WP5/05 SEARCH WORKING PAPER

Culture as a Possible Factor of Innovation: Evidence from the European Union and Neighbouring Countries

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January 2013

SEARCH
SHARING KNOWLEDGE ASSETS: INTERREGIONALLY COHESIVE NEIGHBORHOODS

EUROPEAN COMMISSION
European Research Area

SEVENTH FRAMEWORK PROGRAMME

Funded under Socio-economic Sciences & Humanities

The research leading to these results has received funding from the European Community's Seventh Framework Programme (FP7/2010-2.2-1) under grant agreement n° 266834

Culture as a Possible Factor of Innovation: Evidence from the European Union and Neighbouring Countries

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Abstract

This exploratory study investigates the effect of different cultural dimensions on different innovation indicators covering as much EU-countries and neighbouring countries as possible. The measures of cultural dimensions were composed on the basis of the EVS/WVS data with the help of confirmatory factor analysis. Correlation, regression, graphical and cluster analyses were used. It was confirmed that innovation processes are strongly determined by culture: power distance, uncertainty avoidance and masculinity turned out to be negatively and individualism positively related to innovation performance. The final innovation performance may develop on the basis of the combined effect of four cultural dimensions that may or may not balance each-other in a particular country. Hence, the indicator of the support of culture for innovation was calculated on the basis of four cultural dimensions and it appeared to explain quite well the differences in the innovation performance between different countries.

Keywords

Culture, Hofstede, Europe, innovation

JEL Classification

M59, O31, Z19

1. INTRODUCTION

It is commonly accepted that innovations play an important role in economic development and growth. Besides the research and development (R&D) activity as an important input, the innovation process is additionally influenced by many other factors. One of the factors that have received much attention in the literature is the overall level of human capital of a particular country. However, there are many other intangible factors that possibly influence the propensity to innovate as well, such as the environment, where the innovation process takes place. In forming the innovative milieu, country's societal culture, i.e. shared values, beliefs, and behaviours play an important role. Although geographically close to each-other, the countries in European Union (EU) and its neighbouring countries differ significantly from each-other according to cultural background and environment. Thus, the innovation performance in these countries may also depend on these factors and it can be assumed that part of the differences in the innovative activity and innovation outcomes can be explained by the cultural differences.

The purpose of this exploratory study is to examine the effect of different cultural dimensions on innovation performance covering as much EU-countries and neighbouring countries as possible. The analysis covers all 27 EU countries and 20 neighbouring countries: Norway, Iceland, Switzerland, Albania, Bosnia-Herzegovina, Croatia, Macedonia, Montenegro, Serbia, Moldova, Belarus, Russia, Ukraine, Armenia, Azerbaijan, Georgia, Turkey, Egypt, Jordan, and Morocco. To describe societal culture, Hofstede's (1980) original concept of four cultural dimensions (power distance, uncertainty avoidance, masculinity-femininity, and individualism-collectivism) was used. Data from the latest waves of the European Values Study (EVS, 2010) and the World Values Survey (WVS, 2009) was used to describe culture. From initial indicators latent factors were composed with the help of confirmatory factor analysis. Correlation and regression analysis were used in order to explore the possible influence of four cultural dimensions on innovation. Then, graphical and cluster analysis was used to investigate further the countries' innovation performance and the possible cultural explanations. Last, the indicator of the support of culture for innovation was calculated in order to describe the combined effect of all four cultural dimensions.

The paper is structured as follows. The next section presents the theoretical background and after that data and measurement are introduced. Then, results are given and discussed, and last, conclusions are drawn and limitations pointed out.

2. THEORETICAL BACKGROUND

Innovation is usually understood as the introduction of something new or significantly improved, be they products (goods or services) or processes. The innovation process has two aspects: inputs and outputs (Nasierowski and Arcelus, 1999). The inputs include, for example, R&D. The outcomes of the innovation process include e.g. patent applications, revenues from patents or scientific articles, but also profits from implementing new technologies or introducing new products without patenting them. While both the initiation and implementation aspects are important in innovation, often the initiation aspect receives more attention than the implementation aspect because of data availability: data about patenting, for example, are easily attainable, while the data about the other aspects of innovations, such as the share of enterprises with different innovative activities, new-to-firm products or processes can only be obtained from surveys.

As one of most important factors of innovation, the general level of human capital of a country – knowledge, skills and abilities of the labour force that can be improved with education – is commonly supposed to positively influence innovation. An overview of theoretical reasoning and empirical results can be found, for instance, in Dakhli and de Clercq (2004) or Subramaniam and Youndt (2005). Shortly, the general level of human capital determines the quality of the labour force, which is employed or can potentially be employed in R&D. Educated, bright and skilled employees tend to question common procedures, to be more creative and they also have more knowledge supporting their creativity. Human capital is included in this study as a control variable.

There are many different ways to define culture (see, for example, Taras et al. 2009; Chanchani and Theivanathampillai 2002; Hall 1980) and various definitions of culture are used in different research fields, such as sociology, anthropology, and the humanities. Here, the analysis is based on the sociological approach and culture is defined as a pattern of shared values, beliefs and behaviours of a group of people. These elements are common to various definitions, for example, Hofstede (2001) treats culture as "the collective programming of the mind that distinguishes the members of one group or category of people from another" and he explains that the "mind" stands for thinking, feeling and acting. Cultures can be characterised by the help of distinct dimensions and many different sets of dimensions can be found in literature in order to classify cultures (for example, Parsons and Shils, 1951; Kluckhohn and Strodbeck, 1961; Schwartz, 1994; Inglehart and Baker, 2000; House et al., 2002). This analysis is based on the most widely-used concept of Hofstede (1980), which argues that the main cultural differences can be captured by four dimensions: power distance, uncertainty

avoidance, individualism-collectivism, and masculinity-femininity. Considering the extensive use of Hofstede's set of dimensions during the last three decades in both theoretical and empirical literature allows it to be viewed as a grounded approach for describing culture in the meaning used in this article. Although innovations in firms are undoubtedly influenced by organisational factors (i.e. organisational culture), it can be assumed that they also greatly depend on the surrounding (societal) culture as a whole. Here and hereafter, the focus remains on the societal culture. Next, these dimensions are introduced more closely.

