hees & Jeschke 2011, p. 3). So innovativeness typically includes inventiveness meaning the “quality of being inventive” (Kumar 2014, p. 3). For companies innovative capability contains “the complex interrelationships between the human, organizational and technological requirements to continuously induce innovations” (Trantow, Hees & Jeschke 2011, p. 3). For nations innovativeness can be defined as “a country’s potential [...] to produce a stream of commercially relevant innovations” (Porter & Stern 2001, p. 29) respectively “the ability of a country to produce and commercialize a flow of innovative technology over the long term” (Furman, Porter & Stern 2002, p. 899). This not only includes the sheer volume of realized innovations, but also “the fundamental conditions, investments and policy choices that create the environment for innovation in a particular location” (Porter & Stern 2001, p. 23). For nations or societies this means that “The innovative performance of a country depends to a large extent on how [...] actors relate to each other as elements of a collective system of knowledge creation and use as well as the technologies they use. These actors are primarily private enterprises, universities and public research institutes and the people within them” (OECD 1997, p. 9). In research these systems are typically referred to as National Innovation Systems (NIS).

One central element of national innovativeness and competitiveness is the innovativeness of its businesses (Dreher et al. 2006). The main goal of companies is profit, but as an essential side effect this leads to the introduction of innovative products which increase productivity, create new markets and industries, and improve the standard of living for consumers (Ahlstrom 2010). The Global Innovation 1000 study which analyses the 1,000 public companies worldwide that spend the most on research and development (R&D) and which has been conducted for ten years by Booz & Company (now Strategy&) could find no relationship of R&D spending and sustained financial performance on a company level (Jaruzelski, Staack & Goehle 2014). Innovativeness is based on the understanding of change as an innovation opportu-



nity and the active search and exploitation of changes (Drucker 1993). The innovation capability of a company seems to rely to a large extent on team and innovation orientation as part of the organizational culture to leverage the company's R&D spending (Wang et al. 2010).

Porter (1990, pp. 73-74) argues that nations become more and more important in a world of global competition based to a large extent on innovation and that differences in a nation's competitiveness depend amongst others on differences in national values, cultures and histories. Thus, it can be assumed that national innovativeness is based at least to a certain extent on national culture as described by cultural dimensions. Overviews of previous research in this field by Lubart (2010), Kumar (2014) and Rossberger & Krause (2012) seem to confirm this assumption. To further test this assumption the paper concentrates on the following research question: Which cultural dimensions have a significant impact on national innovativeness? To answer this question, firstly the following two questions have to be addressed: Which cultural dimensions should be taken into consideration? And how can the concept of national innovativeness be operationalized and measured?



2. Cultural Dimensions

An early attempt to “measure” culture was made by Kluckhohn and Strodtbeck (1961) who argued that human beings are confronted with a limited number of problems to which they must find solutions in their respective physical and social environment. There are many ways to solve these problems and thus social groups develop different preferences in choosing their specific solution to universal problems. These preferences duly translate into cultural value orientations that are passed on from the older members of a cultural group to the younger group members.

In the early 1970s the management trainer Geert Hofstede conducted a large-scale study about organisational culture among more than 100,000 employees of IBM's more than 70 national subsidiaries around the world. He used the results of this study to formulate four so called cultural dimensions that form the basis of a national culture each individual acquires in his or her socialisation process and that informs organisational behaviour in an international context. Later research contributed two additional dimensions to the original four cultural dimensions (Hofstede, Hofstede & Minkov 2010). The average manifestations of these dimensions in a cultural group, which Hofstede usually defines through the nationality of the constituent members of the group is measured along a continuum between two extremes. These manifestations correspond with possible solutions to universal problems as defined by Kluckhohn and Strodtbeck and despite much criticism (see below) about the model Hofstede's cultural dimensions are widely used in research and teaching about organisational behaviour.

Further evidence for the practical relevance of the concept of cultural dimensions can be found in the results of later research about the influence of culture on management practices. Although Trompenaars and Hampden-Turner developed their research in differentiating their approach from Hofstede and conducted a discussion about the validity of their respective findings with him (see Hofstede 1996 with a response from Hampden-Turner & Trompenaars 1997), the outcome of Trompenaars/Hampden-Turner's research are also cultural dimensions, again based on the general value orientations as specified by Kluckhohn and Strodtbeck (Trompenaars & Hampden-Turner 2012). Thus despite the differences in research design and focus the resulting cultural dimensions can be broadly matched with Hofstede's dimensions as well as the general value orientations underlying both concepts as done in figure 1.

Hofstede's research has been criticized for a variety of issues, e.g. statistical integrity (Dorfman and Howell 1988), equation of nations with cultures (Baskerville 2003), and



out-datedness of the research (Jones 2007). Robert J. House of the Wharton School of Business focused on the Western bias of Hofstede’s approach, resulting from the fact that the survey questions were developed by researchers with a Western cultural background and administered in English and thus started a programme in 1991 that developed into the biggest research framework on the impact of culture on leadership styles in management yet. This GLOBE (Global Leadership and Organizational Behavior Effectiveness) Study builds on the findings of Hofstede as well as other researchers and includes the contribution of more than 170 collaborators from diverse cultural backgrounds who brought their respective understanding of their own culture into surveys (House et al. 2004; Chhokar, Brodbek & House 2008; House et al. 2013). However, even this most comprehensive study works with the heuristic concept of the cultural dimensions, which can be loosely matched with the existing dimensions from previous studies:

Figure 1: Comparison of Cultural Dimensions

Kluckhohn and Strodtbeck	Hofstede	Trompenaars	GLOBE Study
How are human relations organized?	Individualism vs. Collectivism	Individualism vs. Collectivism	Institutional Collectivism
			In-Group (individual) Collectivism
	Power Distance	Achievement vs. Ascription	Power Distance
What informs our activities in society?	Masculinity vs. Femininity	Specific vs. Diffuse	Performance Orientation
			Gender Egalitarianism
How should we relate to nature?	Uncertainty Avoidance	Universalism vs. Particularism	Uncertainty Avoidance
		Internal vs. External Control	
How do we perceive and prioritize time?	Long term vs. Short term Orientation	Sequential vs. Synchronic	Future Orientation
How is the basic human nature being defined?	Indulgence vs. Restraint	Neutral vs. Affective	Assertiveness
			Human Orientation

Source: Own illustration based on Kluckhohn & Strodtbeck (1961), Hofstede, Hofstede & Minkov (2010), Trompenaars & Hampden-Turner (2012), House et al. (2004).



3. The GLOBE Study

One enhancement of the field through the GLOBE Study lies in its further differentiation of some of the original Hofstede dimensions like Collectivism (now divided into Institutional Collectivism and In-Group or Individual Collectivism) and Masculinity (now differentiated into Performance Orientation and Gender Egalitarianism). Institutional Collectivism is defined as “the degree to which organizational and societal institutional practices encourage and reward collective distribution of resources and collective action” whereas In-Group Collectivism concentrates rather on “the degree to which individuals express pride, loyalty, and cohesiveness in their organization and family” (House et al. 2004, p. 30). The differentiation of the Collectivism dimension has thus led to the inclusion of a rather abstract collective perspective that decides about the trade-off between group goals and individual goals, and the perspective of the individual who decides about the degree of identification with and prioritizing of group goals.

The dimension of Power Distance in the GLOBE study is very much the same as in the Hofstede categories and refers to the extent to which members in a cultural group expect power to be distributed equally as well as the degree to which they accept unequal distribution of power. Hofstede’s Masculinity dimension has been modernized to accommodate the development in the discussion of gender roles. Thus the GLOBE study distinguished between the gender-neutral dimension of Performance Orientation which measures how important competition, excellence and material rewards are for the group members. The degree to which a group is conscious about and tries to minimize gender inequality is measured in the dimension called Gender Egalitarianism.

The GLOBE dimension Uncertainty Avoidance has kept the label given to it in the Hofstede study and includes its notion of measuring the extent to which members of a cultural group feel threatened by ambiguity and the unknown future. In its GLOBE definition it further includes Trompenaars’ focus on Universalism vs. Particularism, since the extent to which the group relies on norms, rules and procedures to alleviate the uneasiness with the unpredictability of the future is taken into consideration. Closely related to this dimension is the Future Orientation, which the GLOBE study defines as “the degree to which a collectivity encourages and rewards future-oriented behaviors such as planning and delaying gratification” (House et al. 2004, p. 30). The time horizon for planning ahead is a main component of Hofstede’s Long-term Orientation, whereas the concept of delaying gratification as an investment in the future can also be related to Hofstede’s newest dimension of Indulgence vs. Restraint.



The last two GLOBE dimensions Human Orientation and Assertiveness are the least connected to previous existing dimension concepts and add the formerly rather neglected aspect of interpersonal relationships. Human Orientation measures how far behavioral traits that are generally perceived as nice and soft, like being altruistic, generous, caring, kind and fair to others are rewarded by the cultural groups. Assertiveness on the other hand measures the display of behavior that is rather rated as hard and aggressive, i.e. the degree to which individuals are dominant, assertive or even confrontational in their relationship with each other. Although these two dimensions have no direct parallel in the Hofstede and Trompenaars dimensions, figure 1 has loosely grouped them into the last slot of the table, because just as with Hofstede's dimension of the extent of Restraint in personal behavior a cultural group demands and Trompenaars' Neutral vs. Affective dimension which focuses on the level of restraint demanded in the display of emotions, Human Orientation as well as Assertiveness last but not least addresses the culturally desirable conception of the human nature as already suggested as a value orientation by Kluckhohn and Strodtbeck.

A new feature and a very important contribution to the state of the field in the GLOBE study is the clear distinction between so called social practices (a description of how things are being handled within the respective culture) and social values (the concept of how things should be handled within the culture). This is an interesting heuristic concept, because for seven of the nine dimensions of the GLOBE Study there is a significantly negative correlation between the practices and their underlying values, showing that often people's value are quite contrary to their practices.

In order to clearly distinguish between practice and value as well as between organizational culture and societal culture, the questions in the GLOBE surveys were arranged in quartets, where each question had to be answered in four versions: organizational cultural practice (as is), organizational cultural values (should be), societal cultural practice (as is), and societal cultural values (should be). In the discussion of the findings the authors acknowledge that the discrepancy between the scores for value and practice runs counter to conventional wisdom, since one could assume that members of a cultural group who hold a certain value in high esteem would make an utmost effort to put that value into practice. As a possible explanation for their findings the authors refer to the study design, where the explicit distinction between values and practices triggers a reflection in the respondent that results in a feeling of wanting more than there is especially if the value is held in high esteem. The explanation that the authors favour is that the relation between values and practice is too complex to be used in a simple cause-effect relationship. Values do not automatically lead to congruent practices. Rather can discrepancies point to a frustration with the as-is-situation and a desire for the should-be-possibility. Thus both cate-



gories – values and practices – have a heuristic value; they are interdependent and can be meaningfully applied in further research (House et al. 2004).



4. Previous Research and Hypotheses

Kumar (2014) developed a conceptual framework to categorize the different research approaches concerning cultural differences in innovation. He identified six viewpoints in the current research which are innovation characteristics, adoption of / propensity to adopt innovations, geographical innovations (region-specific variations and cross-national differences of the diffusion process), market characteristics, learning effect and organizational functions. Each viewpoint is divided into two dimensions. The authors of this paper see their research in the category of innovation characteristics. The two dimensions of this category are speed and form of innovation. Speed according to Kumar (2014, p. 3) means “innovativeness of a country” and “level of inventiveness and innovativeness of societies”; form means the “way(s) in which innovations are developed”. So the research at hand is in the dimension of speed.

In this area of research Shane (1992, 1993) studies the cultural influences as described by the cultural dimensions of Hofstede (2003) on the inventiveness and innovativeness of 33 countries for several years. As a measure for inventiveness he uses the per capita number of invention patents. He finds a positive relationship of Individualism with invention and a negative relationship of Power Distance with invention, even after adjusting for wealth (Shane 1992). As a measure for innovativeness Shane (1993) uses the per capita number of trademarks. He finds a positive relationship of Individualism with innovation and a negative relationship of Uncertainty Avoidance and Power Distance with innovation, even after controlling for national differences in industrial structure and per capita income.

Kaasa & Vadi (2008) use measures of patenting intensity and Hofstede's (2003) concept of cultural dimensions, but indicators from the database of the European Social Survey (ESS) for the cultural dimensions for their research as they find the indexes of Hofstede problematic. In their study which is limited to European countries they observe a negative relationship of Power Distance, Uncertainty Avoidance, family-based Collectivism and Masculinity with all the indicators of patenting intensity and a weaker positive relationship of Individualism to some of the indicators.

Sun (2009) seems to be the first who uses an innovation index for his study to find influences of Hofstede's (2003) dimensions. He uses the national innovation capability index proposed by Porter & Stern (2001) to measure innovativeness. Doing correlation analysis and structural equation modelling (SEM) he observes a negative relationship of innovation capability to Power Distance and a positive relationship to Individualism. Furthermore he finds an indirect negative relationship to Uncertainty Avoidance since it is negatively correlated to Individualism.



In their research Taylor & Wilson (2012) focus on the relationship of Individualism and Collectivism to innovation. For that they take the definitions of the GLOBE-study (House et al. 2004) which divides Collectivism into Institutional Collectivism and In-Group Collectivism. They observe that Individualism correlates with national innovation rates as measured in citations-weighted technology patents per capita and citations-weighted scientific publications per capita, even when adjusted for wealth, military spending, trade openness, fuel exports, and education and R&D-spending. They also find that Institutional Collectivism has a positive relationship to innovation, but that In-Group Collectivism has a negative one, especially on the progress of science. This result can be interpreted in such a way that collectivism on a national level can foster innovation while collectivism as familism or localism harms innovation on a national level.

Rossberger & Krause (2012, 2013) examine the correlation between the cultural dimensions of the GLOBE-study (House et al. 2004) and different innovation indexes, among them the Global Innovation Index 2009, 2010 and 2011. In a combined correlation and regression analysis they identify three cultural dimensions as consistent significant predictors of innovativeness: Uncertainty Avoidance (values) and In-Group Collectivism (practices) show a negative relationship to the indexes and Human Orientation (values) a positive relationship.

Halkos & Tzeremes (2013) use conditional data envelop analysis (DEA) to find influences of Hofstede's (2003) four dimensions Power Distance, Uncertainty Avoidance, Individualism and Masculinity on the innovativeness of European countries as measured by the European Innovation Scoreboard (EIS) of 2007, the forerunner of the Innovation Union Scoreboard (IUS). They observe a negative influence of Power Distance, Uncertainty Avoidance and Masculinity on innovation.

Efrat (2014) examines the influence of Hofstede's (2003) dimensions on innovation output. As indicators for innovation output she uses patents, scientific and technical journal articles and high-technology exports with data of the years 1998, 2003 and 2007 from 35 economically developed countries. She observes that Uncertainty Avoidance has a negative relationship with innovativeness and that Individualism and Masculinity have positive relationships with innovativeness albeit the influence is not on all indicators. Concerning Power Distance she cannot replicate the results of Shane (1992, 1993).

