DEVELOPMENT OF THE TECHNOLOGICAL COMPONENT OF THE MACRO ENVIRONMENT IN BALTIC SEA REGION COUNTRIES

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Abstract

During the period of economic crisis, the development of production economy has a crucial role in the promotion of the states national economy's competitiveness as a whole. The world's strongest states have shifted from process efficiency driven economies to innovation driven economies, so the business macro environment (BME) has the important part in the development of production economy's technological component that would ensure the achievement of sufficiently high production level

The purpose of the research is to perform the contrastive analysis of BME technological component in the countries of the Baltic Sea Region in the period from 2003 to 2009, and identify the factors that have a significant influence on the development of technological component and promote rapprochement/disassociation between the states.

To accomplish the purpose the methodological bibliography was overviewed and the analysis of countries of the Baltic Sea Region macro environment's statistical data were made, as well as performed the analysis and calculations of technological component and its sub-index.

The results of research lead to conclusions that in almost all BME technological component related spheres, Latvia is in the lowest position among countries of the Baltic Sea Region, so to provide the competitiveness for Latvian companies, it need to be immediately improved in the latest technology related fields.

Key words: *business macro environment, ttechnological component.*

Introduction

During the period of economic crisis, the development of production economy has a crucial role in the promotion of the states national economy and competitiveness as a whole. The world's strongest states have shifted from process efficiency driven economies to innovation driven economies, so the progress of business macro environment's (BME) technological component is the important part of the production economy that would ensure sufficiently high level of production.

The **purpose** of this paper – perform the contrastive analysis of business macro environment's technological component in the countries of the Baltic Sea Region in the period from 2003 to 2009, and identify the factors that significantly influence the development of technological component and promotes the rapprochement/disassociation between the states.

During the process of paper accomplishing the following **economic research methods** have been used: logically − constructive, graphical – analysis and synthesis, statistical analysis, etc.

Results

1. The Calculation Methodology of Technological Component Index (further technological index) and Sub-index.

The calculations of technological index (TI) and its sub-index are performed according to the Latvian Council of Science (LCS) funded research "The Monitoring of Business Environment Progress in Latvian Regions and Improvement of its Methodological Basis" (9) within the framework of business macro environment methodology for evaluation and analysis of component. This methodology is based on International Chamber of Commerce's and Ifo Institute's performed World's economies inspection within the framework of developed and in the annual World's Economic forum presented Reports of Global Competitiveness Growth Index (GCI**)** formation principles.

There are three principles in the basics of economic competitiveness calculations, i.e. GCI is formed as an aggregative index from three components: macro economical stability (the macro economic environment index – MEEI), the quality of public institution activities

(the public institutions index − PII) and technological progress (the technological index – TI). However TI as an aggregative index is formed from three sub-indexes – innovation index (II), technological transfer index (TTI) and information and communication technological index (ICTI). Each of these sub-indexes is calculated using both official statistical data (hard data - HD) and data, which are the result of specific, international surveys (survey data - SD). The results of surveys are being written in scale starting from 1 (being the lowest assessment) to 7 (the highest assessment). Also all the officially statistical data are put in the scale from 1 to 7. Almost all data used in calculations can be found in annually published Global Competitiveness Reports (2).

The technology index is calculated for the core innovators and none-core innovators as follows:

TI for core innovators = ½ II + ½ ICTI

TI for non-core innovators = 1/8 II+ 3/8 TTI + ½ ICTI

The innovation subindex (II) is calculated as follows: II = ¼ survey data + ¾ hard data, where:

Innovation survey questions:

II sd (1) – What is your country's position in technology relative to world leader?

II sd (2) – Companies in your country are not interested/aggressive in absorbing new technology?

II sd (3) – How much do companies in your country spend on research and development (R&D) relative to other countries?

II sd (4) – What is the extent of business collaboration in R&D with local universities?

Innovation hard data:

II hd (1) – US utility patents granted per million popilation;

II hd (2) – gross tertiary enrollment rate in most recent available year.

