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## National Culture as a Determinant of Innovativeness

### Summary

According to The Global Competitiveness Report innovations are a necessity for the most advanced economies in the world, if they want to sustain high wages and a high standard of living. This is why determinants of a country's innovativeness are a very important economic issue. The purpose of this original research paper is to examine what types of national culture are conducive for innovations. Pearson correlation coefficient and Spearman's rank correlation coefficient were calculated between two measures of innovativeness and different culture dimensions. The results show that innovations are created statistically more often in national cultures characterized as: low power distance, high individualism, long-term orientation (G. Hofstede culture dimensions); monochronic, low-context (E. T. Hall culture dimensions) and with internal control (F. Trompenaars and Ch. Hampden-Turner culture dimension).

**Key words:** national culture, innovation-friendly national cultures, fostering innovations, determinants of innovativeness.

**JEL codes:** O31, O33

### Introduction

Technological change is considered to be one of if not the most important single factor standing behind economic growth. It was widely discussed basing on empirical evidence and on theoretical approach to economic growth. In the years 1929-1969 technical progress contributed to almost one-half of growth of real national income and three-quarters of the real national income growth per capita (Dornbusch, Fischer 1978, p. 571). Other results calculated by E. Denison (Denison, cited in Samuelson, Nordhaus 1985, p. 36) show that the contribution of technological change, education and other factors accounts for two-thirds of the gross national product growth and even four-fifths of the output per worker growth (data for the United States, during the years 1948-1981). Neoclassical theories of economic growth believe that in the long run growth of the gross domestic product per capita depends on the rate of technological progress which comes from outside of the economy (Fagerberg 1994, p. 1149). Contrary to exogenous theories, in endogenous growth models technological progress needs to be generated inside the economy. Technological progress depends on many different factors. Usually financing and performing research and development are listed in the first place. Then comes intellectual property rights protection, tax preferences on R&D, competitive pressure in the market, education at each level, foreign direct investments, funds availability (e.g. business angels, venture capital funds) and national culture.

The possible relation between national culture and innovations<sup>1</sup> will be examined further on in this paper. Similar subject for the research was taken under investigation by some other authors. The positive impact of low uncertainty avoidance index<sup>2</sup> on innovativeness was confirmed by S. Shane, basing on the data from 33 countries (Shane 1993, pp. 59-60). In the same paper Shane stated that low power distance and high individualism are conducive for innovations. The same conclusions as Shane's come from research conducted by A. Kaasa on the sample of 47 European countries. National cultures with low uncertainty, low power distance and high individualism tend to be more innovative. Moreover, the same can be said about nations with high level of masculinity (Kaasa 2013, p. 7).

R.J. Rossberger and D.E. Krause took a sample of 33 countries on the different stages of development. Their results confirm that innovation-friendly are nations with low hierarchy, high individualism, tendency to plan and with internal locus of control (Rossberger, Krause 2014, pp. 75-77).

The purpose of this paper is to examine the relation between culture and innovativeness on a much wider geopolitical range and investigating more culture dimensions than it was done by abovementioned authors. So the research gap is going to be fulfilled by this paper is much bigger sample of countries and some new culture dimensions taken into account, especially those proposed by E.T. Hall.

First, it's necessary to choose and explain the measures of innovativeness (section 2) and national culture typologies (section 3). Hypothesis concerning impact of different national cultures on innovativeness are formulated in section 4. The same section provides statistical results of the research and answers to hypothesis. The paper ends with some concluding remarks.

## Innovation measures

Innovative performance of countries can be measured in two ways. The first group of indicators takes into account only one dimension, that's why they called simple or homogenous. The most widely used among them are Triadic Patent Families and Technology Balance of Payments. The second group are the composite indicators, because they combine many innovation aspects into one score for each country. The most popular composite indicators are Summary Innovation Index, Global Innovation Index and Bloomberg Innovation Index. Also The Global Competitiveness Report can be used to measure innovative performance. In the report each country's competitiveness is based on twelve pillars and last of them are Innovations. In this paper Global Innovation Index and the twelve pillar of The Global Competitiveness Index are used, because of their widest geopolitical coverage.

