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**Evaluation of the Level of Internationalization
of the Region of Łódź
in the Market of High Technology Products**

Abstract

Technology and innovation belong to most important factors stimulating competitiveness in the microeconomic and regional level.

The aim of the paper is to analyze and evaluate the level of innovation and technological competitiveness of the Region of Lodz in comparison to other regions of Poland. In the paper several groups of high –tech products were taken into consideration, with special reference to: aerospace, computers-office machines, electronics-telecommunications, pharmacy, scientific instruments, electrical machinery, non-electrical machinery, chemistry, armament.

Region of Łódź for several years has been taking the 6th position at the economic map of the Polish regions. However, the level of internationalization of the region of Łódź is not high since as far as the share of export in GDP is concerned, the region of Łódź takes only 14th position in the country.

From the point of view of high technology products' position in export, the region of Łódź was taking 11th position in the year 2004 among the Polish regions, while in the year 2005 it dropped to the 12 position. The same position [meaning 12] the region of Łódź took also in export of ultrahigh technology products.

1. Technology, innovativeness and competitiveness of regions – theoretical aspects

Globalisation and technological changes are closely interrelated. Regional technological policies base on assumptions that outlays on R&D affect production and create innovativeness of production, which increases competitiveness and has an impact on growth of trade. Technology and ability to create innovation of products and processes of production belong to most important factors stimulating competitiveness of enterprises (Roelandt 1999, p. 413).

Technological innovations cover new products and production processes as well as significant technological changes in products and production processes. An innovation is implemented when it is introduced into the market (a product innovation) or used for production processes (a process innovation). Thus they pertain to a whole range of scientific, technological, organizational, financial or trading activities.

Innovation as a rule does not result from activity of a single firm but is based on a continuous research process aimed at using new sources of knowledge and technologies and applying them in products and production processes. Innovative systems allow shaping new ideas which enterprises use for improving their competitiveness and in this way they become more dependent on the complementary knowledge possessed by other firms and institutions. The cluster approach consists in the links and interdependencies between subjects co-operating in the network of the manufacture of products, services and innovations. The approach visible in this concept is alternative to the earlier sectoral approach (*Innovative Firms* 1999, pp. 49–61). Economic clusters can be defined as production networks of mutually interdependent firms (including specialized suppliers) connected with other firms in production chains creating a high value added. In some cases, clusters also comprise strategic alliances with universities, research institutes, institutions offering business-supporting services based on advanced knowledge, with consultants and customers. Clusters as a rule are supra-sectoral (horizontal) networks and cover dissimilar and complementary firms specializing in a certain activity or knowledge in the chain favoring the creation of a higher value. This concept is a wider approach than the innovation systems and it treats the systemic approach as a starting point but it differs both in the subject and level of analysis. Thus, five rungs of approach to innovation can be distinguished: national, regional, sectoral or technological systems and clusters. Clusters can be interpreted as national innovation systems

on a reduced scale. The dynamic, characteristics and interdependences are similar to those existing in national systems (Roelandt 1999, p. 414).

International trade is stimulated by international production because of internationalized big trading activity. International production occurred at that time because trade was not possible in certain cases such as e.g. certain types of services located abroad because of the need to ensure closeness between the buyer and the seller. Trade within transnational corporations and trade by enterprises associated with them is estimated at about two-thirds of global trade and intra-firm trade at one-third. The outcomes of researches show that trade in technologically advanced products was characterized by a growing trend in the last 25 years (Guerrieri, Milana 1991) which however resulted in the case of industry to a large degree from its connection with R&D activity, and the regions' potential and capacity of innovation were the main factor of the growth of their exports of not only high tech products but also licenses and know how. These factors create a significant feed-back between the national technological capacity and export capacity as well as between export capacity and capacity to use technologies on the international and global scales (Archibugi, Michie p. 178). Growth in the position in the global market follows primarily from development of intra-firm trade between companies from highly developed countries (chiefly the EU and USA) and companies in developing countries, with the usage of not only lower labor costs but also with the addition of a number of innovations in the process of production, designing, marketing and promotion as well as an appropriate sales network (Bhatti, Kock 1999).