The technological transfer subindex (TTI) is calculated as unweighted average of two **technology transfer survey questions**.

TTI sd (1) – Is foreign direct investment in your country an important source of new technology?

TTI sd (2) – Is foreign technology licensing in your country a common means of acquiring new technology?

Information and communication technological subindex (ICTI) is calculated as follows: ICTI = 1/3 survey data + 2/3 hard data, where:

Information and communication technology survey questions:

ICTI sd (1) – How extensive is Internet access in schools?

ICTI sd (2) – Is there sufficient competition among internationaly sold products in your country to ensure high quality, infrequent interruptions and low price?

ICTI sd (3) – Is ICT an overall priority for the government?

ICTI sd (4) – Are government programs successful in promoting the use of ICT?

ICTI sd (5) – Are the laws relating to ICT (electronic commerce, digital signatures, consumer protection) well developed and enforced?

Information and communication technology hard data:

ICTI hd (1) – cellular mobile subscribers per 100 inhabitants;

ICTI hd (2) – internet users per 10,000 inhabitants;

ICTI hd (3) – broadband internet users per 10,000 inhabitants;

ICTI hd (4) – main telephone lines per 100 inhabitants;

ICTI hd (5) – personal computers per 100 inhabitants.

2. The Progress of Technological Index and Sub-index within the States, and their affective factors

In the Picture 1 are shown the changes of technological index in the period from 2003 to 2009, to each of countries of the Baltic Sea Region, and the change of average value of these

eight countries' technological indexes. The four Nordic countries – Sweden, Finland, Denmark and Norway are the key innovation countries (core innovators), and their technological indexes exceed the average value of the all eight countries together, the other group of four countries – Estonia, Lithuania, Latvia and Poland – are viewed as the less innovative countries (non-core innovators), because their technological value does not meet the average values of all eight countries, and within the framework of this paper these countries will be called − Baltic States.

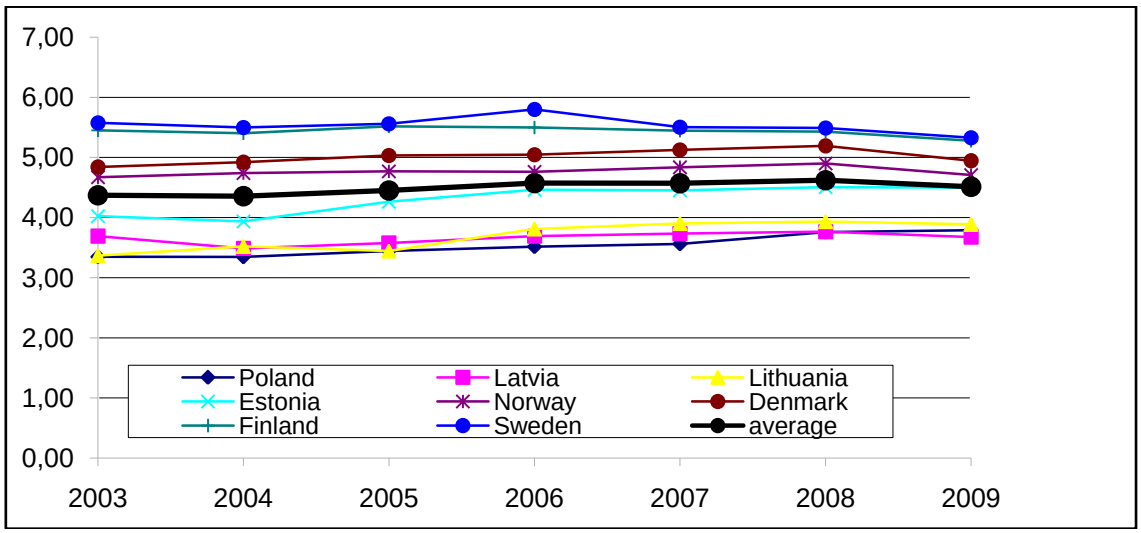

Figure 1: **The Progress of Countries of Baltic Sea Region Indexes from 2003 to 2009**

Source: The calculations made by the author, on the basis of the Report of Global Competitiveness's Data (2.-8.)