Busse (2014) examines the linkage between all cultural dimensions of Hofstede (2003) including long-term orientation and Indulgence on innovativeness. To meas-



ure innovativeness he uses a three-dimensional construct including number of patents, expenses for research and development and an innovation indicator calculated by the Federation of German Industry (Deutsche Telekom Stiftung & BDI 2013). Busse (2014) observes a negative correlation of Power Distance with the innovation index and a positive correlation of Individualism with the innovation index. Furthermore he finds positive relationships between long-term orientation and R&D-spending and between Indulgence and the innovation index.

Most of the cited studies (Shane 1992, Shane 1993, Kaasa & Vadi 2008, Sun 2009, Halkos & Tzeremes 2013, Efrat 2014, Busse 2014) use Hofstede's (2003) dimensions to describe the cultural impacts on innovation. Only Taylor & Wilson (2012) and Rossberger & Krause (2012, 2013) use the dimensions of the GLOBE-study. As described Hofstede has been criticized by many authors because he collected data from the workers of just one organization (IBM) in the 1970s. For that reason the authors of this paper choose the dimensions and indicators of the GLOBE-study which are based on a broader data set and a more recent data collection (House et al. 2004).

Many of the cited studies (Shane 1992, Shane 1993, Kaasa & Vadi 2008, Taylor & Wilson 2012, Efrat 2014) use only single parameters such as the number of patents per capita as an indicator for innovation. Since innovation is a multi-faceted phenomenon the authors of this paper think that the use of an innovation index as e.g. used by Sun (2009), Rossberger & Krause (2012, 2013), Halkos & Tzeremes (2013) and Busse (2014) gives a more appropriate measure of national innovativeness.

Some of the cited studies restrict their scope to a limited set of countries: Kaasa & Vadi (2008) and Halkos & Tzeremes (2013) focus on European countries while Efrat (2014) only analyses economically developed countries. The authors of this paper argue that the research should include a broad range of countries from different cultural backgrounds to get clearer results. All the cited studies use innovation indicators based on data from single years. E.g. Rossberger & Krause (2012, 2013) use the values of the Global Innovation Index 2009, 2010 and 2011. Since cultural dimensions are mainly stable over longer periods of time the authors argue that the indicators which are used to measure innovativeness should be averages over a certain time span to exclude short-term fluctuations caused by other factors.

From the current research the following hypotheses can be directly deduced:

- H1: Uncertainty Avoidance has a negative correlation to national innovativeness (see results of Shane 1993, Kaasa & Vadi 2008, Sun 2009, Rossberger & Krause 2012, Halkos & Tzeremes 2013, Rossberger and Krause 2013, Efrat 2014).



- H2: Power Distance has a negative correlation to national innovativeness (see results of Shane 1992, Shane 1993, Kaasa & Vadi 2008, Sun 2009, Halkos & Tzeremes 2013, Busse 2014).
- H3: Future Orientation has a positive correlation to national innovativeness (Busse 2014).
- H4: Human Orientation has a positive correlation to national innovativeness (Rossberger & Krause 2012, Rossberger & Krause 2013).

Many studies (Shane 1992, Shane 1993, Sun 2009, Taylor & Wilson 2012, Efrat 2014, Busse 2014) find a positive relationship of Individualism and innovation. But that doesn't mean that all collectivism has a negative influence on national innovation. As Taylor & Wilson (2012) show in accordance with the definitions of the GLOBE-study (House et al. 2004) collectivism as nationalism can have a positive influence while collectivism as localism can have a negative influence:

- H5: Institutional Collectivism has a positive correlation to national innovativeness.
- H6: In-Group Collectivism has a negative correlation to national innovativeness.

For the cultural dimension Masculinity there are mixed results. Kaasa & Vadi (2008) and Halkos & Tzeremes (2013) observe a negative impact on innovativeness while Efrat (2014) observes a positive influence. This seems to confirm the decision of the GLOBE-study (2004) to split this cultural dimension into the two dimensions Gender Egalitarianism and Performance Orientation. Efrat (2014) explains her results that not all of the indicators are influenced positively by Masculinity, but some are influenced negatively, with the importance for collaboration and networking for innovations which can be linked to Femininity. For this reason the authors of this paper propose the following hypotheses:

- H7: Gender Egalitarianism has a positive correlation to national innovativeness.
- H8: Performance Orientation has a positive correlation to national innovativeness.

As for the dimension Assertiveness of the GLOBE-study which is not covered by Hofstede (2003) the authors assume in accordance with Schumpeter (2006, pp. 129-134) that an entrepreneur has to have a certain assertiveness to overcome the obstacles and resistances which an innovation faces at the beginning and to convince or – if necessary – force customers to accept his new product:

- H9: Assertiveness has a positive correlation to national innovativeness.



As for the distinction between value scales and practice scales by the GLOBE-study there is no clear indication, if this distinction has an effect on national innovativeness. The GLOBE-study (House et al. 2004) acknowledges differences in the practice and value scales of its cultural dimensions, but finds it difficult to explain them. Rossberger & Krause (2012) find some differences in the correlation of practice and value scales to innovation, but fail to discuss possible reasons for this result. So for the time being the authors choose the following hypothesis:

- H10: There are no significant differences in the influences of the practice scales and the value scales.



5. Innovation Indexes

Innovation indexes can be seen as one result of the research into National Innovation Systems (NIS). The research concerning NIS acknowledges that innovation performance of a nation is not only caused by formal research and development expenditures, but also by a variety of other factors linked to the flow and diffusion of knowledge, especially technological knowledge (Freeman & Groete 1997, p. 295 ff., Lundvall 1999, p.62). The OECD e.g. lists the following types of knowledge flows as important in NIS: interactions among enterprises, diffusion of knowledge and technology to enterprises, interactions among enterprises, universities and public research institutes and personnel mobility (OECD 1997, p. 7).

Typically innovation indexes try to measure and assess innovativeness or innovation performance of nations by building a hierarchy of sub-indexes which contain a certain number of key indicators. A key indicator can be either a figure calculated from statistical data (e.g. number of patents per capita) or the result of an opinion poll. These key indicators are then usually condensed to a single index or sub-index by using a scoring model and/or weighted averages.

In their research the authors found the following innovation indexes:

- **Global Competitiveness Report** (Innovation and sophistication factors subindex) by World Economic Forum (WEF)
 The Global Competitiveness Report of the WEF measures the competitiveness of 148 national economies using three sub-indexes. The “Innovation and sophistication factors subindex“ is the main factor for innovation-driven national economies and is composed of the two pillars Business Sophistication and R&D Innovation. These two pillars contain eight respectively ten indicators which are mainly derived from an opinion survey (WEF 2014).
- **Global Innovation Index** of Cornell University, INSEAD and World Intellectual Property Organization (WIPO)
 The Global Innovation Index evaluates the innovation performance of 143 countries and consists of an Innovation Input Sub-Index and an Innovation Output Sub-Index. The input is measured via key indicators in the areas Institutions, Human Capital and Research, Infrastructure, Market Sophistication and Business Sophistication. The output is measured using key indicators from the areas Scientific Outputs and Creative Outputs. The sum of the two indexes amount to the Global Innovation Index. The quotient of output and input is called Innovation Efficiency Index (Cornell University, INSEAD & WIPO 2014).



- **Innovationsindikator** (Innovation Indicator) by Deutsche Telekom Stiftung and Bundesverband der Deutschen Industrie (BDI)

The Innovationsindikator has been conducted since 2005 first by Deutsches Institut für Wirtschaftsforschung (DIW), then by Fraunhofer Institut für System- und Innovationsforschung (ISI). The indicator compares the innovation performance of 28 national economies from all continents and contains 38 single key indicators. These sub-indicators have been tested with regard to explanatory power using an empirical model and show results in the sub-systems “Wirtschaft” (Economy), “Bildung” (Education), “Wissenschaft” (Science), “Staat” (Government) and “Gesellschaft” (Society) (Deutsche Telekom Stiftung & BDI 2014).
- **Innovation Union Scoreboard (IUS)** by the European Commission

The Innovation Union Scoreboard (IUS) measures the innovation performance of the EU-countries. It contains three main types of indicators containing in total eight innovation dimensions and 25 different key indicators. The three main indicators are Enabler, Firm Activities and Outputs. Countries are ranked according to the index and divided into the following four groups of decreasing performance: Innovation leaders, Innovation followers, Moderate innovators and Modest innovators (EC 2014).
- **OECD Science, Technology and Industry Scoreboard (STI)** by the Organisation for Economic Co-operation and Development (OECD)

Since 1999 the OECD publishes an STI-Report containing more than 200 key indicators to support political decision making with regard to science, technology and innovation. Key indicators are grouped into several categories (e.g. Building knowledge, Targeting new growth ideas etc.), but no composite index is calculated and, thus, no ranking of countries is possible. So the STI-Scoreboard is no index in the sense of this research (OECD 2013).

Figure 2 gives an overview about the scope and availability of data of the aforementioned innovation indexes (excluding the STI-Scoreboard). Only reports currently available on the respective websites were considered.



Figure 2: Overview about Scope and Availability of Innovation Indexes

Index	Editor	Number of countries or regions	Reports available for							
			20 07	20 08	20 09	20 10	20 11	20 12	20 13	20 14
Global Competitiveness Report	World Economic Forum (WEF)	148		X	X	X	X	X	X	
Global Innovation Index	Johnson Cornell University, INSEAD, WIPO	143	X	X	X	X	X	X	X	X
Innovations-indikator	Deutsche Telekom Stiftung, BDI	28		X ¹⁾	X		X		X	X
Innovation Union Scoreboard	European Commission	34 ²⁾	X	X	X	X	X	X	X	X

1) Published since 2005, currently only shown reports available online

2) Focus on EU-countries

Source: Own illustration based on Deutsche Telekom Stiftung & BDI (2008), Deutsche Telekom Stiftung & BDI (2009), Deutsche Telekom Stiftung & BDI (2011), Deutsche Telekom Stiftung & BDI (2013), Deutsche Telekom Stiftung & BDI (2014), EC (2007), EC (2008), EC (2009), EC (2010), EC (2011), EC (2012), EC (2013), EC (2014), World Business & INSEAD (2007), INSEAD (2009), INSEAD (2010), INSEAD (2011), INSEAD (2012), Cornell University, INSEAD & WIPO (2013), Cornell University, INSEAD & WIPO (2014), WEF (2008), WEF (2009), WEF (2010), WEF (2011), WEF (2012), WEF (2013), WEF (2014)

The authors selected the Global Innovation Index (GII) and the Innovation Union Scoreboard (IUS) on the grounds that they offer enough data to calculate an average innovation performance of a sufficient number of countries over a certain period of time, that they were conducted by or on behalf of supranational organisations and that they contain a high amount of calculated key figures instead of indicators based on opinion polls.

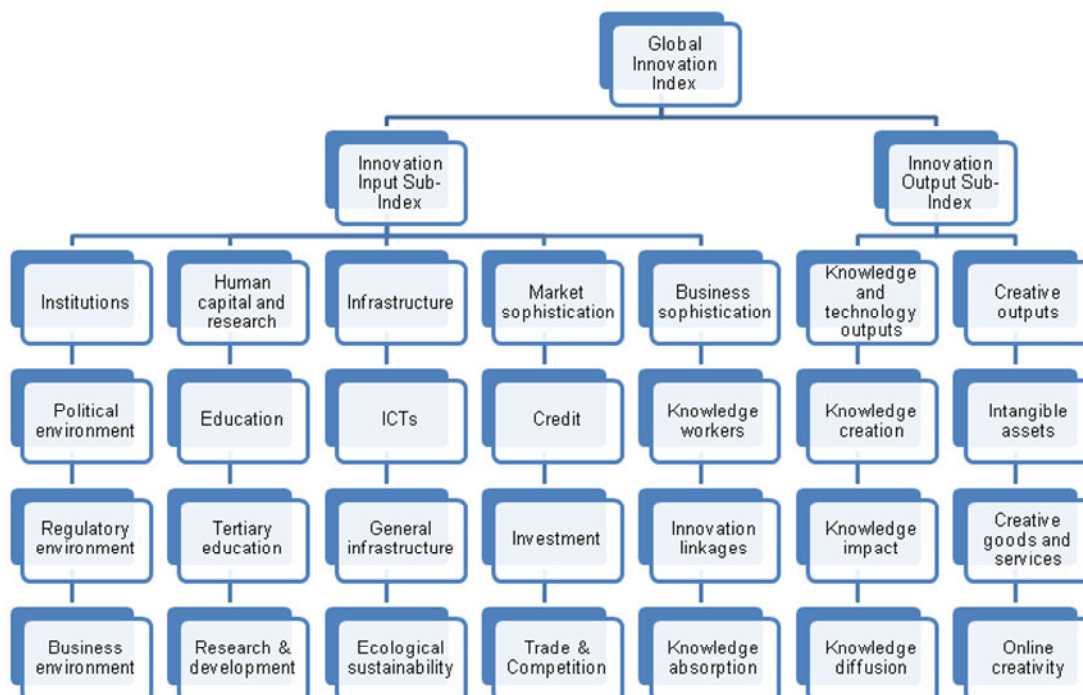


6. Descriptions of the Global Innovation Index (GII) and the Innovation Union Scoreboard (IUS)

The Global Innovation Index (GII) is composed of the Innovation Input Sub-Index and the Innovation Output Sub-Index and calculated as the simple average of those two sub-indexes. Each sub-index is composed of several pillars. Each pillar is again composed of three sub-pillars which are calculated using a score of individual indicators. In total the index contains 81 indicators (Cornell University, INSEAD & WIPO 2014, p. 7 f.).

The Innovation Input Sub-Index captures “elements of the national economy that enable innovative activities” (Cornell University, INSEAD & WIPO 2014, p. 7) and contains the five pillars Institutions, Human capital and research, Infrastructure, Market sophistication, and Business sophistication. The Innovation Output Sub-Index measures “results of innovative activities within the economy” (Cornell University, INSEAD & WIPO 2014, p. 7) and contains the two pillars Knowledge and technology outputs and Creative outputs. The framework of the Global Innovation Index (GII) 2014 including all sub-pillars is shown in figure 3.