First, power distance (PDI) reveals the extent to which unequal distribution of power in organizations and institutions and hierarchical relations are accepted in a culture. A large power distance can be characterized by centralized decision structures and the extensive use of formal rules. Second, uncertainty avoidance (UAI) shows to what degree people feel comfortable with uncertainty and ambiguity. In the case of high uncertainty avoidance, rules play an important role and are carefully followed, while in societies with low uncertainty avoidance, ambiguous and different situations are regarded as natural. Third, masculinity (MAS) (as opposed to femininity) describes to what degree masculine values, such as orientation towards achievement and success, assertiveness and competitiveness, prevail over values like modesty and good relationships, caring, solidarity or tolerance. Fourth, individualism (IND) (as opposed to collectivism) shows the extent to which people prefer to act as individuals rather than as members of groups. In individualistic cultures, autonomy, individual freedom and responsibility are valued, whereas in collectivist cultures, close social relations are important and individuals expect groups to look after them in exchange for loyalty.

The influence of culture for innovation lies in forming a more or less innovative milieu. Culture is considered to be an important determinant of innovation (Ulijn and Weggeman 2001; Westwood and Low 2003). First, the openness towards new experiences varies in different cultures, but innovations are associated with some kind of change and uncertainty. Cultures with strong uncertainty avoidance can be more resistant to innovations (Shane, 1993; Waarts and van Everdingen, 2005). To avoid uncertainty, these cultures adopt rules to minimize ambiguity. Rules and reliance on them, in turn, may constrain the opportunities to develop new solutions. Uncertainty-averse attitudes also mean that there is less incentive to come out with a new idea, which could be possibly rejected. However, there does not need to be a contradiction between following rules and creativity (Rampley, 1998; Rizzello and Turvani, 2002). It is possible that the certainty offered by the rule-following culture enables and encourages creativity. In addition, it can also be supposed that in cultures with stronger uncertainty avoidance, there is a stronger tendency to protect intellectual property with patenting, hence, if

patenting is used as an innovation indicator, the expected influence is not clear. Regarding the previous empirical evidence, Shane (1993) demonstrated that uncertainty avoidance has a negative effect on the number of trademarks per capita. Williams and McQuire (2005) showed that uncertainty avoidance has a negative effect on the economic creativity of a country and Kaasa and Vadi (2010) found a negative relationship between uncertainty avoidance and patenting intensity.

While innovation significantly depends on the spread of information, in the case of larger power distance, the sharing of information could be constrained by the hierarchy (van Evergingen and Waarts, 2003). In cultures that exhibit less power distance, communication across hierarchical boundaries is more common (Williams and McQuire, 2005; Shane, 1993), making it possible to connect different creative ideas and thoughts, which can then lead to unusual combinations and even radical breakthroughs. Also, it has been argued that bureaucracy reduces creative activity (Herbig and Dunphy, 1998). In the case of small power distance there is more trust between different hierarchical levels. When employees believe that it is appropriate to challenge the status quo, creativity is higher. Societies with larger power distance tend to be more fatalistic and hence, have less incentive to innovate (Herbig and Dunphy, 1998). These arguments are supported by several previous studies about the relationship between innovation initiation and power distance. Shane's (1992) analysis showed a negative correlation between the inventions patented and power distance. Later, Shane (1993) provided empirical evidence that power distance has a negative effect on the number of trademarks per capita. Kaasa and Vadi (2010) have also shown positive relationship between power distance and patenting intensity.

Innovation initiation is often seen as the act of an individual (Williams and McQuire, 2005): the initial ideas emerge in the head of an individual and the group can only be supportive or not. Individualistic cultures value freedom more than collectivistic cultures (Herbig and Dunphy, 1998; Waarts and van Everdingen, 2005). Hence, in individualistic societies employees have more opportunities to try something new, although that does not mean that in implementing collectivistic cultures cannot be more successful. Another important aspect is that in collectivistic societies, the contribution of an individual rather belongs to the organisation. In the individualistic societies individuals have more reasons than in collectivistic societies to expect compensation and recognition for inventive and useful ideas (Shane, 1992; Herbig and Dunphy, 1998). Also, there is less emphasis on loyalty to the organisation in individualistic societies (Herbig and Dunphy, 1998), which promotes the information exchange necessary for innovation. Looking at previous results, Shane (1992) found a positive correlation between the inventions patented and individualism. In addition, Shane (1993) showed that

individualism has a statistically significant positive effect on the number of trademarks per capita. In the analysis by Williams and McQuire (2005), there appeared to be a positive effect of individualism on the economic creativity in a country. Kaasa and Vadi (2010) found no relationship between overall individualism and patenting intensity, while family-related collectivism appeared to be negatively (and friends-related and organisations-related collectivism, positively) related to patenting intensity.

Masculinity is often believed to have no particular effect on economic creativity (Williams and McQuire, 2005; Shane, 1993). This proposition is also confirmed by some of the empirical evidence. Shane (1993) demonstrated that masculinity has no effect on the number of trademarks per capita. Williams and McQuire (2005) found no significant effect of masculinity on the economic creativity of a country. Nevertheless, there are some possible influences that have to be taken into account. In feminine societies the focus is on people and a more supportive climate can be found. A warm climate, low conflict, trust and socio-emotional support help employees to cope with the uncertainty related to new ideas (Nakata and Sivakumar, 1996). This is confirmed by Kaasa and Vadi (2010), who found a negative relationship between masculinity and patenting intensity.