2. Position of the region of Łódź in comparison with other Polish regions in high-tech sectors -empirical study -regional view

Region of Łódź for several years has been taking the 6th position at the economic map of the Polish regions. However, the level of internationalization of the region of Łódź is not high since as far as the share of export in GDP is concerned, the region of Łódź takes only 14th position in the country. The export in the region of Łódź per 1 capita was at the level of about 2 times lower than the national average in the period under consideration, and this distance has, unfortunately, enlarged in the year 2006 in comparison to 2004, since it increased from about 2 times to almost 2,3 times as high – see table 1. It means that the region of Łódź takes 13th position in the country when taking into account the value of export per capita and for example 6th position when taking into account the number of people, so the productivity of the population of the

region measured by the level of internationalization by export is about 2 times lower – see table 1.

From the point of view of high technology products' position in export, the region of Łódź was taking 11th position in the year 2004 among the Polish regions, while in the year 2005 it dropped to the 12 position. The same position [meaning 12] the region of Łódź took also in export of ultrahigh technology products [product classification according to SITC Rev. – ONZ] – see table 1.

Specific data referring to the position of the region of Łódź in export of high and ultrahigh technology products is presented in table 2. From that table it results that in the years under consideration 2004-2006 the region of Łódź lowered its share in export of Poland from 3,3% in 2004, to 3,2% in 2005, and later to 3,0% in 2006, which only enabled taking of the 10th position among Polish regions – see table 2. There has been also a decrease of share of high technology products in overall export of the region of Łódź, from 1,9% in 2004 to 1,7% in 2005 and 2006, which caused also the decline of the position of the region of Łódź in export of high technology products from Poland, from 2,3% in 2004 to 1,7% in 2005 and 2006. There has been also a decrease of share of the region of Łódź in Polish export with respect to ultrahigh technology products, from 2,2% in 2004 to 1,4% in 2005 and 2006, which caused also a decline of the position of the region of Łódź from 9th place in 2004 to 10th place in 2005 and 2006 – see table 2. The decline of position in the ranking of export of regions of our country took place both at the systematic increase of value of export of the region [from 239,9 million dollars to 330,3 million dollars] and at the increase of value of export of high technology products [from 45,2 million dollars in 2004 to 56,7 million dollars in 2006 – see table]. The previously mentioned data show, however, that the development of other regions of Poland was in the field of their internationalization far more dynamic.

The increasing trend of export of high technology products was mainly caused by an increase of export of pharmaceuticals [from about 1million dollars in 2004 to 2,3 million dollars in 2005 and than to 3,3 million dollars in 2006], scientific and research equipment [from 2,7 million dollars in 2004 to 4,7 million dollars in 2005 and 5,5 million dollars in 2006], electric machines [from 4,3 million dollars in 2004 to 5,8 million dollars in 2005 and than to 9,5 million dollars in 2006] and chemicals [from 0,6 million dollars in 2004 to 2,4 million dollars in 2005 and to 3,2 million dollars in 2006]. The export of ultrahigh technology products in the region of Łódź increased from 28,6 million dollars to 29,8 million dollars in the period under consideration 2004-2006, but the share of these products in export of the region of Łódź decreased from 1,2% in 2004 to 0,9% in the years 2005 and 2006 – see table 2.

As it also results from the results of research included in the table 3 in the region of Łódź, the dynamics of export both of the high technology products in the period under consideration, particularly with respect to electronic and telecommunication devices, and of ultrahigh technology products was increasing.

When taking into account the structure of products' export of the region of Łódź in the period under consideration 2004-2006 the dominant position had electronic and telecommunication devices [at the decreasing tendency of this share from 75,6% in 2004 to 61,8% in 2005 and 58,3% in 2006, but simultaneously at much higher position taken by this product group in the region of Łódź in comparison to the position of this group in structure of Poland – see table 4], and electric machines [at an increasing tendency of their share from 9,5% in 2004 to 12,3% in 2005 and 16,8% in 2006, also with much higher position of this product group in the region of Łódź in comparison to its position in the structure of export of Poland – see table 4]. There was one more product group that had significant share in export of the region of Łódź – chemicals [increase of share in export from 1,2% to 5,6%]. One should, however, take a note on the decreasing position of ultrahigh technology products in the region of Łódź in comparison to the position of this group in the structure of export of Poland and an increasing of gap in this field, since as far as in 2004 the range of this position was only 1,8 percentage points, then in 2006 this range was higher than 10 percentage points to the disadvantage of the region of Łódź – see table 4.