Figure 3: Framework of the Global Innovation Index 2014



Source: Cornell University, INSEAD & WIPO (2014)



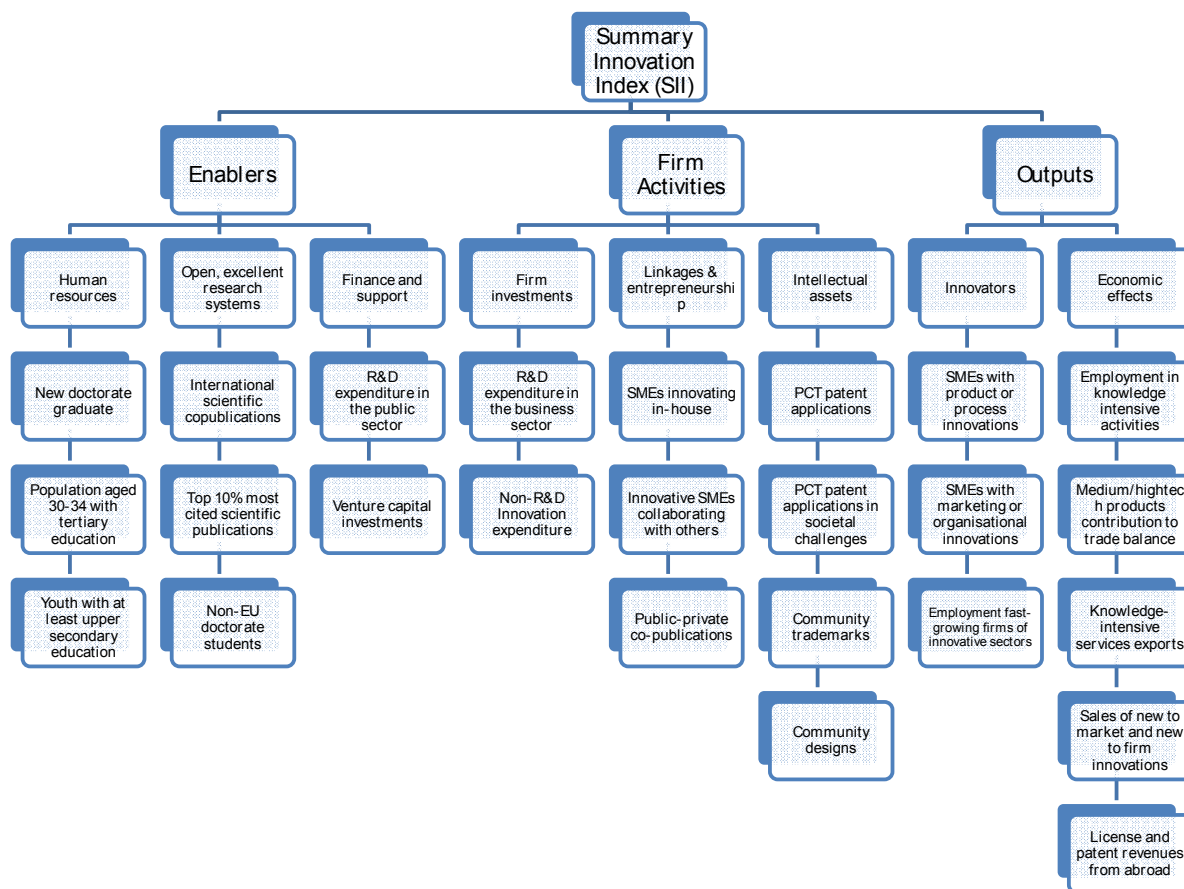
The Innovation Union Scoreboard (IUS) uses the Summary Innovation Index (SII), a composite indicator from eight innovation dimensions calculated by a scoring model, to rank the different national economies. In total 25 indicators are used to determine the 8 innovation dimensions which are categorized into three main types of indicators: Enablers, Firm Activities and Outputs (EC 2014, p. 8 ff.).

“The **Enablers** capture the main drivers of innovation performance external to the firm [...]” (EC 2014, p. 8). In this category the three innovation dimensions Human resources, Open, excellent and attractive research systems and Finance and support are calculated. “**Firm activities** capture the innovation efforts at the level of the firm [...]” (EC 2014, p. 8). This category contains the three innovation dimensions Firm investments, Linkages & entrepreneurship and Intellectual assets. These two main types of indicators correspond to the Innovation Input Sub-Index of the GII insofar as they measure inputs to the innovation activities of the economy.

“**Outputs** capture the effects of firms’ innovation activities [...]” (EC 2014, p. 9). This category contains the two innovation dimensions Innovators and Economic effects and corresponds to the Innovation Output Sub-Index of the GII. The measurement framework of the Innovation Union Scoreboard (IUS) including all 25 indicators is displayed in figure 4.



Figure 4: Measurement Framework of the Innovation Union Scoreboard



Source: EC (2014)



7. Research Method

The Global Innovation Index (GII), the Innovation Union Scoreboard (IUS) and the GLOBE-Study all use different methods to calculate scores and rank nations. Although all those scales are cardinal scales, they are, thus, not directly comparable. That is why the authors used Spearman's rank correlation coefficient which uses the ranks assigned to the values to calculate the correlation (Zöfel 2001, p. 126). This means that the nations of the GII/IUS and the GLOBE-Study were arranged respectively according to their score. Then the rank correlation examines if there is a coherency between the respective ranks of the nations. Moreover the rank correlation coefficient of Spearman can be used with nonlinear and non-numerical data (Borradaile 2003, p. 159) and is robust against outliers (Prasad & Ahson 2009, p. 112). The rank correlation was calculated using the respective module of "R", an open-source language for statistical computing (R-Project).

The values of the GLOBE-Study for the practice scales and the value scales of the cultural dimensions are from House et al. (2004, pp. 742-744). The values of the GII were provided by Cornell University (personal communication with Ms. Alexandra Bernard, Project Manager of The Global Innovation Index, Cornell University, September 26th, 2014). The data of the GII contains values from the years 2011 to 2014 which were also published in the respective reports (see INSEAD 2011, INSEAD 2012, INSEAD & WIPO 2013, Cornell University, INSEAD & WIPO 2014). The authors used this range because there were no significant changes in the framework used for the indexes of those years (Cornell University, INSEAD & WIPO, 2014, pp. 8-10). Between the GII 2010 and GII 2011 the index underwent major changes (see INSEAD 2010, INSEAD 2011) so that a direct comparison between GII 2010 (and earlier) and GII 2011 (and later) is difficult. For the correlation analysis the arithmetic averages of the scores were calculated for the values of GII 2011 to GII 2014 which were then ranked.

This approach is the main difference between the research at hand and the research of Rossberger & Krause, who used the years 2010 and 2011 of the GII (2013, p. 345) and the years 2009 to 2011 of the GII (2012, p. 86) separately. The authors questioned this approach, not only because the structure of the GII changed in 2011, but also because innovation is a long-term effort and, thus, the average over a longer period of time should give a more accurate measure.

This approach is also justified by the fact that the rankings of both indexes GII and IUS seem to be remarkably stable. The GII 2014 report states that "there is relative stability in the top 10" (Cornell University, INSEAD & WIPO 2014, pp. 9-10). And al-



though there are some changes in ranks of nations from year to year it is hard to conclude which changes derive from real improvement or deterioration and which changes are generated by adjustments to the index (Cornell University, INSEAD & WIPO 2013, p. 49 ff.). As described the IUS clusters the nations into the four innovation performance groups “Innovation leaders“, “Innovation followers“, “Moderate innovators“ and “Modest innovators“. In the last report the European Commission states that “membership of the innovation performance groups is stable with hardly any country managing to move between groups” (EC 2014, p. 26). An analysis of the authors shows that for all 36 nations of the IUS the mean average deviation (MAD) of the span of ranks between 2006 and 2013 is just 2.71 ranks for this eight year period.

The GII offers data from more nations than the GLOBE-Study. Therefore the authors used the data of the 56 nations both studies have in common for the research (see table 1). For nations with more than one set of data for the cultural dimensions (e.g. East and West Germany) the authors calculated a weighted average of the cultural dimensions according to the percentage of population.

Table 1: Countries in alphabetical order

Albania	Guatemala	Poland
Argentina	Hong Kong	Portugal
Australia	Hungary	Qatar
Austria	India	Russia
Bolivia	Indonesia	Singapore
Brazil	Ireland	Slovenia
Canada (English-speaking)	Israel	South Africa
China	Italy	South Korea
Colombia	Japan	Spain
Costa Rica	Kazakhstan	Sweden
Denmark	Kuwait	Switzerland
Ecuador	Malaysia	Thailand
Egypt	Mexico	Turkey
El Salvador	Morocco	United Kingdom
Finland	Namibia	United States of America
France	Netherlands	Venezuela
Georgia	New Zealand	Zambia
Germany	Nigeria	Zimbabwe
Greece	Philippines	



The data for the IUS is available online on the website of the European Commission (downloadable from http://ec.europa.eu/enterprise/policies/innovation/files/ius/ius-2014-database_en.xlsx). Here the authors used the data from 2006 to 2013 which is in the Excel sheet provided by the European Commission and also calculated the arithmetic average over the time range as for the GII. All in all the authors could analyse 18 of 36 nations of the IUS for which both the IUS as well as the GLOBE-Study supply data.

To test in how far correlations exist not only on an aggregated level, but may be caused by single dimensions of the respective index, covered by the sub-indexes, the authors calculate the correlation between the cultural dimensions and the innovation indexes as well as between the cultural dimensions and the two levels of sub-indexes of each index. This enables us to draw more sophisticated conclusions regarding the relevance of the single characteristics (as covered by the respective sub-index), and the cultural dimensions. This also may provide a basis for future research on causal relations between cultural factors and innovativeness. So for the GII the authors calculated correlations to the main index as well as the Innovation Input sub-Index, the Innovation Output Sub-index and the seven innovation pillars (Institutions, Human capital and research, Infrastructure, Market sophistication, Business sophistication, Knowledge and technology outputs and Creative outputs). Concerning the IUS that means the authors calculated the correlation to the Summary Innovation Index (SII) and the eight innovation dimensions (Human resources, Open, excellent and attractive research systems, Finance and support, Firm investments, Linkages & entrepreneurship, Intellectual assets, Innovators and Economic effects). Since the IUS offers no summarized values for the three main types of indicators – Enablers, Firm activities and Outputs – it is not possible to calculate a correlation for that level of the hierarchy.



8. Results

Tables 2 und 3 display the results concerning the Global Innovation Index (GII) and tables 4 and 5 the results concerning the Innovation Union Scoreboard (IUS) for practice scales and value scales of the GLOBE study respectively. In order to find out whether the rank correlations are significant, the p-value was calculated.

Table 2: Results of the rank correlations between the cultural dimensions (practice scales) and the Global Innovation Index (GII) and level of significance (for $p < 0.01$, * for a $p < 0.05$ and no asterisk for $p \geq 0.05$)**

	Assertiveness	Institutional.Collectivism	In.Group.Collectivism
Global.Innovation.Index	0.05	0.47***	0.55***
Innovation.Input.Sub.index	0.02	0.46***	-0.54***
Innovation.Output.Sub.index	0.07	0.48***	-0.56***
Institutions	0.14	0.47***	-0.62***
Human.capital.and.research	0.09	0.46***	-0.53***
Infrastructure	0.13	0.43***	-0.50***
Market.sophistication	0.04	0.48***	-0.47***
Business.sophistication	0.00	0.45***	-0.62***
Knowledge.and.technology.outputs	-0.06	0.54***	-0.41**
Creative.outputs	0.10	0.27*	-0.62***

	Future.Orientation	Gender.Egalitarianism	Human.Orientation
Global.Innovation.Index	0.52***	0.26	-0.20
Innovation.Input.Sub.index	0.56***	0.20	-0.16
Innovation.Output.Sub.index	0.53***	0.28*	-0.22
Institutions	0.50***	0.36**	-0.18
Human.capital.and.research	0.43***	0.28*	-0.23
Infrastructure	0.49***	0.24	-0.28*
Market.sophistication	0.55***	0.12	-0.11
Business.sophistication	0.55***	0.32*	-0.16
Knowledge.and.technology.outputs	0.45***	0.13	-0.08
Creative.outputs	0.55***	0.22	-0.22

	Performance.Orientation	Power.Distance	Uncertainty.Avoidance
Global.Innovation.Index	0.45***	-0.31*	0.60***
Innovation.Input.Sub.index	0.46***	-0.32*	0.60***
Innovation.Output.Sub.index	0.45***	-0.32*	0.60***
Institutions	0.43***	-0.31*	0.61***
Human.capital.and.research	0.31*	-0.21	0.50***
Infrastructure	0.41***	-0.21	0.50***
Market.sophistication	0.58***	-0.38**	0.64***
Business.sophistication	0.40**	-0.31*	0.56***
Knowledge.and.technology.outputs	0.41**	-0.27*	0.53***
Creative.outputs	0.38**	-0.26	0.58***

The p-value is the probability of error (Hackl 2005, p. 78) and, thus, a measure for the significance of the correlation. The lower the p-value, the lower is the probability of a random correlation. Moreover the correlation between the cultural dimensions and the innovation indexes is stronger, if the p-value is lower.

The number of asterisks in the table has the following meaning:

*** for a p-value below 0.001

** for a p-value below 0.01

* for a p-value below 0.05



and no asterisk for all p-values above or equal to 0.05. The rank correlations without any asterisks cannot be proven as significant.

Table 3: Results of the rank correlations between the cultural dimensions (value scales) and the Global Innovation Index (GII) and level of significance (for $p < 0.01$, * for a $p < 0.05$ and no asterisk for $p \geq 0.05$)**

	Assertiveness	Institutional.Collectivism	In.Group.Collectivism
Global.Innovation.Index	0.04	-0.38**	-0.13
Innovation.Input.Sub.index	0.03	-0.33*	-0.15
Innovation.Output.Sub.index	0.06	-0.41**	-0.13
Institutions	0.07	-0.43***	-0.05
Human.capital.and.research	-0.07	-0.35**	0.00
Infrastructure	0.02	-0.32*	-0.10
Market.sophistication	0.23	-0.49***	-0.20
Business.sophistication	0.09	-0.35**	-0.05
Knowledge.and.technology.outputs	0.09	-0.41**	-0.19
Creative.outputs	-0.12	-0.12	-0.05

	Future.Orientation	Gender.Egalitarianism	Human.Orientation
Global.Innovation.Index	-0.52***	0.48***	0.50***
Innovation.Input.Sub.index	-0.52***	0.48***	0.45***
Innovation.Output.Sub.index	-0.50***	0.46***	0.49***
Institutions	-0.41**	0.45***	0.47***
Human.capital.and.research	-0.45***	0.49***	0.56***
Infrastructure	-0.44***	0.47***	0.55***
Market.sophistication	-0.45***	0.35**	0.37**
Business.sophistication	-0.44***	0.48***	0.46***
Knowledge.and.technology.outputs	-0.52***	0.37**	0.45***
Creative.outputs	-0.41**	0.56***	0.41**

	Performance.Orientation	Power.Distance	Uncertainty.Avoidance
Global.Innovation.Index	0.01	0.09	-0.70***
Innovation.Input.Sub.index	0.03	0.03	-0.72***
Innovation.Output.Sub.index	-0.01	0.12	-0.69***
Institutions	0.11	0.19	-0.69***
Human.capital.and.research	0.09	0.05	-0.64***
Infrastructure	0.01	0.02	-0.65***
Market.sophistication	-0.09	0.23	-0.64***
Business.sophistication	0.07	0.05	-0.67***
Knowledge.and.technology.outputs	-0.04	0.05	-0.65***
Creative.outputs	0.21	-0.09	-0.70***

The GII shows strong positive correlations ($p < 0.001$) for the practice scales of Institutional Collectivism, Future Orientation, Performance Orientation and Uncertainty Avoidance and a strong negative correlation ($p < 0.001$) for the practice scale of In-Group Collectivism (see tables 2 and 3). Concerning the value scales it shows strong positive correlations ($p < 0.001$) for Gender Egalitarianism and Human Orientation and strong negative correlations ($p < 0.001$) for Future Orientation and Uncertainty Avoidance. Furthermore it shows weaker negative correlations for the value scale of In-Group Collectivism ($p < 0.01$) and for the practice scale of Power Distance ($p < 0.05$). No correlation could be found for Assertiveness, neither for the practice scale



nor for the value scale. It is striking that for each strong correlation between GII and a cultural dimension the Input and Output Sub-Indexes are also strongly correlated ($p < 0.001$) and all pillars are correlated as well (either $p < 0.001$ or $p < 0.01$).