3. DATA AND MEASUREMENT

The set of countries under this analysis (neighbouring countries in addition to the EU countries) puts a researcher in front of a challenging task to find comparable data covering as much countries as possible from the set of countries under discussion. The data about cultural dimensions were mainly drawn from the European Values Study (EVS, 2010), that were complemented with the data about Egypt, Jordan and Morocco obtained from the World Values Survey (WVS, 2009). Unfortunately, form some neighbouring countries data were not available from the WVS as well. These two surveys are very closely connected and stand on the very similar methodological grounds. Many questions asked in these surveys coincide and that enabled to integrate the data from these two databases. Both surveys are multi-country surveys that are repeated every nine years and cover an increasing number of countries. Here, the data from the latest waves were used: for most countries the indicators pertain to the year 2008, except for Belgium, Finland, the United Kingdom, Iceland, Italy, Sweden, Turkey (2009) and Jordan and Morocco (2007). It should be pointed out that in WVS, data were given for Great Britain and Northern Ireland separately, instead of United Kingdom. However, as the population of Northern Ireland is only ca 3% of the population of United Kingdom, here the data of Great Britain were used as a proxy for the data of United Kingdom. There are about 1,500 respondents interviewed in every country (in some countries this number is smaller or larger, though: for countries

analysed here the number of respondents ranged from 808 to 3,051). The country-level indicators used in the current paper were obtained by aggregating individual-level data using the database-provided weights in order to ensure that the data would be representative of the demographic structure of a country.

In order to describe four cultural dimensions, the indicators were chosen based on the Hofstede's (2001) overview of the characteristics and differences of dimension extremes, and also resting on the previous analyses describing these cultural dimensions with the help of data from new surveys (see Kaasa and Vadi, 2010; Kaasa et al., 2012). Unfortunately, while the referred studies used the data from the European Social Survey, the choice of suitable variables for constructing the indicators of cultural dimensions is different and poorer in the EVS/WVS. Therefore, the dimensions of power distance, uncertainty avoidance and masculinity were each described by four indicators and individualism by three indicators. In order to capture the information of initial indicators into corresponding dimensions, a confirmatory factor analysis (the principal components method) was performed. As there were some missing values in the dataset, here and hereafter cases were excluded pairwise, not listwise, in order to utilise all the information available. The results of the factor analysis are presented in Appendix Table A1. In the case of power distance the negative relationship with the importance to give people more say probably reflects that in case of higher power distance people miss the opportunity to participate in decision-making processes. The percentages of total variance explained by the factors range from 47.79% to 59.98% and Kaiser-Meyer-Olkin (KMO) measures indicate the appropriateness of the factor models (values of the KMO measure larger than 0.5 are usually considered as acceptable). The factor scores of latent variables were again saved as variables. The scores of the indicators describing cultural dimensions for all countries can be found in Appendix Table A2.

Considering the set of countries analysed here (not only EU countries), the choice of innovation indicators appeared to be very complicated. It was not possible to use databases that include only a limited set of European countries, such as for example Eurostat or European Innovation Scoreboard, although they would enable to cover more different aspects of innovative activities as it is managed to include into this study. World Intellectual Property Indicators (WIPO, 2011) offered data about the resident patent filings (per million of population). In order to smoothen the fluctuations and to reduce the influence of possibly unusual values, the average values of the years 2008-2010 were calculated. Next, the Innovation Index that is a part of World Bank's Knowledge Indexes (World Bank, 2012) takes more output aspects into account. It is calculated as and average of the normalized scores of

(weighted by population) three indicators: royalty and license fees payments and receipts, patent applications granted by the US Patent and Trademark Office, and scientific and technical journal articles. The input side of innovative process is covered by the gross expenditure on R&D (as a percentage of GDP, data pertaining to 2007 or 2008) obtained from the INSEAD (2011). The indicator covering different innovation-related aspects in the broadest sense used in this analysis is the Global Innovation Index came from the INSEAD (2011). This index relies on two sub-indices, covering innovation inputs and outputs, respectively. The inputs are described by institutions, human capital and research, infrastructure, market sophistication and business sophistication; the outputs are characterized with the help of scientific and creative outputs (for more details see INSEAD (2011)). Last, human capital is described by the share of population aged 25 and over with completed tertiary education from Barro and Lee (2010) and here the average of the values from the years 2005 and 2010 was calculated. The standardized values of innovation indicators can be seen in Appendix Table A3.

Regarding the choice of observation years, it makes sense to assume that the innovation process takes time and thus a time lag could be useful between the observations of innovation and its factors. On the other hand, as the cultural environment does not change rapidly, it is possible that the results are not drastically influenced by the chosen time lag. Here, the data describing innovation factors, all pertain to the years 2007-2009. The innovation indicators come from the years 2007-2011.

4. RESULTS AND DISCUSSION

First, a correlation analysis of innovation indicators and the included factors on innovation was conducted. The results are presented in Table 1. It can be seen that the share of population with tertiary education is only moderately correlated with two indices and the correlation with patenting is not statistically significant. Regarding cultural dimensions, uncertainty avoidance, masculinity and power distance all appear to be negatively correlated with the innovation indicators, although in the case of power distance, the correlation seems to be stronger with R&D expenditures and the Global Innovation Index. As the Global Innovation Index incorporates R&D as one aspect, it can be assumed that power distance is more related to the inputs of innovation. In general, countries with lower uncertainty avoidance, masculinity and power distance could be more successful innovators. Individualism turned out to be positively correlated with innovation indicators. All these results are in accordance with the theoretical considerations about the relationships between cultural dimensions and innovations.

Table 1. Correlations between the innovation indicators, human capital and cultural dimensions

	R&D expenditures	Global Innovation Index	Innovation Index	Patenting
R&D expenditures	1	0.89***	0.80***	0.78***
Global Innovation Index	0.89***	1	0.88***	0.71***
Innovation Index	0.80***	0.88***	1	0.64***
Patenting	0.78***	0.71***	0.64***	1
Tertiary education	0.23	0.32**	0.38***	0.22
PDI	-0.33**	-0.36**	-0.26*	-0.21
UAI	-0.69***	-0.65***	-0.63***	-0.56***
MAS	-0.64***	-0.68***	-0.69***	-0.59***
IND	0.29*	0.46***	0.47***	0.30**

*** significant at the 0.01 level, ** significant at the 0.05 level, * significant at the 0.10 level (two-tailed).

Next, regression analysis was conducted in order to investigate further the relative importance of different factors for different innovation indicators. After entering all cultural dimensions and tertiary education as a control variable into the model, backward method was used in order to find out the models, where statistically insignificant variables are excluded. The results are presented in Table 2.

For all models, the p-value of the F-statistic was below 0.001. As it can be expected in social sciences (Langbein and Felbinger, 2006), the values of R-squared were not very high ranging from 0.40 to 0.74. Regarding possible multicollinearity, VIF values were ranging from 1.27 to 2.81 for models with all variables entered and from 1.00 to 1.80 for models obtained by the backward method.