<sup>1</sup> Innovations are not the same as technological progress, but most of the innovations are based on technological progress. Technological progress put into new product or processes is an innovation, although some innovations don't have to be based on technological progress.

<sup>2</sup> All the culture dimensions mentioned in this section will be explained in section 3.

Global Innovation Index (GII) was created in 2007 by INSEAD. The GII gives a key tool of detailed metrics for 128 countries (year 2016), representing 92.8% of the world's population and 97.9% of the world's GDP (in current US dollars). The overall GII score comes as the simple average of the Input and Output Sub-Index scores. The Innovation Input SubIndex comprises of five pillars that captures national economy innovative potential. These pillars are: institutions, human capital and research, infrastructure, market sophistication, and business sophistication. The Innovation Output SubIndex provides data about the results of innovative activities taken within the economy. There are only two output pillars here, first is knowledge and technology outputs and second is creative outputs. Each of the five Innovation Input pillars and each of two Innovation Output pillars is divided into three sub-pillars (Dutta et al. 2016, p. 14).

The Global Competitiveness Report presents the results of tests conducted annually by the World Economic Forum. Methodology used in The Global Competitiveness Report comes from Klaus Schwab's original idea backed from 1979. Since 2005 the World Economic Forum has published The Global Competitiveness Index developed by Xavier Sala-i-Martin in collaboration with the Forum. Since the 2007 update, the methodology has remained largely unchanged. The GCI combines 114 indicators grouped into 12 pillars: institutions, infrastructure, macroeconomic environment, health and primary education, higher education and training, goods market efficiency, labor market efficiency, financial market development, technological readiness, market size, business sophistication, and innovation. In this paper interest is put not in competitiveness of economies, but in their innovativeness. That's why only "innovation" pillar (GCI-I) was taken for further research. Innovation pillar combines 8 indicators, from both sides: inputs and outputs. Indicators are as follows: capacity for innovation, quality of scientific research institutions, company spending on R&D, university-industry collaboration in R&D, government procurement of advanced technology products, availability of scientists and engineers, PCT patent applications, intellectual property protection (Schwab 2016, pp. 5, 39-40).

## Main typologies of national culture

National culture is, according to Geert Hofstede, "the collective programming of the mind which distinguishes members of one group or category of people from another" (Hofstede 1991, p. 5). At first G. Hofstede distinguished five<sup>3</sup> culture dimensions: power distance index (PDI), uncertainty avoidance index (UAI), individualism (IDV), masculinity (MAS), and long term orientation (LTO). Research conducted by Michael Minkov led to add sixth dimension in 2010. It is named indulgence (IND) and the opposite national culture is a restrained one (Hofstede 2011, pp. 7-8, Hofstede G., Hofstede G.J., Minkov M. 2010, pp. 281, 286). In the section below each of the six dimensions will be explained. Usually there will

<sup>3</sup> In fact, fifth dimension (Long-term Orientation) G. Hofstede took, with permission, from Michael H. Bond, who labelled this dimension as Confucian Work Dynamism.

be presented features of one score only (either low or high) and the other score is presumed to have exactly the opposite features.

In countries with low **power distance** you have student-centered education (not teacher-centered), pluralist governments and rare corruption. Moreover, subordinates expect to be consulted (not just told what to do) and income distribution in society is rather even. German and English-speaking western countries tend to have low power distance, while East European, Latin, Asian and African countries tend to have higher scores.

Weak **uncertainty avoidance** means that people tolerate deviant persons and ideas, they see different as curious. They also feel comfortable with ambiguity and chaos, so changing job is not a problem. In contrast, in countries with strong uncertainty avoidance people try to minimize new and unstructured situations. Low uncertainty avoidance was observed in English speaking countries, in Nordic countries and in China.