Table 4: Results of the rank correlations between the cultural dimensions (practice scales) and the Innovation Union Scoreboard (IUS) and level of significance (for $p < 0.01$, * for $p < 0.05$ and no asterisk for $p \geq 0.05$)**

	Assertiveness	Institutional.Collectivism	In.Group.Collectivism
Summary.Innovation.Index	-0.09	0.60**	-0.90***
Human.resources	-0.20	0.67**	-0.64**
Research.systems	-0.06	0.59*	-0.85***
Finance.and.support	-0.25	0.67**	-0.80***
Firm.investments	-0.19	0.52*	-0.64**
Linkages.and.entrepreneurship	-0.17	0.64**	-0.86***
Intellectual.assets	0.05	0.51*	-0.85***
Innovators	0.04	0.37	-0.62**
Economic.effects	0.07	0.34	-0.78***

	Future.Orientation	Gender.Egalitarianism	Human.Orientation
Summary.Innovation.Index	0.83***	-0.02	0.38
Human.resources	0.56*	0.12	0.42
Research.systems	0.81***	-0.05	0.39
Finance.and.support	0.68**	0.16	0.37
Firm.investments	0.59*	0.12	0.29
Linkages.and.entrepreneurship	0.85***	0.05	0.50*
Intellectual.assets	0.78***	-0.03	0.26
Innovators	0.75***	-0.22	0.34
Economic.effects	0.59*	0.01	0.17

	Performance.Orientation	Power.Distance	Uncertainty.Avoidance
Summary.Innovation.Index	0.62**	-0.54*	0.94***
Human.resources	0.44	-0.47	0.64**
Research.systems	0.72***	-0.50*	0.82***
Finance.and.support	0.50*	-0.45	0.80***
Firm.investments	0.40	-0.44	0.78***
Linkages.and.entrepreneurship	0.50*	-0.62**	0.87***
Intellectual.assets	0.67**	-0.49*	0.93***
Innovators	0.53*	-0.36	0.80***
Economic.effects	0.45	-0.25	0.69**

The Summary Innovation Index (SII) of the IUS shows strong positive correlations ($p < 0.001$) for the practice scales of Future Orientation and Uncertainty Avoidance and a strong negative correlation ($p < 0.001$) for the practice scale of In-Group Collectivism (see tables 4 and 5). Concerning the value scales it shows strong negative correlations ($p < 0.001$) for Future Orientation and Uncertainty Avoidance and weaker positive correlations ($p < 0.01$) for Gender Egalitarianism and Human Orientation. No correlations could be found for Assertiveness, Institutional Collectivism, Performance Orientation and Power Distance. For each correlation between SII and a cultural dimension each innovation dimension of the SII is also correlated to the cultural dimension with p-values between $p < 0.001$ and $p < 0.05$.



Table 5: Results of the rank correlations between the cultural dimensions (value scales) and the Innovation Union Scoreboard (IUS) and level of significance (for $p < 0.01$, * for $p < 0.05$ and no asterisk for $p \geq 0.05$)**

	Assertiveness	Institutional.Collectivism	In.Group.Collectivism
Summary.Innovation.Index	0.01		-0.40
Human.resources	0.18		-0.60**
Research.systems	-0.03		-0.21
Finance.and.support	0.14		-0.44
Firm.investments	0.15		-0.55*
Linkages...entrepreneurship	-0.07		-0.42
Intellectual.assets	-0.09		-0.28
Innovators	-0.33		0.01
Economic.effects	0.01		-0.32

	Future.Orientation	Gender.Egalitarianism	Human.Orientation
Summary.Innovation.Index	-0.72***	0.60**	0.62**
Human.resources	-0.57*	0.20	0.45
Research.systems	-0.61**	0.65**	0.55*
Finance.and.support	-0.48*	0.45	0.62**
Firm.investments	-0.70**	0.35	0.49*
Linkages...entrepreneurship	-0.75***	0.57*	0.53*
Intellectual.assets	-0.63**	0.49*	0.71***
Innovators	-0.65**	0.43	0.55*
Economic.effects	-0.59**	0.54*	0.44

	Performance.Orientation	Power.Distance	Uncertainty.Avoidance
Summary.Innovation.Index	0.15	0.15	-0.78***
Human.resources	0.25	0.17	-0.50*
Research.systems	-0.06	0.23	-0.73***
Finance.and.support	0.18	0.01	-0.57*
Firm.investments	0.52*	0.15	-0.54*
Linkages...entrepreneurship	0.14	0.08	-0.68**
Intellectual.assets	0.26	0.14	-0.77***
Innovators	0.16	0.11	-0.69**
Economic.effects	-0.01	0.35	-0.61**

The results for GII and IUS are summarized in table 6. The correlations for the two indexes show the same tendencies of correlation for the practice scales of In-Group Collectivism, Future Orientation and Uncertainty Avoidance and for the value scales of Future Orientation, Gender Egalitarianism, Human Orientation and Uncertainty Avoidance.



Table 6: Comparison of correlations between cultural dimensions of GLOBE and GII or IUS

		GII	IUS
Assertiveness	Practice		
	Value		
Institutional Collectivism	Practice	+++	
	Value	--	
In-Group Collectivism	Practice	---	---
	Value		
Future Orientation	Practice	+++	+++
	Value	---	---
Gender Egalitarianism	Practice		
	Value	+++	++
Human Orientation	Practice		
	Value	+++	++
Performance Orientation	Practice	+++	
	Value		
Power Distance	Practice	-	
	Value		
Uncertainty Avoidance	Practice	+++	+++
	Value	---	---

+++: positive correlation ($p < 0.001$)

++: positive correlation ($p < 0.01$)

+: positive correlation ($p < 0.05$)

---: negative correlation ($p < 0.001$)

--: negative correlation ($p < 0.01$)

-: negative correlation ($p < 0.05$)

Source: Own illustration



9. Discussion, Limitations and Further Research

In line with the hypotheses concerning practice scales are the positive correlation to Future Orientation (H3) and the negative correlation to In-Group Collectivism (H6). For the GII alone also negative correlations to Power Distance and Institutional Collectivism and a positive correlation to Performance Orientation could be detected which is in line with hypotheses H2, H5 and H8. Not in line with the hypotheses concerning practice scales is the positive correlation concerning Uncertainty Avoidance (H1). In line with the hypotheses concerning value scales are the positive correlations to Human Orientation (H4) and Gender Egalitarianism (H7) as well as the negative correlation to Uncertainty Avoidance (H1). Not in line with the hypotheses is the negative correlation concerning Future Orientation (H3).

It is astonishing that Power Distance of the GLOBE-study has only a weak correlation to innovativeness (and only to the GII) since many authors found correlations of innovativeness to the corresponding dimension of Hofstede (see results of Shane 1992, Shane 1993, Kaasa & Vadi 2008, Sun 2009, Halkos & Tzeremes 2013, Busse 2014), but the finding is in line with the result of Efrat (2014). Overall the power structure of a country is seen by some authors as a key variable of economic prosperity (see e.g. Acemoglu & Robinson 2013) which is not reflected in our data concerning innovativeness.

The strong negative correlation of In-Group Collectivism is in line with the findings of Taylor & Wilson (2012). The impacts of in-group collectivism may be explained through the degree of clanism in a society. According to Collins (2004, p. 231) “a clan is an informal organization comprising a network of individuals linked by kin-based bonds”. Those kin-based bonds can be immediate kinship through blood ties, kinship resulting from marriage as well as fictive kinship, e.g. close friendships (Collins 2004, pp. 231-232, Minbaeva & Muratbekova-Touron 2013, p. 133). Clans can have positive and stabilizing effects in unreliable and uncertain societies and “serve as an alternative to the formal institutions of markets and state bureaucracies” (Collins 2013, p.174). But clans also lead to a solidification of the status quo through “norms of loyalty, inclusion of members, and exclusion of outsiders” (Collins 2004, p. 232) and especially clan elites rely on these factors to maintain and consolidate their position (Collins 2013, p. 174). This seems to have negative effects on the innovativeness of a nation, but needs to be seen in connection with the effects of instable political contexts and corruption.

Further research shows that collectivism also impacts risk perception and preference (Weber & Hsee 1999, Kim & Park 2010) as well as corporate entrepreneurship (Mor-



ris, Davis & Allene 1994) of a society which might affect innovativeness. Moreover the negative relationship of religiosity and innovation established by Bénabou, Ticchi & Vindigni (2015) has to be considered in this context.

The strong positive correlations to Human Orientation and Gender Egalitarianism show that a human-centred and gender-conscious approach to innovation seems to be preferable to an aggressive and performance-oriented approach. This can be explained by the importance of collaboration and networking in contemporary innovation efforts (Efrat 2014). Another reason could be today's need to include the customer perspective into innovation processes to better understand customer needs and wishes which leads to concepts such as Empathic Design (Mattelmäki, Vaajakallio & Koskinen 2013, Kouprie & Sleeswijk Visser 2009) and Design Thinking (Kelley 2001, López 2015). Together with the insight that many innovations come from outside the company (Hippel 1988) this trend is also reflected in the approaches of Open Innovation, Co-Creation and Lead User Integration (Chesbrough 2006, Hippel 2006, Hippel, Sonnack & Churchill 2009). The question why only the value scale shows a relationship to innovativeness remains to be answered.

It is striking that there are significant differences between practice scales and value scales, especially concerning Future Orientation and Uncertainty Avoidance which are clearly not in line with hypothesis H10 and demand an explanation. Since up-to-now the authors only used correlation analysis the results should be seen as preliminary, and only a tentative interpretation can be given.

From the previous research and the hypotheses one would expect a negative correlation of the innovation indexes and Uncertainty Avoidance which can only be demonstrated for the value scales. For the practice scales the correlation is reversed. This seems to be contradictory at first. The central question seems to be if curiosity is grounded in fear (high Uncertainty Avoidance) or in courage (low Uncertainty Avoidance). Maslow (2007, p.45) saw the cognitive need of curiosity both under conditions of fear and of courage. Under fear there is a "primary goal of allaying anxiety" and new objects are "detoxified, familiarized". Under courage there is a growth-motivated curiosity where the individual has "mastered his anxieties" and deals "positively with problems in order to be victorious over them". Our research indicates that from a cultural perspective a certain level of stability is needed for a society to become innovative (high Uncertainty Avoidance as practice scale) and that clear structures and regulations aren't inhibitory to innovations but on the contrary seem to be a prerequisite for national innovation capability. On the other hand the cultural values should be of low Uncertainty Avoidance so that individuals and companies feel the need to create inventions and innovations within the national set of stability and sometimes bend, circumvent or break the existing structures and regulations. Or as Mumford



(1967, p. 39) put it: “The fact that order and creativity are complementary has been basic to man’s cultural development; for he has to internalize order to be able to give external form to his creativity.”

Concerning Future Orientation one would expect a positive correlation which can only be shown for the practice scale of the cultural dimension, but not the value scale. This seems to indicate that a long-term orientation of a nation needs to be brought into practice to be effective, again hinting at the importance of stability of structures and regulations but with an outlook for future developments. For the cultural values a more short-term orientation seems to be conducive to innovation which can maybe be explained with a certain eagerness to achieve results and a proactive can-do attitude instead of adopting a wait and see attitude in expectance of a bright but remote future. The interpretation of this result is, thus, to some degree impeded by a certain fuzziness of the definition of the term Future Orientation which includes not only future-oriented behaviour such as planning but also restraint (see page 5).

A long-term orientation is seen as one of the main success factors of family-controlled businesses (FCB). Miller & Le Breton-Miller (2005, pp. 17 ff.) argue that the strategy of FCBs is driven by a substantive mission – “some real contribution the company makes to its customers, employees, or society at large” – and that FCBs invest substantially more in long-term development of their employees and assets than non-FCBs. Lumpkin, Brigham & Moss (2010) link long-term orientation of FCBs to entrepreneurial orientation, especially to innovativeness (“a company’s efforts to discover potential opportunities”), autonomy (“independence that is needed to explore opportunities, bring forth business concepts and carry them through to completion”) as well as to proactiveness (“a company’s efforts to recognize and seize them [potential opportunities]”). This shows that future orientation in practice leads to innovativeness and proactiveness rather than a wait and see attitude and seems to indicate that countries with future-oriented cultures create innovativeness amongst others through a strong basis of entrepreneurial FCBs.

One reason for the seemingly paradoxical result for Future Orientation could lie in the way entrepreneurs operate. They often do not follow a causal logic with a prediction of the future and goal-oriented planning and execution. They rather start with the means that they have (bird-in-hand principle) and try to control what they can control to create a new business (pilot-in-the-plane principle) as they move forward trying to make the best of contingencies instead of trying to avoid them (lemonade principle) (Sarasvathy 2008, pp. 15-16, Faschingbauer 2010, pp. 21 ff.). This is another hint at the action-oriented approach of entrepreneurs which emphasizes “making things happen now” but with a possible long-term implication rather than making plans for



the future and delaying gratification. How this exactly relates to the results concerning practice and value scale of the GLOBE- dimension remains to be explained.

Overall it can be concluded that culture has an impact on national innovativeness. The different cultural dimensions of the GLOBE-study show a multi-faceted interrelationship between culture and innovation which deserves further examination. To come to a concise answer for the question which factors drive or at least trigger the innovation capability/innovativeness of a country, additional research will be necessary. One important issue is the question regarding the causal direction of the correlations: while we so far only could demonstrate that a – positive or negative – link between cultural dimensions and different measures of national innovativeness exist, one would expect a clear-cut direction of cultural factors driving innovation in different forms. The next step of our quantitative analysis therefore will be to test for (multi-variate) links between culture as the independent variable and different operationalizations of innovation as the dependent variable. A more elaborated approach like this comes with additional challenges for the research design, e.g. the fact that not only the rank of a respective country may be taken into consideration, but also the absolute value, or the use of binary outcome variables to test for the overall innovative potential (high/low). Additionally, we will test for the possibility that in some cases non-linear relations may be given, including non-linear regression models.