It can be seen from Table 2 that all four cultural dimensions seem to have significant influence on innovation, while at the same time the level of human capital seems to have almost no effect at all. Masculinity appeared to be the cultural dimension that is most strongly related to innovations: in less masculine and more feminine countries the innovative activity is higher. Uncertainty avoidance appears to be almost of the same importance: the results confirm that innovation is hindered by higher levels of uncertainty avoidance. The negative effect of power distance turned out to be statistically significant for R&D expenditures and the Global Innovation Index that also incorporates R&D activity. Hence, the previous supposition that the levels of power distance influence more the inputs and less the outputs of innovation, is confirmed. Individualism, on the contrary, appears to be more related with the outputs of innovation, which is also logical, as the positive influence of individualism

on innovation is largely reasoned by the incentives to initiate something new offered by the more individualist environment.

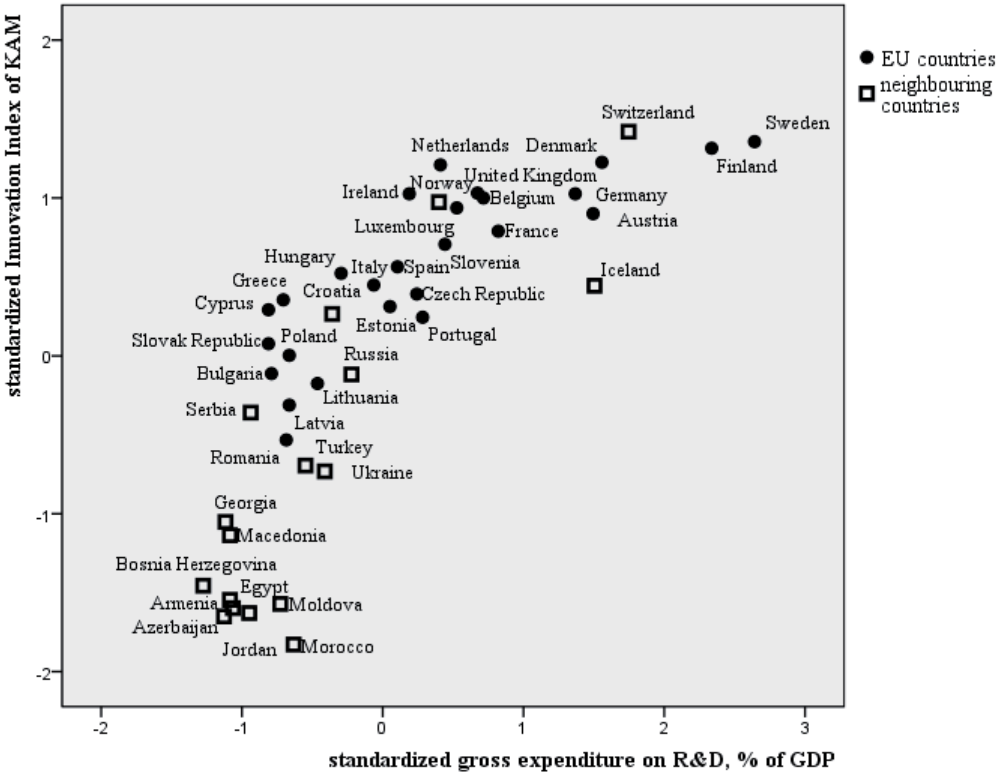
Table 2. The results of the regression analysis (standardized regression coefficients)

	Dependent variable:							
	R&D expenditures		Global Innovation Index		Innovation Index		Patenting	
Method	enter	backw.	enter	backw.	enter	backw.	enter	backw.
Tertiary education	-0.15		-0.06		-0.01		-0.09	
PDI	-0.19	**-0.28*** **	-0.22**	**-0.22***	-0.10		-0.06	
UAI	-0.54***	**-0.34****	-0.31**	**-0.23****	-0.26*	**-0.28****	-0.30	**-0.29***
MAS	-0.25	**-0.44*** **	-0.38***	**-0.52*** **	-0.35***	**-0.48*** **	-0.35*	**-0.39*** **
IND	0.16		0.35***	**0.29*** **	0.40***	**0.41*** **	0.26*	**0.26****
F-Statistic	12.85***	20.48***	19.90***	24.07***	24.13***	33.59***	6.23***	12.55***
Adjusted R-square	0.60	0.58	0.70	0.68	0.74	0.68	0.40	0.43
No. of observations	39	43	40	44	41	46	40	46

*** significant at the 0.01 level, ** significant at the 0.05 level, * significant at the 0.10 level (two-tailed).

Figure 1 provides a closer look at the positions of EU and neighbouring countries across R&D expenditure reflecting innovation inputs and the Innovation Index covering three aspects of innovation outputs. It can be seen that except Iceland, Norway and Switzerland, the most successful innovators are all EU countries. At the same time, the other end of the 'cloud of observations' comprises only non-EU countries. In the middle, both EU countries and neighbouring countries can be found. Also, as the relationship does not seem to be linear, it can be assumed that on the higher levels of innovation activity, more additional expenditure on R&D is needed in order to gain the comparable rise in innovation performance.

Figure 1. Positions of EU and neighbouring countries across R&D expenditure and the Innovation Index



In order to explore further the countries under consideration, cluster analysis was used next. Standardised indicators were used in order to prevent the influence of different scales of initial indicators on the results. Countries were grouped on the basis of three variables: R&D expenditures, the Global Innovation Index, and the Innovation Index (in order to balance the output-oriented and input-oriented indicators, the patenting indicator was left out). The k-means clustering with running means was used in order to get adequate results. For choosing the number of clusters the following principle was used. If adding one cluster results in a new cluster significantly different from the previous clusters, it will be added. If adding one more cluster gives a new cluster quite similar to some other cluster, the cluster will not be added. It turned out that it was most reasonable to divide countries into three clusters. The results of the cluster analysis are presented in Table 3. In order to give an idea about the variations within clusters, standard deviations are added in brackets.