**Individualism** measures to what degree people in different nations are integrated into groups. From economy's innovativeness point of view important features of individualistic societies are: speaking one's mind is seen as healthy, purpose of education is learning how to learn (not to how to do), tasks prevail over relationships. Western countries tend to be more individual, Eastern – more collective and Japan is somewhere in the middle.

In **feminine** countries people seek balance between work and family and they feel sympathy for the weak (instead of admiration for the strong). There is minimum social and emotional role differentiation between the genders, so both mothers and fathers are supposed to deal with facts and feelings. It's difficult to formulate a simple rule describing femininity and masculinity in different parts of the world. Femininity is high in Nordic countries and in the Netherlands, moderately high in France, Spain and Korea. Masculinity is high in Japan, in German speaking countries and in Italy and moderately high in English speaking Western countries.

As far as innovations are concerned there are some important features of **long-term orientation**. People in such countries believe that important events in life are in the future, traditions are not sacrosanct and should be adaptable to changed reality and it's always worthy to learn from other countries. Moreover, in long-oriented countries you can expect to have high savings rate, which makes bigger investments possible. The most long-term oriented are East Asia countries, then Eastern- and Central Europe. South and North Europe are medium oriented, and USA, Latin American, Africa and Muslim countries are short-term oriented.

The last dimension from Hofstede typology is **indulgence**. Indulgent societies usually have higher rate of very happy people, higher importance of leisure and freedom of speech is seen as a primary concern. Indulgence is connected with a perception of personal life control, while restrained with helplessness. The Americas and Western Europe tend to be indulgent (Hofstede 2011, pp. 9-16).

The second culture dimensions typology, summarized below, is the one presented by E.T. Hall. Hall distinguished two dimensions: monochronic or polychronic and low or high context countries. The first distinction is based on peoples' attitude towards time. In **mono-**

**chronic** (MNC) societies people usually do one thing at a time, they like schedules, punctuality, they plan ahead and then stick to plans. Polychronic cultures (PNC) are the opposite. The most monochronic are German speaking countries, Americans (WASP), Nordic countries, and then British, Canadians, Australians, Japanese, Dutch. The second dimension is based on the way messages are communicated within society.

In **low-context** (LCT) nations messages are explicit; their interpretation depends on what's written, not on contextual cues like in high-context nations. High-context countries (HCT) tend to be more rooted in the past and slow to change (which is disadvantageous to innovations). Low-context are German speaking countries at the top and then New Zealanders, white South Africans, North Americans, Canadians, Nordic countries, British, Australian, Benelux people (Hall 1989, pp. 17, 22, 93, 150, van Everdingen, Waarts, pp. 222-224).

F. Trompenaars and Ch. Hampden-Turner distinguished seven dimensions, which describe national culture. From the innovation point of view specially one can be meaningful – the split into **inner- and outer-directed** (INN) nations. People in inner-directed societies tend to believe that what happens in their lives is their own doing, not fate or act of god like it is believed in outer-directed countries. That's why inner-directed economies can be expected to be more innovative, because of high rate of "the captains of their fate", as Trompenaars and Hampden-Turner call them (Trompenaars, Hampden-Turner 1998, pp. 141-144).

## Hypothesis, research method and results

In this section hypothesis, research method and results of the research are presented. Basing on the descriptions of culture dimensions in section 3 the following hypothesis are suggested:

- H1:** The lower the country's PDI score, the more likely the country is to be innovative.
- H2:** The lower the country's UAI score, the more likely the country is to be innovative.
- H3:** The higher the country's IDV score, the more likely the country is to be innovative.
- H4:** The higher the country's LTO score, the more likely the country is to be innovative.
- H5:** The higher the country's IND score, the more likely the country is to be innovative.
- H6:** The lower the country is on PNC list, the more likely the country is to be innovative.
- H7:** The lower the country is on HCT list, the more likely the country is to be innovative.
- H8:** The higher the country's INN score, the more likely the country is to be innovative.