Analysing the progress of technological index for each country, Sweden's value of technological index from 2003 to 2006 have increased by 4%, but then follows the decline that by 2009 have reached 8% in comparison to value of 2006. The decline of the technological index from 2006 to 2009 is the reason of innovation sub-index's II decline that was caused by the decrease of the amount of presented patents in USA (per one million of the national inhabitant), and the introduction of gross in the rate of highest education's decrease.

In Finland the technological index from 2003 to 2005, when its value started to decrease, has increased only by 1.2%. From 2006 to 2009 the technological index of Finland has decreased by 4.4%, the capacity of Finland to establish innovations during the last years have significantly declined. Nevertheless Finland, in comparison to other Nordic countries, has a very strong and unique educational system, but according to the research, the companies of Finland use very little of their employee creativity and innovation, i.e. Finland do not use all potential of its distinguished educational systems and investments of new knowledge. It must be noted that Finland's educational instances are among the world's progressive in the sphere of digitalization. To facilitate the innovation of Finland's capacity progress, the greater part of investments must be placed in research and development, so the Finland's employers would able to receive benefit from the knowledge produced by the educational institutions, and also to ensure the growth of recently founded companies (1).

Denmark's and Norway's value of technological index from 2003 to 2008 have increased, in 2009 the same as for other countries of Baltic Sea Region, the value of technological index have declined − in Denmark by 4.8% and in Norway by 3.9%. The decline of both countries is due to the decrease of the value of information and communication technology sub-index ICTI. Denmark has the greater decrease compared to previous year, in the usage of broadband Internet per 10,000 inhabitants (-34.1%), the number

mobile phone subscribers per 100 inhabitants (-21.6%), users of personal computers per 100 inhabitants (-19.9%) and users of the stationery phone lines (subscribers) per 100 inhabitants (-13.8%). Norway − broadband Internet users per 10,000 inhabitants (-30.2%), and mobile phone subscribers per 100 inhabitants (- 27.1%).

Comparing the progress of four Baltic States, Estonia and Poland have positive progress of technological value from 2003 to 2009, in Poland the index of technological progress from 2003 to 2009 has increased by 13.2% (sub-index of innovation by 4.3%, the sub-index of technological transfer by 3.6%, and information and communication sub-index – 26.8%), and in Estonia by 11.8% (sub-index of innovation by 2.3% and sub-index of information and communication technologies by 21.3%).

In Lithuania and Latvia the value of technological index from 2003 to 2008 have increased, in Lithuania the increase was 16.8%, but in Latvia only 2%, in 2009 the technological index of both countries have decreased – in Lithuania by 1.2% (the sub-index of innovation and sub-index of technological transfer have not decreased, but the sub-index of information and communication technologies decreased by 2.4%), in Latvia by 2.4%.

In the period from 2003 to 2009 in all countries of Baltic Sea Region, except for Poland, Finland and Sweden, the maximum value of technological index have been reached in 2008, however Poland reached it in 2009, Finland − in 2005, and Sweden − in 2006. The rapidest growth was in Lithuania, its technological index have increased by 16.8% compared to minimal value, then comes Poland with 13.2%, Estonia with 11.9%, Denmark with 7.3%, Norway with 4.9%, Sweden with 4%, Latvia with 2% and Finland with 1.2%.