It can be seen that Cluster 1 embodies countries that are most successful regarding innovation. Again, they are all EU countries, except Iceland, Norway and Switzerland. On the contrary, all countries in Cluster 3 are EU neighbouring countries that have the lowest values of the innovation indicators,

especially concerning the outputs of innovation. Cluster 2 incorporates all other countries – some of them EU countries and some neighbouring countries – that remain on the average levels according to the innovation performance. Hence, the results of the cluster analysis are in accordance with the grouping that could be suggested on the basis of Figure 1.

Table 3. Results of the cluster analysis on the basis of three innovation indicators (standard deviations in brackets)

	Cluster 1	Cluster 2	Cluster 3
Final cluster centres:			
R&D expenditures	1.07 (0.76)	-0.44 (0.36)	-1.01 (0.20)
Global Innovation Index	1.10 (0.52)	-0.36 (0.47)	-1.11 (0.37)
Innovation Index	0.98 (0.30)	-0.02 (0.43)	-1.55 (0.28)
Countries in clusters:	Austria	Belarus	Albania
	Belgium	Bulgaria	Armenia
	Czech Republic	Croatia	Azerbaijan
	Denmark	Cyprus	Bosnia Herzegovina
	Finland	Estonia	Egypt
	France	Greece	Georgia
	Germany	Hungary	Jordan
	Iceland	Italy	Macedonia
	Ireland	Latvia	Moldova
	Luxembourg	Lithuania	Morocco
	Netherlands	Malta	
	Norway	Poland	
	Slovenia	Portugal	
	Sweden	Romania	
	Switzerland	Russian Federation	
	United Kingdom	Serbia	
		Slovak Republic	
		Spain	
		Turkey	
		Ukraine	

Table 5 gives the mean values of cultural dimensions (and standardized indicator of tertiary education) by clusters. First, it can be seen that on average, the share of people with tertiary education is largest, the level of individualism highest and the levels of power distance, uncertainty avoidance and masculinity lowest in Cluster 1. Cluster 3 has, on the contrary, lowest levels of tertiary education and individualism, and highest levels of uncertainty avoidance and masculinity, but not the highest level of power distance (here, as also in the case of individualism, also the deviation within the cluster

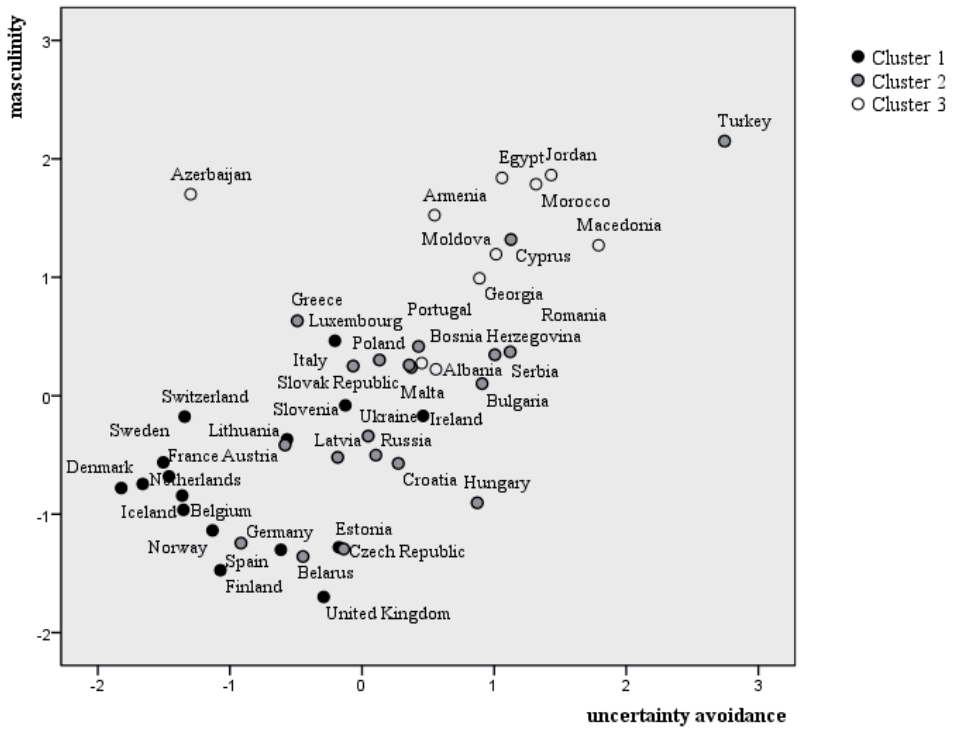
is the highest). Examining standard deviations shows that the consistency within clusters is highest in Cluster 1.

Table 5. Mean values of factors of innovation by clusters (standard deviations in brackets)

	Cluster 1	Cluster 2	Cluster 3
Tertiary education	0.29 (0.69)	0.03 (1.19)	-0.87 (0.53)
PDI	-0.35 (0.96)	0.55 (0.87)	0.25 (1.11)
UAI	-0.89 (0.67)	0.33 (0.82)	0.78 (0.84)
MAS	-0.74 (0.58)	-0.04 (0.87)	1.27 (0.61)
IND	0.68 (0.76)	-0.27 (0.77)	-0.44 (1.26)