Hypothesis H1-H5 are based on Hofstede culture dimensions. The decision is not to formulate hypothesis about impact of masculinity/femininity on innovativeness, because some features of both masculine and feminine cultures are conducive for creating and diffusing innovations. Hypothesis H6-H7 uses Hall culture dimensions and the last one (H8) is based on inner- and outer-directed dimension proposed by Trompenaars and Hampden-Turner.

To verify above-mentioned hypothesis it will be checked if there is a correlation between countries scores/ranks in eight culture dimension (as in hypothesis H1-H8) on one side, and results in two different innovativeness measures described in section 2 (GII and GCI-I) on

the other side. Pearson correlation coefficient will be used to verify hypothesis H1-H5 and H8. As E.T. Hall's culture dimensions are ranking variables then Pearson correlation can't be used. In this case, to verify H6 and H7 hypothesis, a nonparametric test will be used and Spearman's rank correlation coefficient will be calculated.

Data used in this section comes from The Global Competitiveness Report 2016-2017 (GCI-I values; The Global Competitiveness Report 2016-2017, p. 50), from The Global Innovation Index 2016 (GII values; The Global Innovation Index 2016, pp. XVIII-XIX), from G. Hofstede official site (PDI, UAI, IDV, LTO and IND values; www 1), from Y.M. van Everdingen and E. Waarts paper (PNC and HCT values; van Everdngen, Waarts 2003, pp. 223-224) and from Trompenaars and Hampden-Turner book (INN values; Trompenaars, Hampden-Turner 1998, p. 144). Table 1 summarizes results of hypothesis testing.

**Table 1**

**Correlation matrix between innovation measures and national culture dimensions**

|       |                                   | PDI           | UAI             | IDV          | LTO          | IND             | PNC           | HCT           | INN          |
|-------|-----------------------------------|---------------|-----------------|--------------|--------------|-----------------|---------------|---------------|--------------|
| GII   | Correlation coefficient           | <b>-0,632</b> | -0,078          | <b>0,694</b> | <b>0,475</b> | 0,182           | <b>-0,765</b> | <b>-0,573</b> | <b>0,463</b> |
|       | Significant at level (two-tailed) | 0,01          | not significant | 0,01         | 0,01         | not significant | 0,01          | 0,01          | 0,01         |
|       | Sample size                       | 89            | 89              | 89           | 76           | 72              | 40            | 37            | 47           |
| GCI-I | Correlation coefficient           | <b>-0,573</b> | -0,176          | <b>0,576</b> | <b>0,426</b> | 0,176           | <b>-0,761</b> | <b>-0,559</b> | <b>0,504</b> |
|       | Significant at level (two-tailed) | 0,01          | not significant | 0,01         | 0,01         | not significant | 0,01          | 0,01          | 0,01         |
|       | Sample size                       | 93            | 93              | 93           | 79           | 75              | 41            | 37            | 47           |

Source: own calculations.

The results in table 1 shows that hypothesis H1, H3, H4, H6, H7, H8 are true while hypothesis H2 and H5 must be rejected. Conclusions are exactly the same when two different variables to measure innovativeness (GII and GCI-I) are used. It was found that a statistically significant (at  $p$ -value < 0,01; two-tailed) **positive influence** of individualism (H3), of long-term orientation (H4) and of inner-directed culture (H8) on innovativeness, and a **negative influence** of power distance (H1), polychronic culture (H6) and high-context culture (H7) on innovativeness.

## Conclusions

This study tried to find out what national culture features are conducive for innovativeness of the economy. It was confirmed that innovations will appear statistically more often in

societies which are individualistic, with low power-distance, long-term oriented, monochronic, low-context and inner-directed. Unfortunately, positive impact of indulgence culture and, surprisingly, of low uncertainty avoidance on innovativeness was not confirmed. The last result is particularly interesting and it leaves room for further research, maybe separately in a group of countries divided by a different innovation model or by income level.