3. The Development of Technological Index and Sub-indexes in the Comparison of States, and their influencing factors.

By looking at the progress of technological sub-index in the level of state group (Picture 2), in the Baltic group of states from 2003 to 2009, the rapidest growth is in the information and communication technologies sub-index ICTI – 22.3%, innovation sub-index II has increased by 4.5%, the technological transformations sub-index TTI has decreased by – 1.2% (the increase from 2003 to 2006 – 2.1%, the decrease from 2003 to 2006 – 3.2%). The technological transfer sub-index TTI in Nordic group of states has increased by 2.5%, but the innovation sub-index II and the information and communication technologies sub-index ICTI has increased only by 0.3% and 0.9% in comparison to 2003, the reason of this is the decrease of this sub-index in the period from 2006 to 2009 (II by 1.8%and ICTI by 4.7%). Comparing the value of sub-indexes the difference between Baltic and Nordic States shows that the less differences are in the progress of TTI, then – II, and the greatest − in the progress of ICTI.

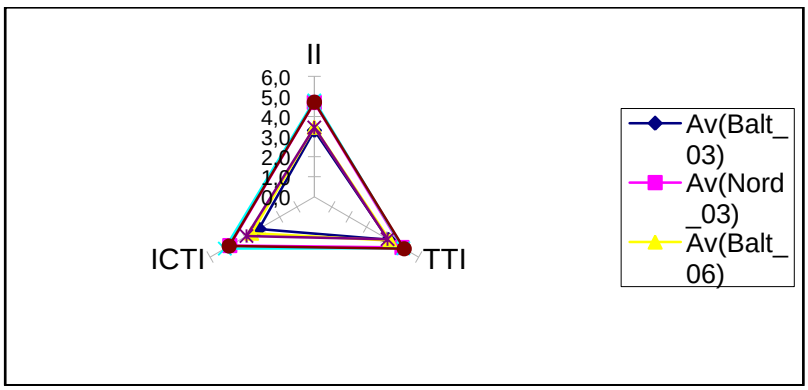

***Figure 2*: Group of States average technological sub-indexes in 2003, 2006 and 2009**

Source: The calculations made by the author, on the basis of the Report of Global Competitiveness Data (2.-8.)

Analysing the development of technological indexes within the framework of Baltic group of states, in 2003, 2006 and 2009 the greatest TI value has Estonia (Picture 3). In 2003, Latvia was at the second place of technological development after Estonia, then came Lithuania and Poland. In 2006 Lithuania outpaced Latvia; Poland was the last in this group of states. Also in 2009 Lithuania was at the second place after Estonia, but Poland outpaced Latvia, and left it in the last position.

Year 2003	Year 2006	Year 2009
Estonia: TI =4,02	Estonia: TI =4,46	Estonia: TI =4,50
Latvia: TI=3,69	Lithuania: TI=3,81	Lithuania: TI=3,89
Lithuania: TI=3,37	Latvia: TI=3,69	Poland: TI=3,79
Poland: TI=3,35	Poland: TI=3,52	Latvia: TI=3,67

Figure 3: **The Development of Baltic States technological index in 2003, 2006 and 2009.**

Source: The calculations made by the author, on the basis of the Report of Global Competitiveness Data (2.-8.)

The superiority of Estonia among other Baltic States – Lithuania, Latvia and Poland, was determined by the development of information and communication technological sub-index ICTI, more specific – the access to the Internet at schools, the protection of intellectual property, laws that apply to ICT sphere, the number of the Internet users per 10,000 inhabitants, broadband Internet users per 10,000 inhabitants, the stationery phone lines (subscribers) per 100 inhabitants, personal computers per 100 inhabitants.

Several factors, which in 2006 determined that Lithuania outpaced Latvia, in the sphere of technological index progress. Firstly, Latvian government decreased the usage of ICT programmes to promote work efficiency (-17.1%), in Lithuania it was preserved in the level of 2003. Secondly, the number of laws that were applying to ICT and its quality were decreased (-14%), in Lithuania this factor was increased by 10.8%. Thirdly, in Lithuania the number of mobile phone subscribers per 100 inhabitants increased faster than in Latvia (in Lithuania + 45.1%, in Latvia +21.4%), and the broadband Internet users per 10,000 inhabitants (in Lithuania + 45.1%, in Latvia 21.4%).