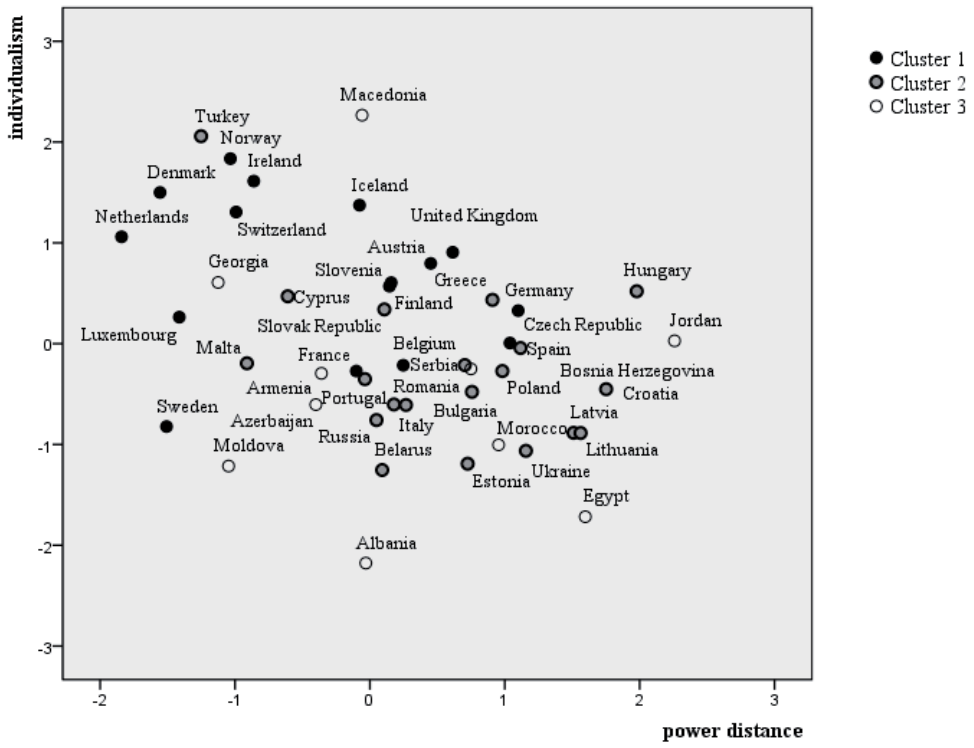
The possible within-cluster variations can also be seen in Figure 2. It demonstrates that in the countries with high innovation indicators (Cluster 1) both masculinity and uncertainty avoidance are lower than average. At the same time countries with poorest performance in innovation (Cluster 3) all have masculinity and uncertainty avoidance higher than average (except Azerbaijan, where this holds only for masculinity).

Figure 2. Positions of countries across uncertainty avoidance and masculinity



However, there are also countries, such as Turkey or Cyprus that although having both high uncertainty avoidance and masculinity, perform quite well according to innovation indicators. Also, there are countries with low levels of masculinity and uncertainty avoidance, e.g. Belarus or Spain that are not successful in innovating. One explanation can be found from the Figure 3. Turkey and Cyprus have quite a high level of individualism and low level of power distance and that probably enables to balance out the negative influence of high uncertainty avoidance and high masculinity. In Spain and Belarus, on the contrary, power distance is higher and individualism lower than average and that may hinder their success in innovating.

Figure 3. Positions of countries across power distance and individualism

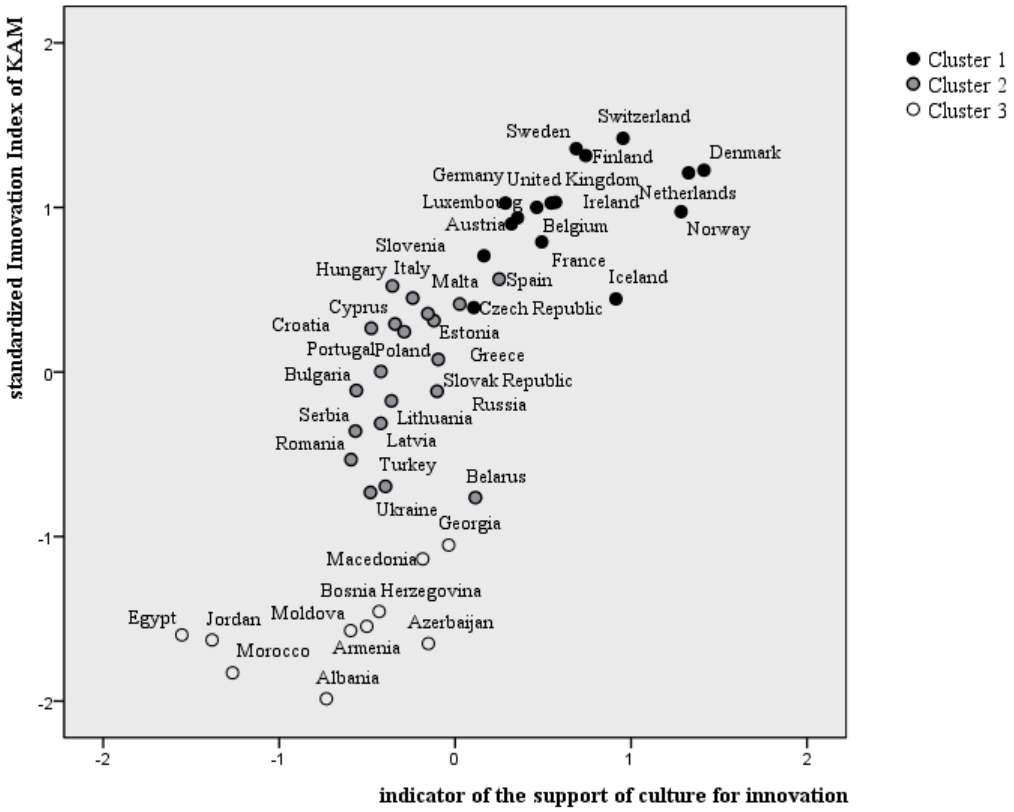


As the results of the regression analysis indicated that all four cultural dimensions have significant relationship with innovation, it can be assumed that the final innovation performance may develop on the basis of the combined effect of these four cultural dimensions. Although countries may have different combinations of these four cultural dimensions, they may perform equally well in innovating. Thus, the combined effect of culture (all four cultural dimensions) could be estimated by combining all four cultural dimensions into one indicator that reflects the expected influence of cultural background of a country on its innovation performance. The results of correlation and

regression analyses as well as the graphical analysis all indicate that individualism is positively and power distance, uncertainty avoidance and masculinity negatively related to innovation performance. Hence, the indicator that could reflect the support of culture for innovation should incorporate the indicator of individualism with a plus sign and the indicators of power distance, uncertainty avoidance and masculinity with minus signs.

Next, the indicator of the support of culture for innovation was calculated. First, the factors of power distance, uncertainty avoidance and masculinity were multiplied by -1 and then an average of the four indicators of cultural dimensions was calculated. The values of the new indicator for all countries can be found in Appendix Table A2. Figure 4 presents the positions of EU and neighbouring countries across the Innovation Index covering three aspects of innovation outputs and the indicator of the support of culture for innovation.