Another issue that may be of relevance in this context will be the inclusion of different kinds of control variables. Testing for (linear) links between influencing factors and innovation (in its different sub-indexes and key indicators) as an outcome variable, control variables such as GDP per capita, corruption (as measured by the Corruption Perception Index) or other indicators for economic performance and institutional quality (e.g. Index of Economic Freedom, Human Development Index) could be used.

Furthermore the authors see the need for a more detailed analysis of the indicators used in the Global Innovation Index (GII) and the Innovation Union Scoreboard (IUS) on the one hand and the questions asked to determine the cultural dimensions of the GLOBE-study on the other hand. Especially the differences between practice scales and value scales of the GLOBE-study deserve further attention. Another examination could focus on different phases of the innovation process since they have different requirements. As Lubart (2010, pp. 272-273) writes “The phases of creative and innovative processes may relate differentially to these cultural dimensions. For example, low power distance, individualism, and low uncertainty avoidance may foster creativity, but hinder idea implementation”. These analyses should lead to a deeper understanding of what has been measured to determine innovativeness as well as culture and facilitate a more profound interpretation of the results of the statistical analysis.



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Appendix

Appendix 1: Graphs for cultural dimensions (practice scales) and Global Innovation Index (GII)

Appendix 2: Graphs for cultural dimensions (value scales) and Global Innovation Index (GII)

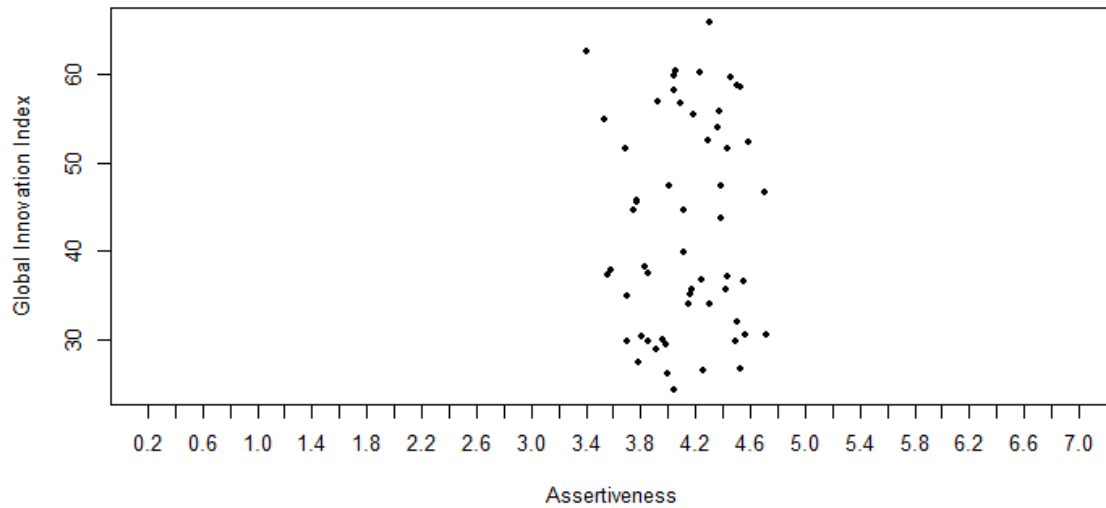
Appendix 3: Graphs for cultural dimensions (practice scales) and Innovation Union Scoreboard (IUS)

Appendix 4: Graphs for cultural dimensions (value scales) and Innovation Union Scoreboard (IUS)

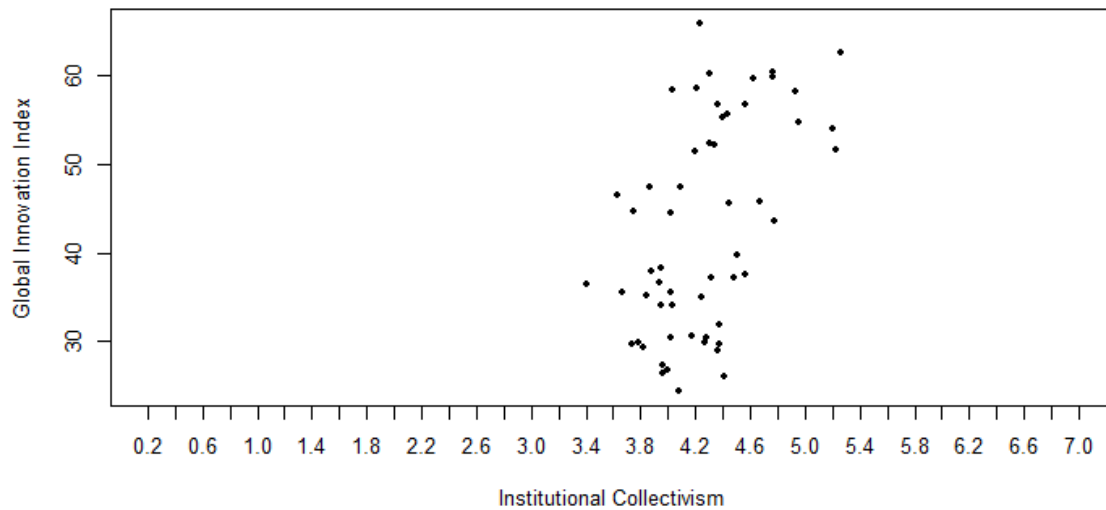


Appendix 1: Graphs for cultural dimensions (practice scales) and Global Innovation Index (GII)