In import of high technology products the region of Łódź was characterised by clear increasing tendency of its competitive position in comparison with other Polish regions [see table 2], what meant moving in the ranking of provinces from 9th place in 2004 to 8th in 2005 and next to 7th in 2006, thanks to clear increase of value of imports in 2006 in comparison to two previously investigated years – see table 5.

The import in the region of Łódź per 1 inhabitant was [similarly as export] in the period under consideration almost 2 times smaller than the national average, but this distance in 2006 in comparison to 2004 increased from about 1,7 to about 1,9 – see table 6. It means that the region of Łódź as regards both the total size of import per 1 inhabitant and the size of import of high technology products takes the 8th position in the country, and as regards the import of ultrahigh technology products it takes the 13th position [in comparison to the position from the year 2004 there has been a decrease by 2 places, from position 11] – see table 6.

An increase in import in 2006 in comparison to 2005 was equal to 27,2 million dollars. Specifically in electronics-telecommunication – increase of about 2,6 million dollars, scientific and research equipment – about 1,2 million

dollars, electric machines – about 0,8 million dollars, non-electric machines – about 7,1 million dollars [the highest increase of import] – see table 5.

The dynamics of import of high technology products was negative in years 2005/2004, while in 2006/2005 period it achieved positive level [about 116%], including particularly high increase for non-electric machines [271%] and pharmaceuticals [124%] – see table 8.

In the structure of import of high technology products in the region of Łódź the pharmaceuticals were dominating [at an increasing share from 43% to 49% in the years under consideration. This share in the structure of import of the region of Łódź was significantly higher than the share of this product group in national import – see table 7]. The electronic and telecommunication devices, and chemicals also had the significant position in the structure of import of the region of Łódź had – see table 7.

The share of import of ultrahigh technology products in import of high technology products in the region of Łódź was at significantly lower level than national average [oscillating at the level of about 73%] and was characterised by decreasing tendency [decrease from 29,2% in 2004 to 23,2% in 2006] – see table 7.

The share of high technology products in overall import of the region of Łódź decreased, however, in the period under consideration from 4,9% in 2004 to 4,6% in 2006. Similarly, also import of ultrahigh technology products in the region of Łódź was characterised by the decreasing tendency [from 1,4 million dollars in 2004 to 1,1 million dollars in 2006, which caused in the last 2 years the decrease of share of the region of Łódź in import of Poland of ultrahigh technology products by 1 percentage point, that is from 7,6% to 6,6%. It also caused the decline of the position of the region of Łódź in the ranking of provinces from 15th to 16th place in this field – see table 5].

3. Conclusions

Technology and innovation belong to most important factors stimulating competitiveness in the microeconomic and regional level.

Region of Łódź for several years has been taking the 6th position at the economic map of the Polish regions. However, the level of internationalization of the region of Łódź is not high since as far as the share of export in GDP is concerned, the region of Łódź takes only 14th position in the country.

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Table 1. Region of Łódź – Exports of high-tech products and competitive position in ranking of regions in Poland

	Exports of the region of Łódź in 2004 – 2006 / thousands of USD			Share of the region of Łódź in Polish import (in %)			Position of the region of Łódź in ranking of regions in Poland		
	2004	2005	2006	2004	2005	2006	2004	2005	2006
Population /thousands of USD	2588	2582	2572	6,8	6,8	6,7	6	6	6
Share in the population of Poland	6,8	6,8	6,7	100,0	100,0	100,0	6	6	6
Total Exports of the Region of Łódź <i>per capita</i> (USD) / (shares in%)	927,0	1095,5	1284,5	1932,8	2342,1	2861,3	13	13	13
Exports of high-tech products-total <i>per capita</i> (USD)	17,5	18,3	22,1	52,5	74,4	88,1	11	11	11
• Aerospace	0,1	0,3	0,0	6,7	6,6	10,4	6	8	11
• Computers-Office machines	0,2	0,3	0,2	4,9	6,3	7,7	12	12	12
• Electronics-Telecommunications	13,2	11,3	12,9	20,2	31,9	37,8	8	10	11
• Pharmacy	0,4	0,9	1,3	2,0	3,2	3,6	6	6	7
• Scientific instruments	1,0	1,8	2,2	10,2	11,0	10,0	12	10	10
• Electrical machinery	1,7	2,2	3,7	1,8	1,9	2,8	5	5	5
• Non-electrical machinery	0,7	0,5	0,6	3,6	4,5	5,6	12	12	12
• Chemistry	0,2	0,9	1,2	2,6	5,8	6,4	11	10	9
• Armament	0,0	0,0	0,0	0,6	3,2	3,9	14	14	14
Exports of ultra-high-tech products <i>per capita</i> / USD/	11,1	9,9	11,6	34,2	47,5	55,2	10	12	12