Figure 4. Positions of countries across the Innovation Index and the indicator of the support of culture for innovation



It can be seen that the calculated indicator of the combined effect of culture explains quite well the differences in the innovation performance between different countries. However, it can also be noticed that the countries in Cluster 3 have somewhat lower values of the Innovation Indicator as could be expected based on the cultural background. Inspecting the relationships of the combined effect indicator with other innovation indicators, however, showed that the problem is bigger in the case of innovation outputs than inputs. It can also be seen from Figure 1 that the difference between those countries from other countries is larger in the case of the Innovation Index and smaller in the case of R&D expenditures. Here, at least two explanations are possible. First, in those countries (neighbouring countries belonging to Cluster 3) the R&D expenditures are not utilized well enough. Second, it is also possible that the indicators used in this study focus on the aspects of innovation processes that are poorer in those countries. Usually, the most easily available way to measure innovation outputs is to count patents or scientific articles etc., but as was noted before, the tendency to protect intellectual property with patenting may also depend on culture as well as historical background and traditions. It is possible that the implementation aspect of innovation or even the initiation aspect (if innovations are not documented by patent applications, for example), are not covered well enough with the indicators used in this analysis. However, using other indicators cannot be expected to change the results and the relative positions of countries dramatically.

5. CONCLUSIONS

This paper explored the influence of different cultural dimensions on innovation performance. For societal culture, Hofstede's (1980) original concept of four cultural dimensions was used. Theoretical considerations and previous results allow to suppose that uncertainty avoidance, power distance and masculinity have negative effect and individualism a positive effect on innovation. The measures of cultural dimensions were composed on the basis of the EVS/WVS data with the help of confirmatory factor analysis.

The results from correlation and regression analysis indicated that all four cultural dimensions have significant influence on innovation. Uncertainty avoidance and masculinity appeared to have strong negative relationship with all innovation indicators used. Power distance that was also negatively related to innovation seemed to be more related to the inputs and less to the outputs of innovation while individualism turned out to be positively related to innovation and to be more related with the outputs of innovation. All these results are in accordance with theoretical reasoning and previous results. Next, graphical and cluster analysis showed that countries group differently according to

different cultural dimensions, but different cultural dimensions often seem to balance each-other: countries may have different combinations cultural dimensions, but still perform equally well in innovating.

As all four cultural dimensions were found to be significant in regression analysis, it was assumed that the final innovation performance may develop on the basis of the combined effect of four cultural dimensions. Hence, the indicator of the support of culture for innovation was calculated as an average of the indicators of four cultural dimensions, incorporating the indicator of individualism with a plus sign and the indicators of power distance, uncertainty avoidance and masculinity with minus signs. The calculated indicator appeared to explain quite well the differences in the innovation performance in different countries.

In conclusion, it can be said that innovation outputs are undoubtedly highly related to innovation inputs, such as R&D, but innovation processes are also strongly determined by culture. At that, different cultural dimensions have to be taken into account. The final innovation performance is influenced by different cultural dimensions that may or may not balance each-other in a particular country. In countries, where innovation performance appeared to be the best (mainly EU countries, except Iceland, Norway and Switzerland), the cultural background summarily has to be supporting for innovation. Accordingly, in the countries with poorer innovation performance (most of the EU-neighbouring countries), the culture appears to be less supporting for innovation. It is hard to give any policy recommendations here, as to change culture is a very complicated or possibly even impossible task. However, if this could be possible at least at some extent, for example, by promoting certain beliefs and attitudes, the possible policy should be focussed on those cultural dimensions that need to be changed in a particular country. As in different countries different cultural dimensions may hinder innovation, the thorough investigation of what dimension(s) would be the first priority is of great importance.

Regarding the limitations of this study, first, the choice of the innovation indicators that could be used for the set of countries analysed in this study, was limited. It would be interesting to analyse the relationships of innovation with culture using other innovation indicators as well, covering other aspects of innovations, such as the share of enterprises with different innovative activities, new-to-firm products or processes, etc. that can be obtained from surveys. It is possible that the relationships found in this study between cultural dimensions and patenting, reflect not only the impact of culture on innovation, but also the impact of culture on the propensity to protect intellectual property. Next,

as only EU-countries and neighbouring countries were studied, the conclusions can be drawn also for these countries only. Whether the analysed relationships can apply to the whole world, is a topic for future studies. Last, some neighbouring countries had to be left out because of data availability, therefore, when more complete data became available, it would be interesting to re-run the analysis.

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Appendix

Table A1. Initial and final indicators of cultural dimensions

Cultural dimension	Indicators	Factor loadings	Variance explained (%)	KMO Measure of Sampling Adequacy
Power distance	how much confidence in: parliament, scale 1-4	-0.79	47.79	0.57
	important in a job: use initiative, share of who mentioned	-0.67		
	how free are you to make decisions in job, scale 1-10	-0.66		
	important: give people more say, share of who mentioned	0.65		
Uncertainty avoidance	important in a job: job security, share of who mentioned	0.85	49.92	0.56
	most people can be trusted, share of who mentioned	-0.80		
	learn children at home: obedience, share of who mentioned	0.66		
	Important: maintaining order in the nation, share of who mentioned	0.45		
Masculinity	jobs are scarce: giving men priority, scale 1-3	0.79	55.86	0.69
	important in a job: responsible job, share of who mentioned	0.79		
	are you a religious person, share of who mentioned	0.78		
	how important in your life: work, scale 1-4	0.63		
Individualism	how important in your life: friends and acquaintances, scale 1-4	0.86	59.98	0.59
	how important in your life: leisure time, scale 1-4	0.80		
	learn children at home: independence, share of who mentioned	0.65		

Table A2. Indicators of separate cultural dimensions and the combined indicator of the support of culture for innovation