Assertiveness and Innovation

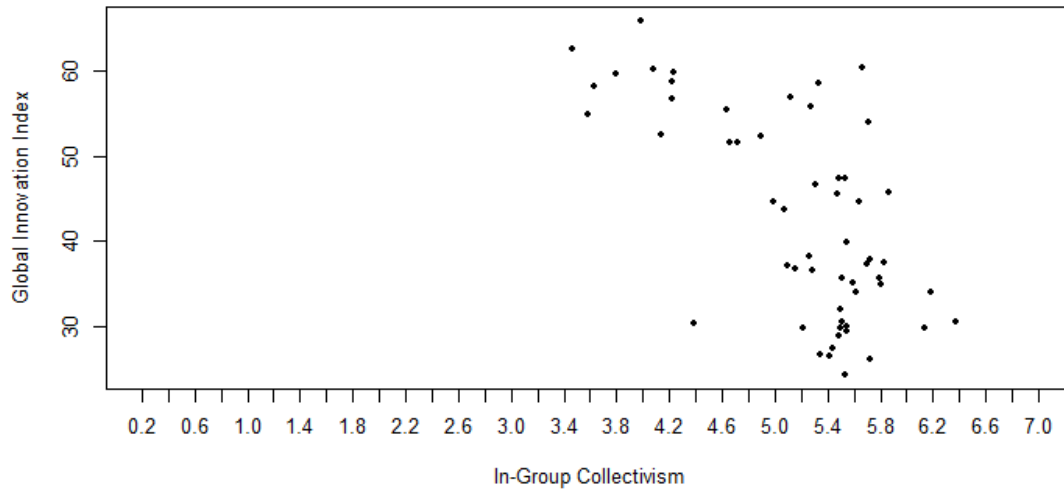


Institutional Collectivism and Innovation

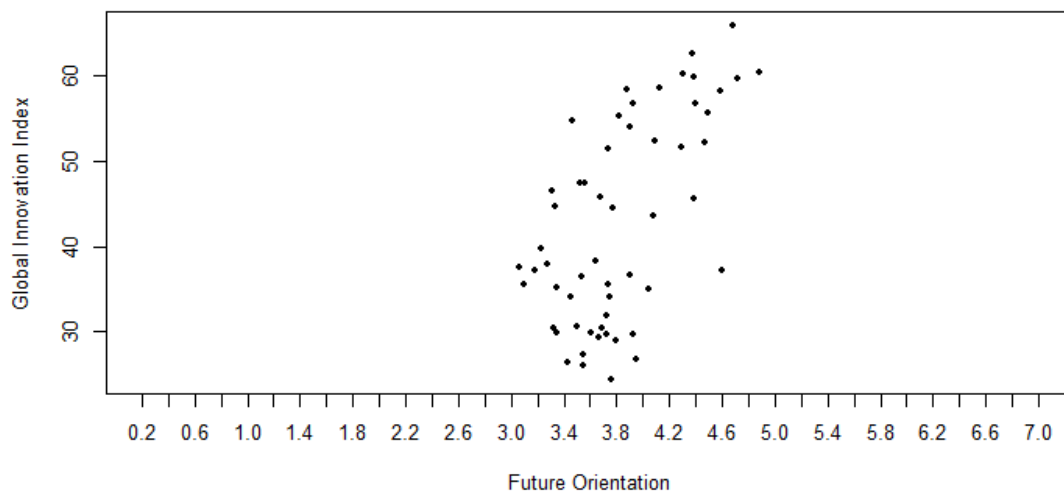




In-Group Collectivism and Innovation

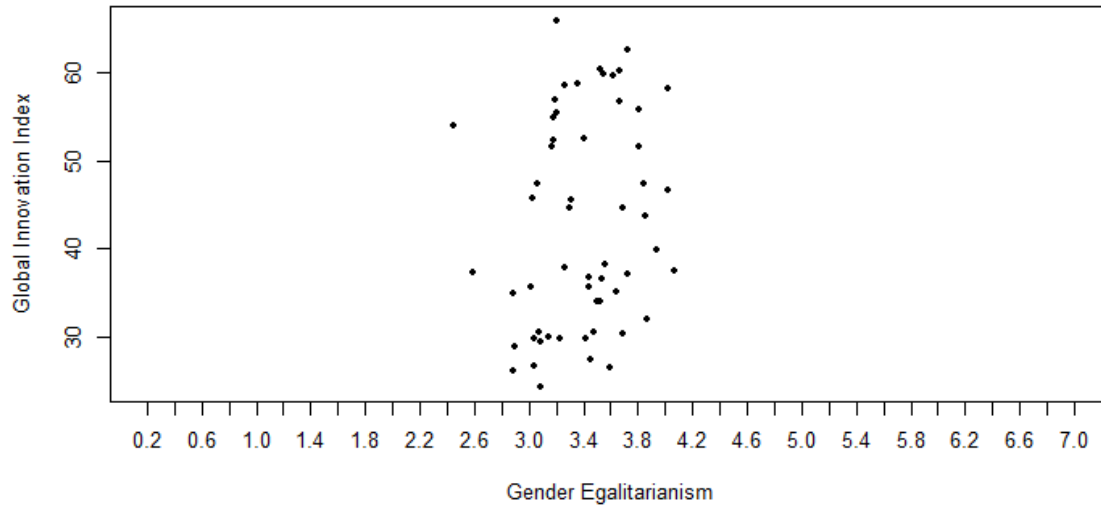


Future Orientation and Innovation

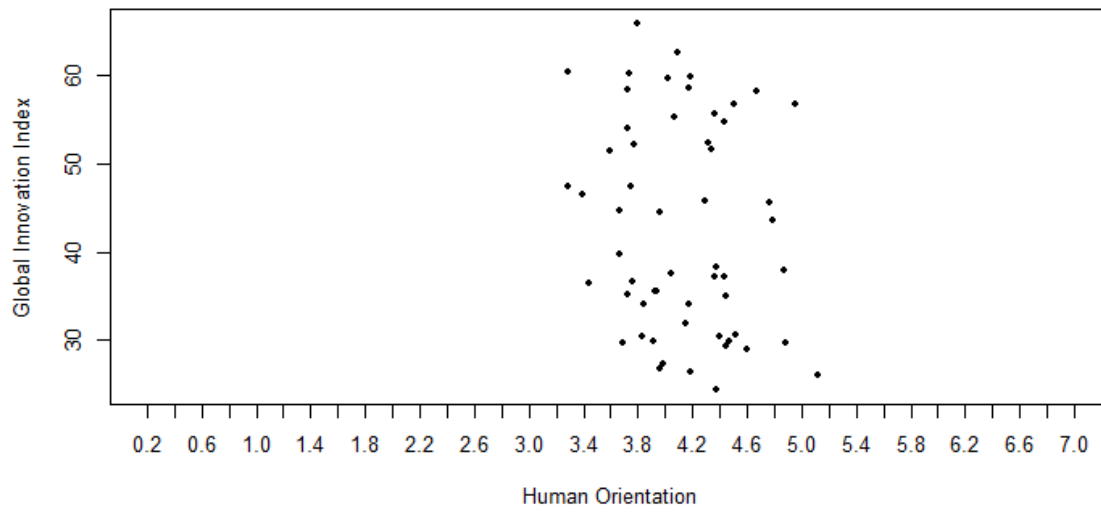




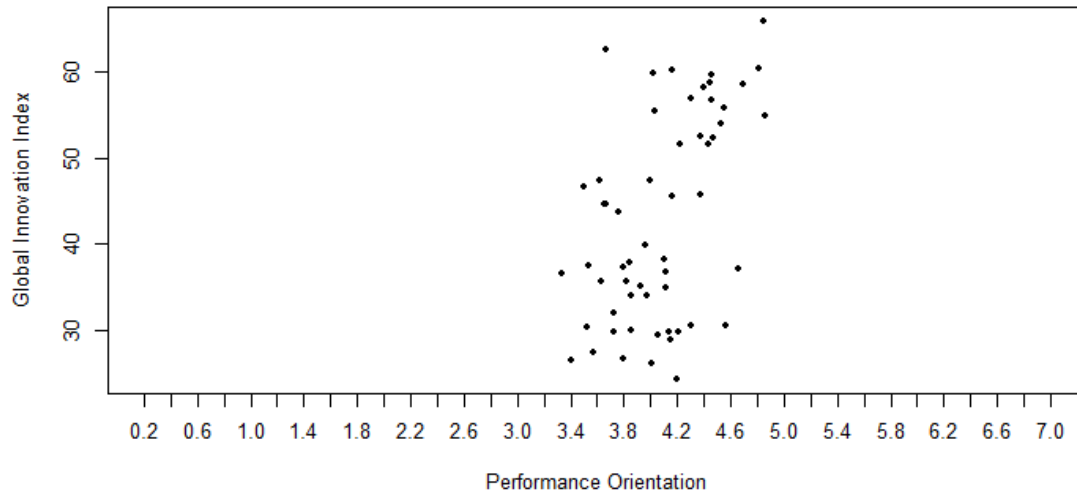
Gender Egalitarianism and Innovation



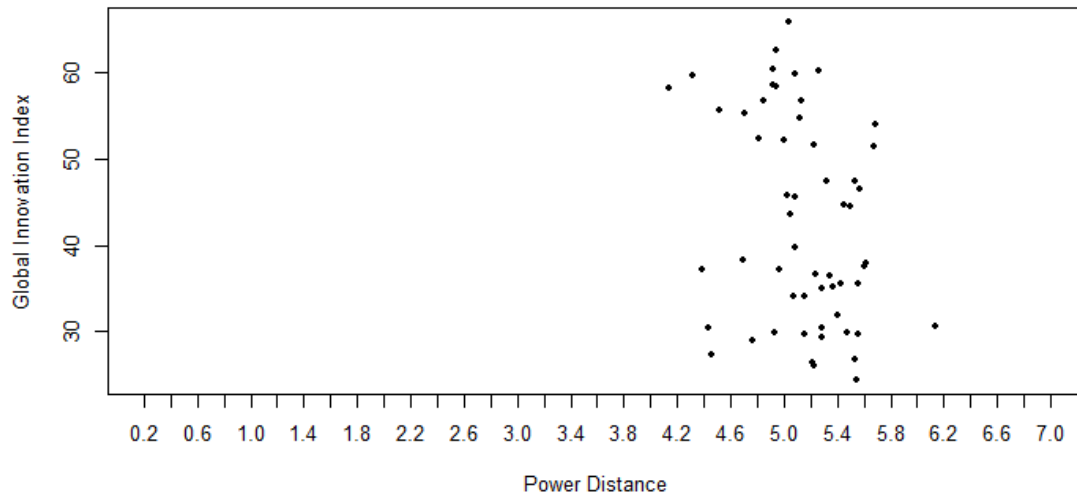
Human Orientation and Innovation



Performance Orientation and Innovation

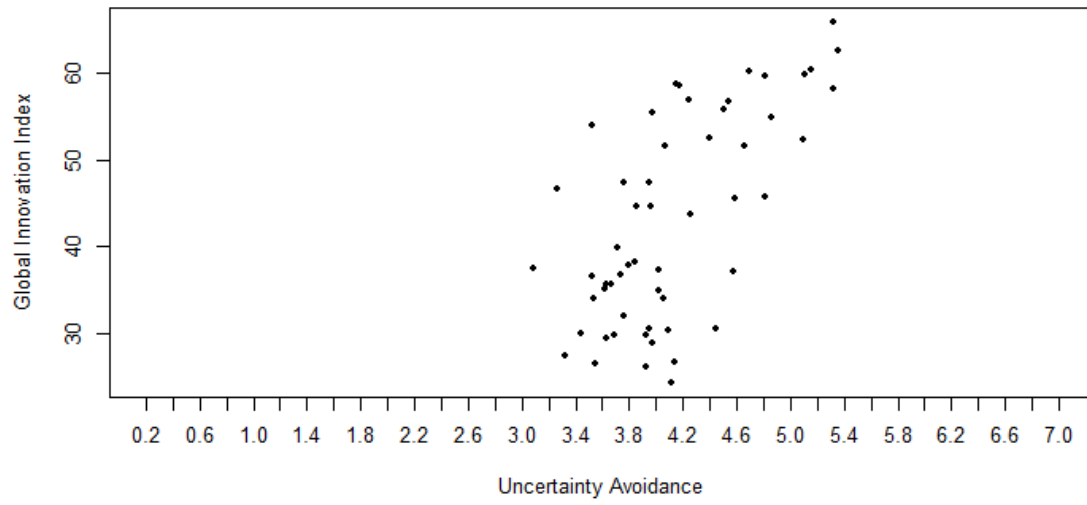


Power Distance and Innovation





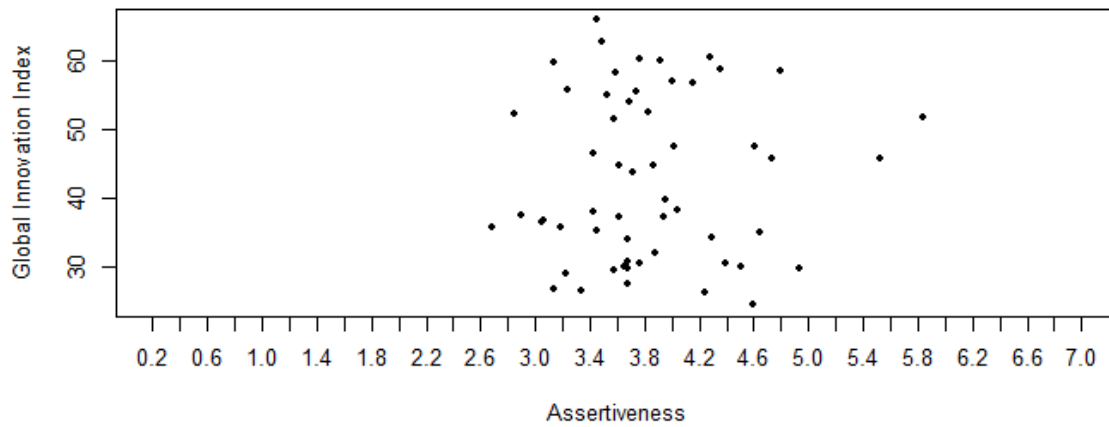
Uncertainty Avoidance and Innovation



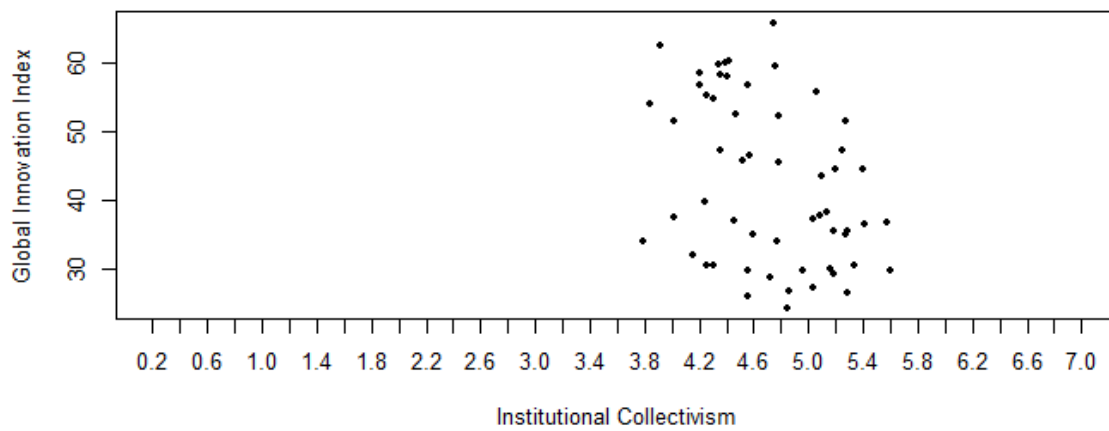


Appendix 2: Graphs for cultural dimensions (value scales) and Global Innovation Index (GII)