Source: Own calculations based on Main Statistical Office Data – Base.

Table 2. Region of Łódź- exports of high-tech products and competitive position of the region of Łódź in Poland

	Exports of the region of Łódź in 2004 – 2006 / thousands of USD			Share of the region of Łódź in the export of Poland (in %)			Position of the region of Łódź in the ranking of regions of Poland		
	2004	2005	2006	2004	2005	2006	2004	2005	2006
Total Exports of the Region of Łódź /USD/	2398719	2828635	3303228	3,3	3,2	3,0	10	9	10
Exports of high-tech products	45206	47141	56733	2,3	1,7	1,7	9	10	11
• Aerospace	272	777	23	0,1	0,3	0,0	7	7	11
• Computers-Office machines	555	764	525	0,3	0,3	0,2	12	11	11
• Electronics-Telecommunications	34190	29142	33094	4,4	2,4	2,3	8	10	11
• Pharmacy	965	2279	3317	1,3	1,9	2,4	6	5	6
• Scientific instruments	2700	4676	5544	0,7	1,1	1,5	10	9	9
• Electrical machinery	4276	5781	9528	6,2	7,9	9,0	4	5	5
• Non-electrical machinery	1687	1359	1534	1,2	0,8	0,7	11	11	11
• Chemistry	560	2363	3169	0,6	1,1	1,3	12	8	8
• Armament	0	0	0	0,0	0,0	0,0	14	14	14
Exports of ultra-high-tech products / USD/	28634	25477	29810	2,2	1,4	1,4	9	10	10
Share of high-tech products in the total exports of the region of Łódź	1,9	1,7	1,7	2,7	3,2	3,1	9	10	9
Share of ultra-high-tech products in the total exports of the region of Łódź	1,2	0,9	0,9	1,8	2,0	1,9	6	10	9

Source: Own calculations based on Main Statistical Office Data – Base.

Table 3. Region of Łódź. Exports' Dynamics of High-Tech Products

	Exports' dynamics in the Region of Łódź in 2004 – 2006 (in %)		Exports' dynamics in Poland in 2004–2006 (in %)	
	2005/2004	2006/2005	2005/2004	2006/2005
High-tech products	104,3	120,3	141,7	118,4
• Aerospace	285,8	2,9	98,1	158,8
• Computers-Office machines	137,7	68,7	129,9	122,1
• Electronics-Telecommunications	85,2	113,6	158,3	118,4
• Pharmacy	236,1	145,5	161,6	111,6
• Scientific instruments	173,2	118,6	108,5	90,1
• Electrical machinery	135,2	164,8	105,6	145,0
• Non-electrical machinery	80,6	112,8	124,5	124,5
• Chemistry	421,8	134,1	222,5	110,8
• Armament			508,9	120,7
ultra-high-tech products /	89,0	117,0	138,9	116,1

Source: Own calculations based on Main Statistical Office Data – Base.