	PDI	UAI	MAS	IND	combined
Albania	-0,03	0,56	0,22	-2,18	-0,73
Armenia	-0,36	0,55	1,52	-0,30	-0,50
Azerbaijan	-0,40	-1,30	1,70	-0,60	-0,15
Austria	0,45	-0,57	-0,37	0,80	0,32
Belarus	0,09	-0,45	-1,36	-1,25	0,12
Belgium	0,25	-1,35	-0,96	-0,21	0,46
Bosnia Herzegovina	0,75	0,45	0,28	-0,25	-0,43
Bulgaria	0,76	0,91	0,10	-0,48	-0,56
Croatia	1,75	0,27	-0,57	-0,45	-0,48
Czech Republic	1,04	-0,18	-1,28	0,01	0,11
Cyprus	-0,61	1,13	1,32	0,47	-0,34
Denmark	-1,56	-1,82	-0,78	1,50	1,41
Egypt	1,60	1,06	1,84	-1,72	-1,55
Estonia	0,72	-0,14	-1,29	-1,19	-0,12
Finland	0,14	-1,07	-1,47	0,57	0,74
France	-0,10	-1,46	-0,68	-0,27	0,49
Georgia	-1,13	0,89	0,99	0,61	-0,04
Germany	1,10	-0,61	-1,30	0,33	0,29
Greece	0,91	-0,49	0,63	0,43	-0,15
Hungary	1,98	0,87	-0,90	0,52	-0,36
Iceland	-0,08	-1,36	-0,84	1,37	0,91
Ireland	-0,86	0,46	-0,17	1,61	0,55
Italy	0,18	-0,07	0,25	-0,60	-0,24
Jordan	2,26	1,43	1,86	0,03	-1,38
Latvia	1,51	-0,18	-0,52	-0,89	-0,42
Lithuania	1,56	-0,58	-0,42	-0,89	-0,36
Luxembourg	-1,41	-0,21	0,46	0,26	0,35
Macedonia	-0,06	1,79	1,27	2,27	-0,18
Malta	-0,91	0,37	0,24	-0,19	0,03
Moldova	-1,05	1,01	1,19	-1,21	-0,59
Morocco	0,95	1,32	1,79	-1,00	-1,26
Netherlands	-1,84	-1,66	-0,75	1,06	1,33
Norway	-1,03	-1,13	-1,14	1,84	1,28
Poland	0,98	0,13	0,30	-0,27	-0,42
Portugal	-0,04	0,43	0,42	-0,35	-0,29
Romania	0,27	1,12	0,37	-0,61	-0,59
Russia	0,05	0,10	-0,50	-0,76	-0,10
Serbia	0,70	1,01	0,35	-0,21	-0,57
Slovak Republic	0,11	0,36	0,26	0,34	-0,10
Slovenia	0,16	-0,13	-0,08	0,61	0,16
Spain	1,12	-0,92	-1,24	-0,04	0,25
Sweden	-1,51	-1,50	-0,56	-0,82	0,69
Switzerland	-0,99	-1,34	-0,18	1,31	0,95
Turkey	-1,25	2,74	2,15	2,06	-0,40
Ukraine	1,16	0,05	-0,34	-1,06	-0,48
United Kingdom	0,61	-0,29	-1,70	0,91	0,57

Table A3. Indicators of innovation and human capital

	R&D expenditures	Global Inn. Index	Innovation Index	Patenting	Tertiary education
Albania		-1,31	-1,99		-1,27
Armenia	-1,09	-1,05	-1,55	-0,54	0,16
Azerbaijan	-1,13	-1,44	-1,65	-0,77	
Austria	1,49	0,77	0,90	1,42	-0,33
Belarus			-0,76	0,53	
Belgium	0,72	0,60	1,00	-0,49	1,57
Bosnia Herzegovina	-1,28	-1,27	-1,46	-0,86	
Bulgaria	-0,79	-0,49	-0,11	-0,71	0,05
Croatia	-0,36	-0,54	0,27	-0,45	-1,32
Czech Republic	0,24	0,42	0,39	-0,34	-1,04
Cyprus	-0,81	0,33	0,29	-0,94	1,02
Denmark	1,56	1,41	1,23	1,51	0,01
Egypt	-1,06	-1,44	-1,60	-0,93	-1,21
Estonia	0,05	0,61	0,31	-0,51	1,08
Finland	2,34	1,46	1,31	1,90	0,38
France	0,82	0,62	0,79	0,96	-0,29
Georgia	-1,12	-1,16	-1,05	-0,57	
Germany	1,37	1,19	1,03	4,10	0,24
Greece	-0,71	-0,93	0,35	-0,47	1,79
Hungary	-0,30	0,50	0,52	-0,39	-0,01
Iceland	1,50	1,22	0,44	0,56	0,78
Ireland	0,19	1,11	1,03	0,68	1,34
Italy	-0,06	-0,26	0,45	0,27	-0,95
Jordan	-0,95	-0,49	-1,63	-0,92	-0,98
Latvia	-0,66	-0,35	-0,31	-0,19	-0,14
Lithuania	-0,46	-0,48	-0,18	-0,74	0,84
Luxembourg	0,53	0,96	0,94	0,09	-0,17
Macedonia	-1,09	-1,00	-1,14	-0,85	
Malta			0,41	-0,75	-0,90
Moldova	-0,73	-0,47	-1,57	-0,56	-0,80
Morocco	-0,63	-1,48	-1,83	-0,95	-1,12
Netherlands	0,41	1,34	1,21	0,32	0,84
Norway	0,40	0,96	0,97	1,11	0,46
Poland	-0,66	-0,53	0,00	-0,34	-0,60
Portugal	0,28	-0,08	0,24	-0,60	-1,43
Romania	-0,69	-0,65	-0,53	-0,53	-1,05
Russia	-0,22	-0,76	-0,12	0,68	1,90
Serbia	-0,94	-0,71	-0,36	-0,60	-0,72
Slovak Republic	-0,81	-0,43	0,08	-0,68	-0,97
Slovenia	0,44	0,19	0,71	0,59	-0,41
Spain	0,10	0,06	0,56	-0,31	0,75
Sweden	2,64	1,93	1,36	1,17	0,97
Switzerland	1,75	2,11	1,42	0,85	0,05
Turkey	-0,55	-0,93	-0,70	-0,70	-1,11
Ukraine	-0,41	-0,84	-0,73	-0,50	2,38
United Kingdom	0,67	1,30	1,03	1,26	0,22


AQR
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CRENoS

LSE

WU

Brunel
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Université
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Monnet
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