Assertiveness and Innovation

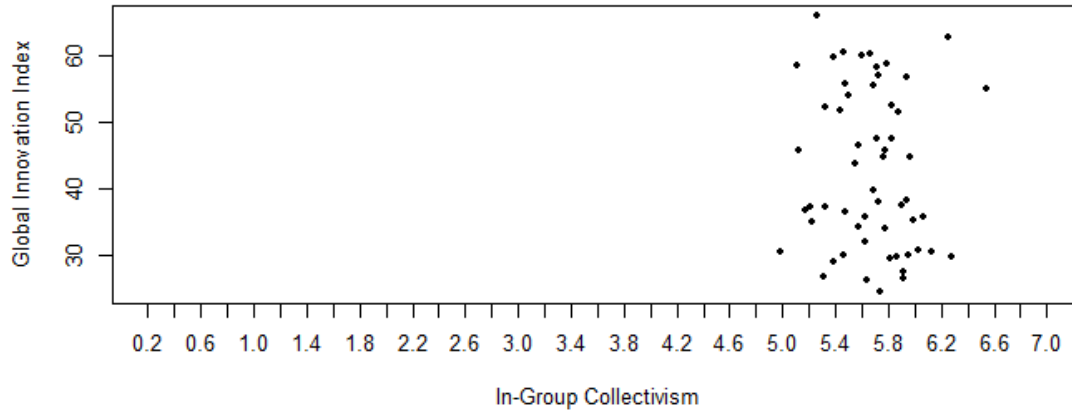


Institutional Collectivism and Innovation

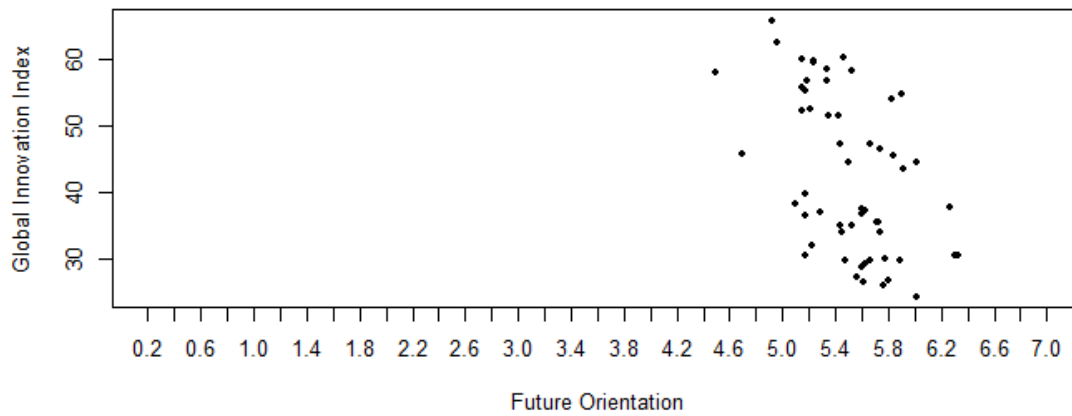




In-Group Collectivism and Innovation

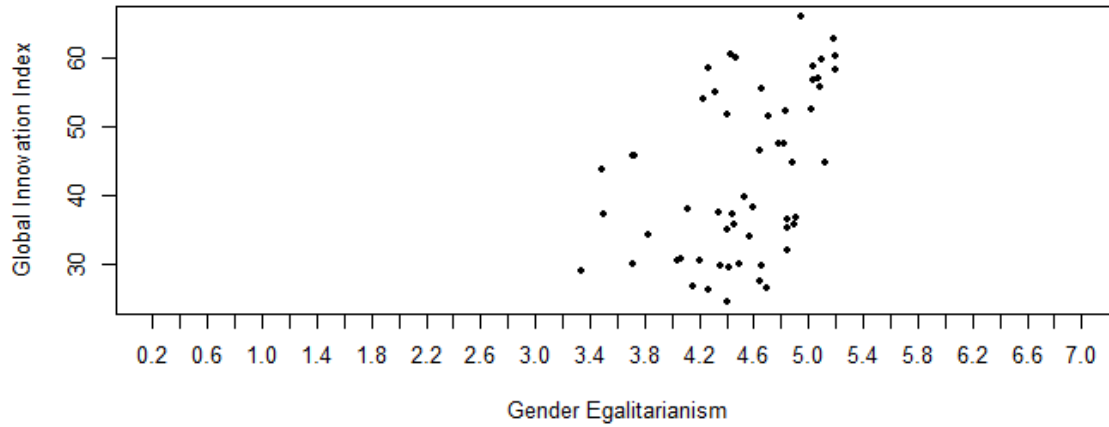


Future Orientation and Innovation

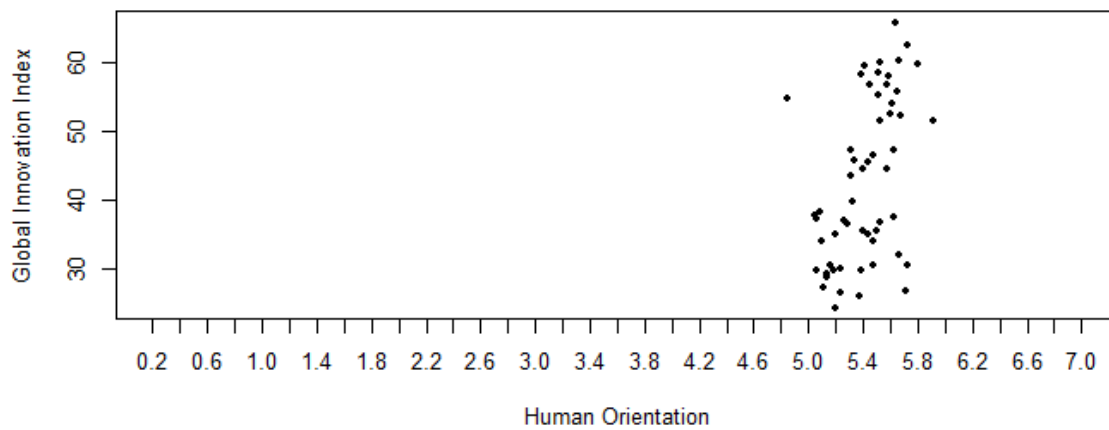




Gender Egalitarianism and Innovation

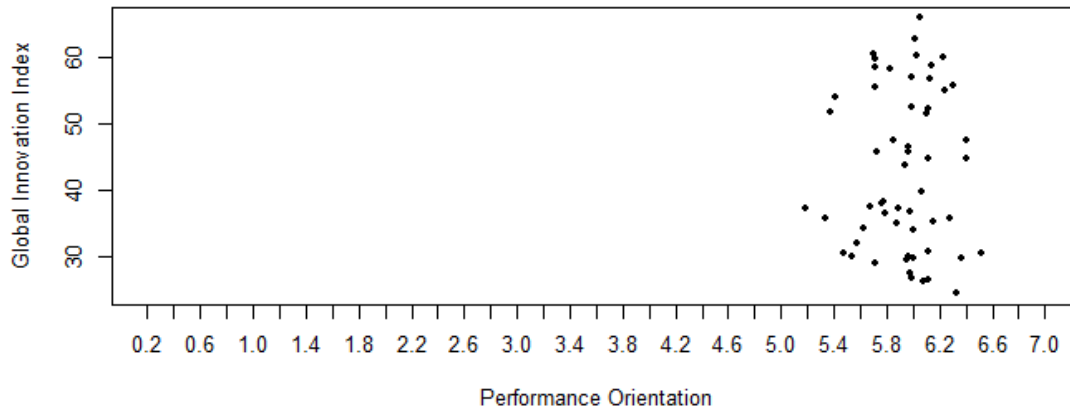


Human Orientation and Innovation

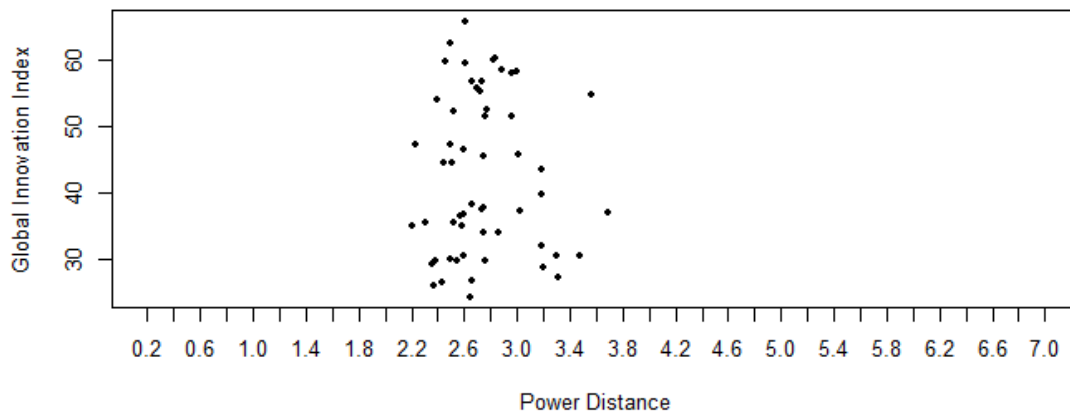




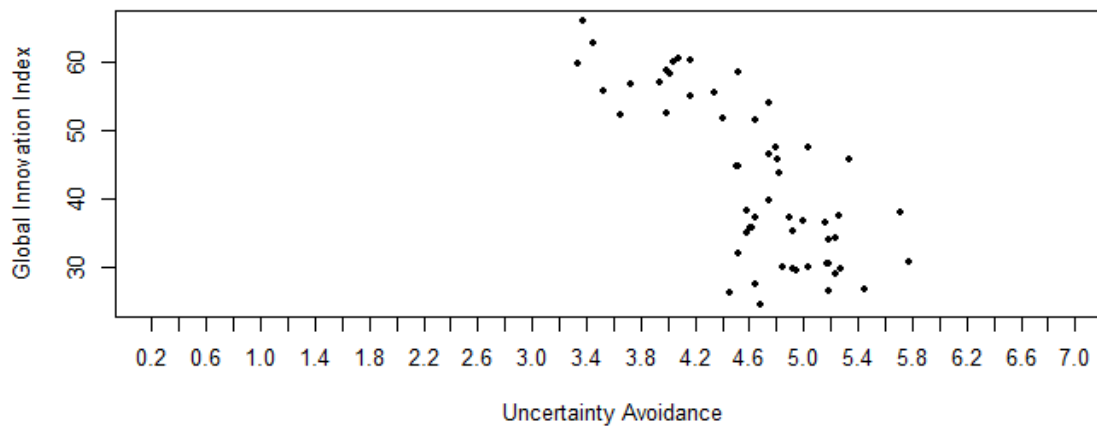
Performance Orientation and Innovation



Power Distance and Innovation



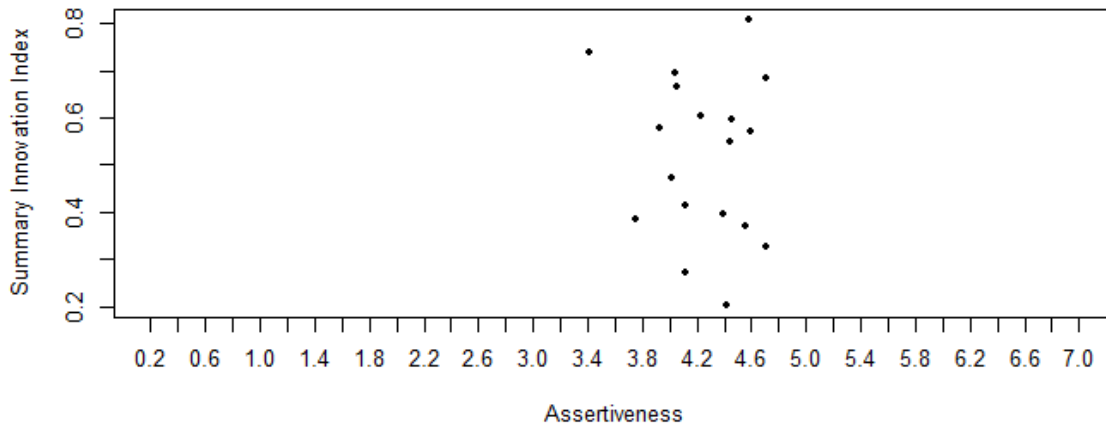
Uncertainty Avoidance and Innovation



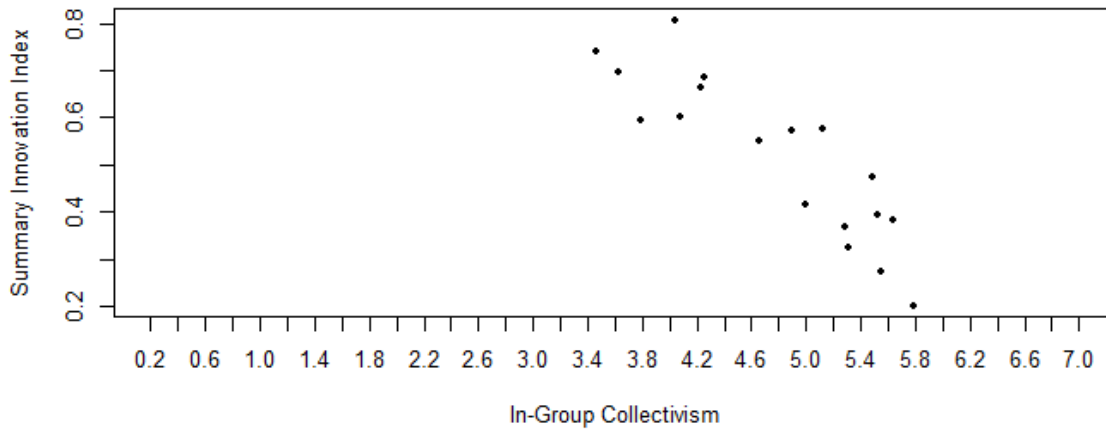


Appendix 3: Graphs for cultural dimensions (practice scales) and Innovation Union Scoreboard (IUS)