In 2009 Poland outpaced Latvia, and was in the third position of four Baltic States, leaving Latvia in the last position, in the progress of technological index, which was influenced by the transfer of technological sub-index TTI, the progress of information and communication technologies sub-index ICTI. The increase (changes) of TTI is significantly connected with the direct foreign investment flow into companies that use new technologies. However ICTI progress was due to, firstly, increase of scientific institutions' quality in Poland (+7.9% in 2006, in Latvia decrease by 2.6%). Secondly, the international distribution and marketing quality in Poland increased by 15.8%, but in Latvia it decreased by 7.7%. Thirdly, the protection of intellectual property that was increased both in Poland and Latvia, however the increase in Poland was greater – 19.4%, but in Latvia only 5.9%. Fourthly, the government's programme of ICT usage as the promotion of work efficiency in Poland have risen by 16.7%, but in Latvia decreased by 5.9%. Fifthly, the number of mobile phones per 100 inhabitants in Poland has increased (+13.9%), yet in Latvia it has decreased (-4.1%). And

the last, the number of broadband Internet users per 10,000 inhabitants in Poland has grown faster than in Latvia, in Poland by 40.9% and in Latvia by 15.2%.

Conclusions

1. Value of technological index of important innovation flow states is higher compared with less intensive innovation states, which means that the latest technologies and innovations have a crucial role in state's national economy in order to ensure sustainable progress.
2. Comparing the differences of technological index's sub-index between Baltic and Nordic states, the less difference is between the values of technological transferring indexes, then follows the values of innovation sub-indexes, and the greatest difference is between the values of information and communication technological sub-indexes.
3. In almost all technological component spheres applying to BME Latvia is in the lowest position among the countries of Baltic Sea Region, so this needs to be immediately improved, in order to provide the competitiveness for Latvian companies in the spheres that are based on the usage of the latest technologies.
4. The calculations done within the framework of this paper shows that countries of Baltic Sea Region have shifted to new, modern and efficient information and communication technologies (WAP, internet solutions through mobile connection operators, etc.), so the data used in these calculations of IT and its sub-index that was formed within the framework of LCS funded research of BME assessment and methodology of analysis, are no longer suitable.

References

1. Nordic Innovation Monitor 2009. Copenhagen.
2. Schwab, K., Porter, M.E., (2004), The Global Competitiveness Report 2003-2004. Oxford; New York: Oxford University Press.
3. Schwab, K., Porter, M.E., (2005), The Global Competitiveness Report 2004-2005. Oxford; New York: Oxford University Press.
4. Schwab, K., Porter, M.E., (2006), The Global Competitiveness Report 2005-2006. Oxford; New York: Oxford University Press.
5. Schwab, K., Porter, M.E., (2007), The Global Competitiveness Report 2006-2007. Oxford; New York: Oxford University Press.
6. Schwab, K., Porter, M.E., (2008), The Global Competitiveness Report 2007-2008. Oxford; New York: Oxford University Press.
7. Schwab, K., Porter, M.E., (2009), The Global Competitiveness Report 2008-2009. Oxford; New York: Oxford University Press.
8. Schwab, K., Porter, M.E., (2010), The Global Competitiveness Report 2009-2010. Oxford; New York: Oxford University Press.
9. J.Vucāns, V.Kozlinskis, A.Vucāne un E.Vītols (2009), Uzņēmējdarbības vides attīstības monitorings Latvijas reģionos un tā metodoloģiskās bāzes pilnveidošana. LZP Ekonomikas, juridiskās un vēstures zinātnes galvenie pētījumu virzieni 2008.gadā. – R.: LZP Humanitāro un sociālo zinātņu ekspertu komisija. Nr.14. - 155.-161.lpp. *(Elektroniska publikācija; skatīt:* http://www.lzp.gov.lv/parskati/LZP2008_5EK.pdf *).*

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