The results of this research that show that low power distance and high individualism are conducive for innovations are compatible with the results presented by Shane (Shane 1993, p. 59-60). This paper also confirmed the results of A. Kaasa research, as it comes to low uncertainty, low power distance and high individualism to be pro innovative (Kaasa 2013, p. 7). The results of this paper are very similar with findings of R.J. Rossberger and D.E. Krause research – nations with low power distance, with high individualism, monochronic and inner-directed were conducive for innovations (Rossberger, Krause 2014, pp. 75-77).

Findings of this article can be used while designing national innovations policy. When relations between culture and innovativeness are discovered, it's easier to know if the culture of certain country is pro innovative or not. Knowing this, in the short run national innovation policy can be redesign and adjusted to culture limitations. In the long run, the governments can try to change national culture, but it is not an easy process.

Interesting field for further research is to verify how national culture influence innovations in a group of countries divided basing on stage of economy development, income level or geographical location. Moreover, it would be interesting to check how national culture limitations influence on the proportion between radical and incremental innovations.

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## Uwarunkowania kulturowe jako determinanta innowacyjności

### Streszczenie

Zgodnie z publikacją *The Global Competitiveness Report* generowanie innowacji jest koniecznością dla najwyżej rozwiniętych gospodarek na świecie, jeśli chcą utrzymać wysokie płace i standard życia swoich mieszkańców. Z tego powodu determinanty innowacyjności gospodarki są bardzo istotnym zagadnieniem w nauce i praktyce ekonomii. Celem artykułu było sprawdzenie, jakie wartości w wymiarach kultury poszczególnych krajów sprzyjają innowacyjności. Badanie zostało przeprowadzone przez obliczenie współczynników korelacji Pearsona oraz rang Spearmana między miarami innowacyjności gospodarek a wartościami w poszczególnych wymiarach kultury. Otrzymane rezultaty wskazują, że innowacje statystycznie częściej pojawiają się w społeczeństwach cechujących się niskim dystansem władzy, wysokim indywidualizmem i orientacją długoterminową (wymiarzy kultury zaproponowane przez G. Hofstede), monochronicznością i niskim znaczeniem kontekstu w komunikacji (typologia E.T. Halla) oraz wewnątrzsterownością (typologia F. Trompenaarsa i Ch. Hampden-Turnera).

**Słowa kluczowe:** kultura narodowa, kultury narodowe przyjazne innowacjom, wspieranie innowacji, determinanty innowacyjności.

**Kody JEL:** O31, O33

## Культурные обусловленности как детерминант инновационности

### Резюме

В соответствии с публикацией *The Global Competitiveness Report* генерирование инноваций – необходимость для наиболее высокоразвитых экономик в мире, если они хотят удержать высокую зарплату и стандарт жизни населения. По этому поводу детерминанты инновационности экономики – весьма

существенный вопрос в науке и практике экономики. Цель статьи – проверить, какие ценности в измерениях культуры отдельных стран способствуют инновационности. Изучение провели, рассчитывая коэффициенты корреляции Пирсона и ранговой корреляции Спирмена между мерами инновационности экономик и ценностями в отдельных измерениях культуры. Полученные результаты указывают, что инновации статистически чаще появляются в обществах, которым свойственны небольшая дистанцированность от власти, высокий индивидуализм и долгосрочная ориентация на будущее (измерения культур, предложенные Г. Хофстеде), монохроничность и низкоконтекстное общение (типология Э. Т. Холла), а также внутренний контроль (типология Ф. Тромпенаарса и Ч. Хэмпден-Тернера).

**Ключевые слова:** национальная культура; национальные культуры, ориентированные на инновации; поощрение инноваций; детерминанты инновационности.

**Коды JEL:** O31, O33

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