Assertiveness and Innovation

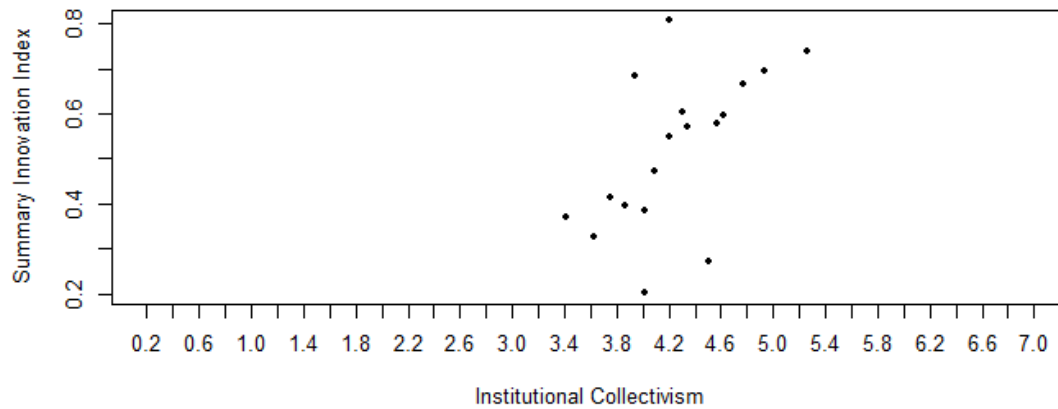


In-Group Collectivism and Innovation

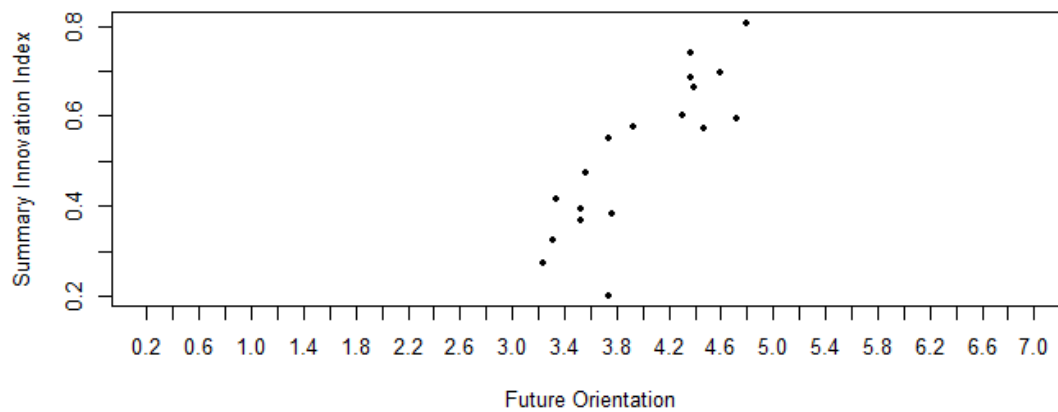




Institutional Collectivism and Innovation

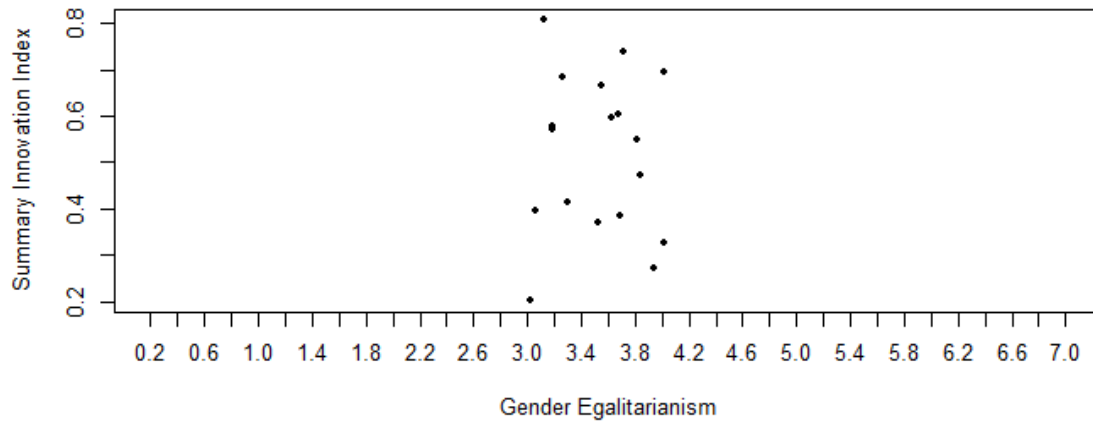


Future Orientation and Innovation

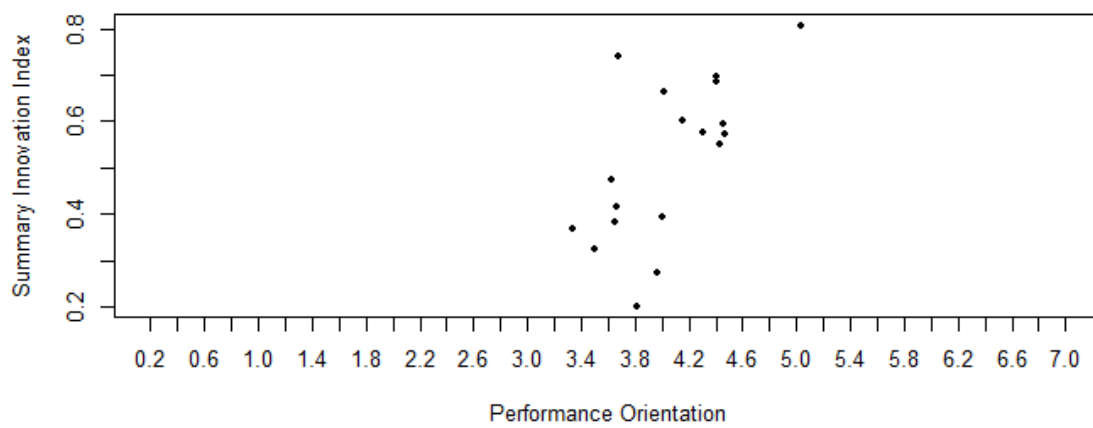




Gender Egalitarianism and Innovation

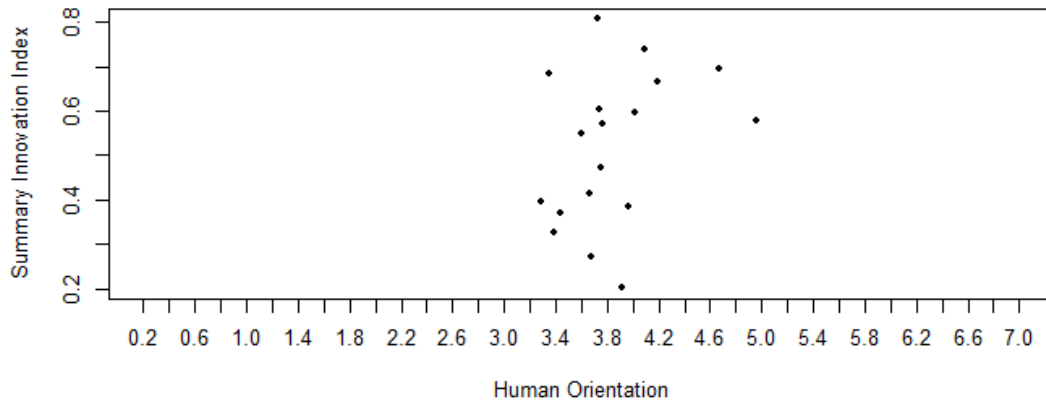


Performance Orientation and Innovation

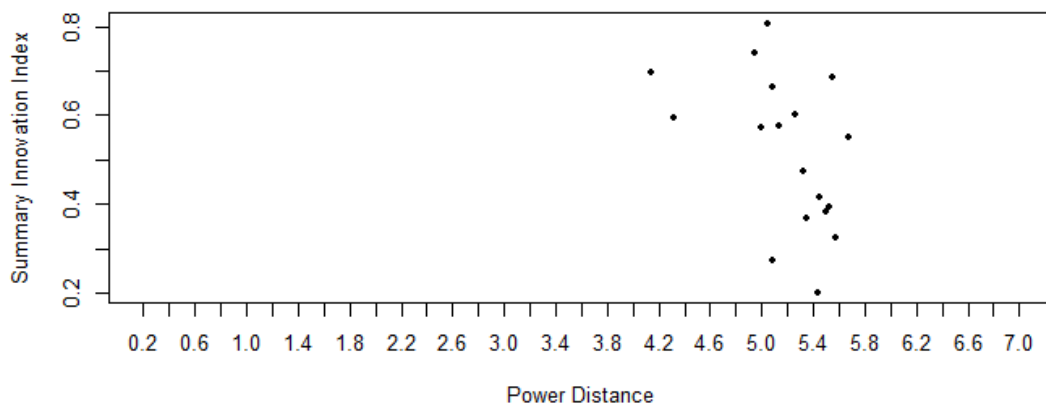




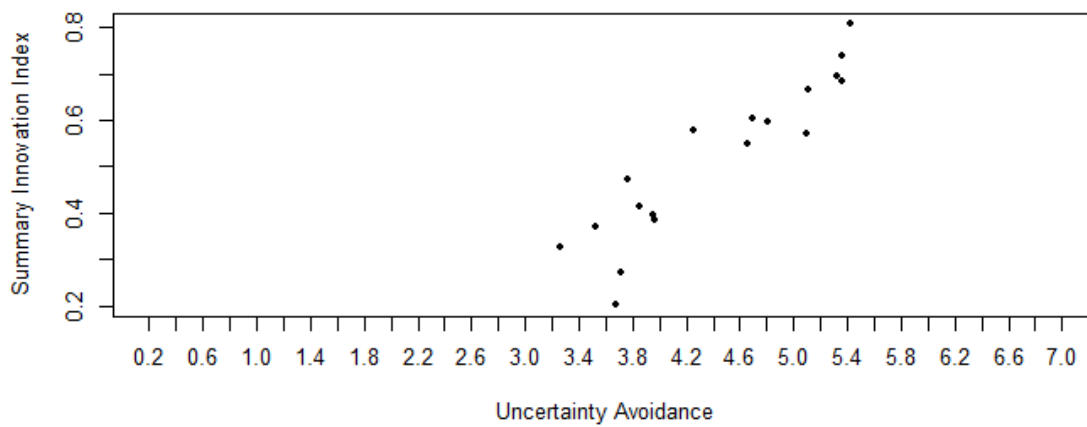
Human Orientation and Innovation



Power Distance and Innovation



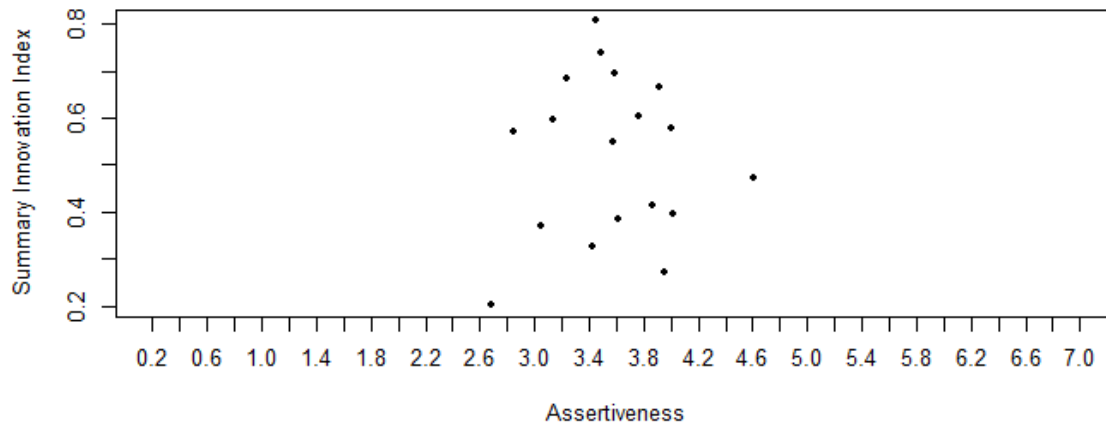
Uncertainty Avoidance and Innovation



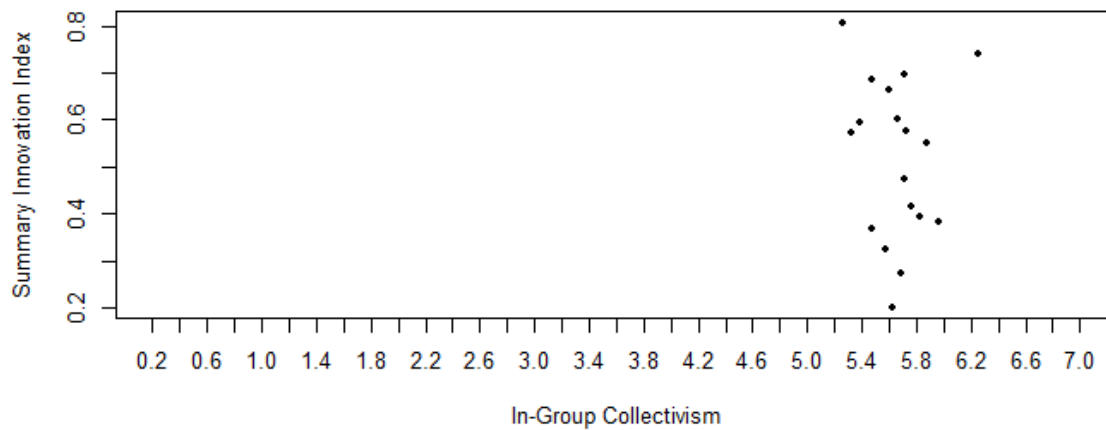


Appendix 4: Graphs for cultural dimensions (value scales) and Innovation Union Scoreboard (IUS)

Assertiveness and Innovation

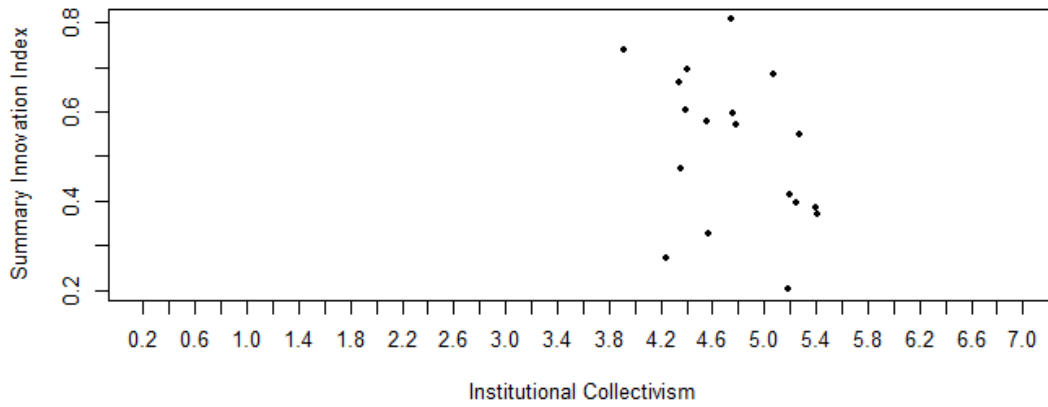


In-Group Collectivism and Innovation

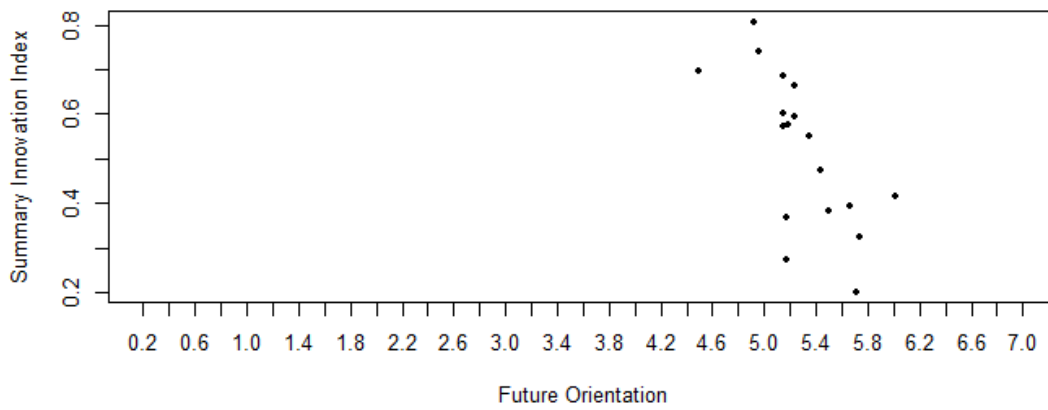




Institutional Collectivism and Innovation

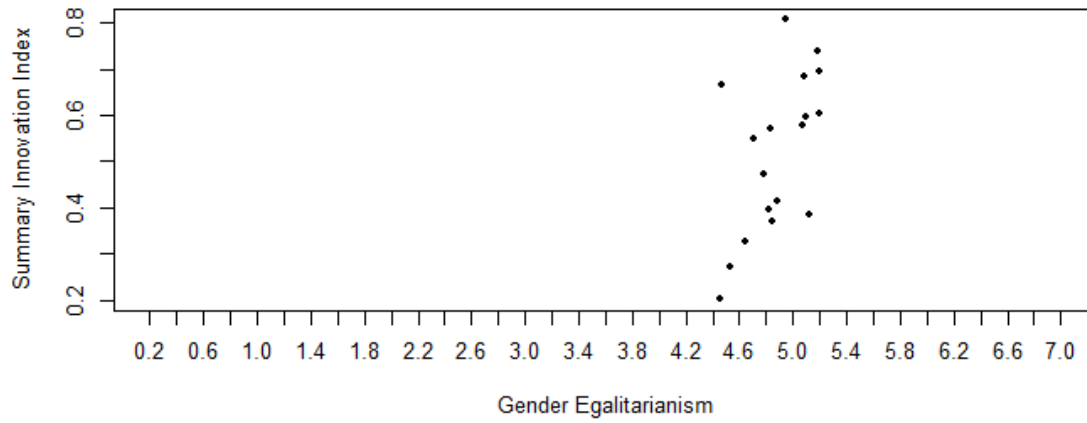


Future Orientation and Innovation

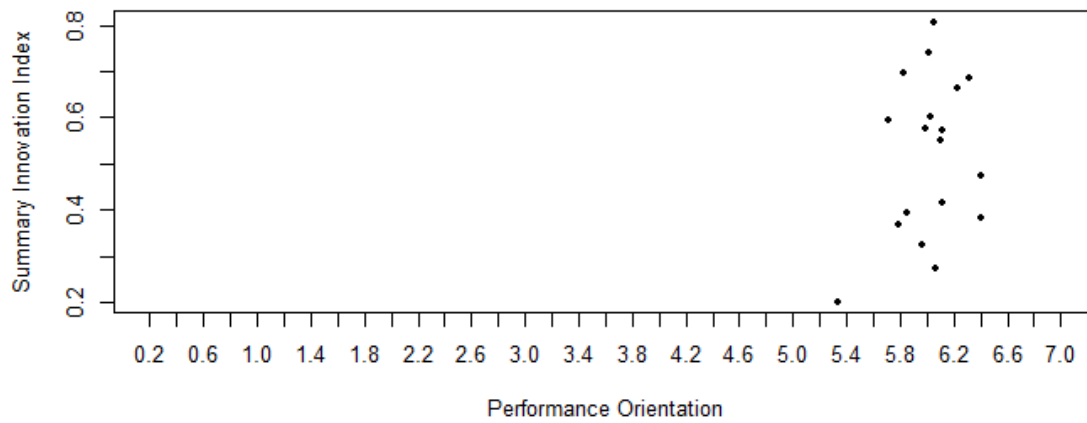




Gender Egalitarianism and Innovation

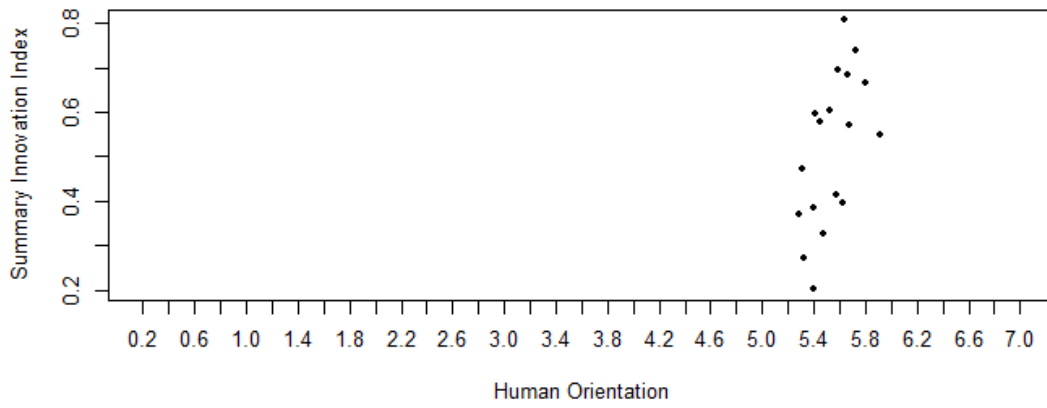


Performance Orientation and Innovation

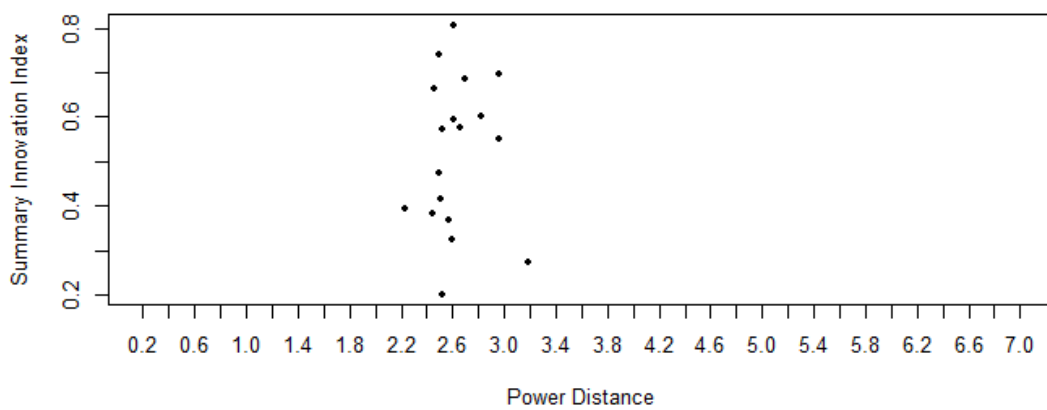




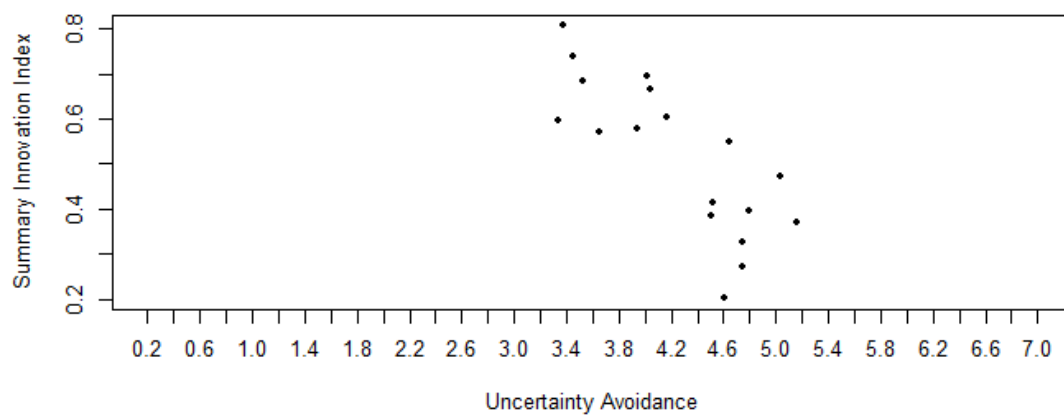
Human Orientation and Innovation



Power Distance and Innovation



Uncertainty Avoidance and Innovation







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