Table 4. Region of Łódź. Exports structure of high-tech products

	Exports' structure of the region of Łódź in 2004 – 2006 (in %)			Exports' structure of Poland in 2004 – 2006 (in %)		
	2004	2005	2006	2004	2005	2006
High-tech products	100,0	100,0	100,0	100,0	100,0	100,0
• Aerospace	0,6	1,6	0,0	12,7	8,8	11,8
• Computers-Office machines	1,2	1,6	0,9	9,3	8,5	8,8
• Electronics-Telecommunications	75,6	61,8	58,3	38,4	42,9	42,9
• Pharmacy	2,1	4,8	5,8	3,7	4,3	4,0
• Scientific instruments	6,0	9,9	9,8	19,4	14,8	11,3
• Electrical machinery	9,5	12,3	16,8	3,5	2,6	3,2
• Non-electrical machinery	3,7	2,9	2,7	6,9	6,0	6,3
• Chemistry	1,2	5,0	5,6	4,9	7,8	7,3
• Armament	0,0	0,0	0,0	1,2	4,3	4,4
ultra-high-tech products /	63,3	54,0	52,5	65,1	63,9	62,6

Source: Own calculations based on Main Statistical Office Data- Base.

Table 5. Region of Łódź- Imports of high-tech products and competitive position in Poland

	Imports of the region of Łódź in 2004 – 2006 (thousands of USD)			Share of the region of Łódź in the imports of Poland (in %)			Position of the region of Łódź in the ranking of regions of Poland		
	2004	2005	2006	2004	2005	2006	2004	2005	2006
Total Imports of the Region of Łódź /USD/	3600182	3870461	4328279	4,1	3,8	3,5	7	7	7
Imports of high-tech products (USD)	174865	172443	199644	1,9	1,7	1,8	9	8	7
• Aerospace	705	1813	444	0,1	0,4	0,1	10	8	11
• Computers-Office machines	7738	5729	5253	0,4	0,2	0,2	9	8	8
• Electronics-Telecommunications	32374	30196	34960	0,9	0,8	0,8	9	11	11
• Pharmacy	75165	79235	98081	9,2	9,1	10,3	3	3	3
• Scientific instruments	15367	21236	22438	1,9	2,1	2,0	8	8	8
• Electrical machinery	5116	3989	4780	2,0	0,8	1,5	7	10	10
• Non-electrical machinery	7719	4146	11229	2,2	1,1	3,1	9	12	7
• Chemistry	30658	26029	22351	4,8	3,6	2,9	4	5	6
• Armament	22	71	109	0,0	0,0	0,1	13	11	12
Imports of ultra-high-tech products (USD/	51088	46951	46350	0,8	0,6	0,6	10	9	10
Share of high-tech products in the total imports of the region of Łódź	4,9	4,5	4,6	10,2	10,3	9,1	9	16	8
Share of ultra-high-tech products in the total imports of the region of Łódź	1,4	1,2	1,1	7,4	7,6	6,6	15	15	16

Source: Own calculations based on Main Statistical Office Data – Base.

Table 6. Region of Łódź- Imports of high-tech products and competitive position in ranking of regions in Poland

	Imports of the region of Łódź in 2004 – 2006 (thousands of USD)			Share of the region of Łódź in Polish import (in %)			Position of the region of Łódź in ranking of regions of Poland		
	2004	2005	2006	2004	2005	2006	2004	2005	2006
Population /thousands of USD/	2588	2582	2572	38174	38161	38132	6	6	6
Share in the population of Poland	6,8	6,8	6,7	100,0	100,0	100,0	6	6	6
Total Imports of the Region of Łódź <i>per capita (USD)</i> / shares in%	1391,3	1498,9	1683,2	2308,6	2660,1	3256,6	7	8	8
Imports of high-tech products-total <i>per capita (USD)</i>	67,6	66,8	77,6	235,1	273,5	295,4	8	8	8
• Aerospace	0,3	0,7	0,2	15,8	11,5	9,4	9	9	13
• Computers-Office machines	3,0	2,2	2,0	51,4	62,4	68,5	9	10	10
• Electronics-Telecommunications	12,5	11,7	13,6	90,5	103,6	121,0	11	11	11
• Pharmacy	29,0	30,7	38,1	21,4	22,9	25,0	3	3	2
• Scientific instruments	5,9	8,2	8,7	21,2	26,4	29,3	9	9	8
• Electrical machinery	2,0	1,5	1,9	6,8	12,3	8,6	8	11	12
• Non-electrical machinery	3,0	1,6	4,4	9,2	9,9	9,7	10	14	9
• Chemistry	11,8	10,1	8,7	16,7	18,8	20,2	4	5	7
• Armament	0,0	0,0	0,0	2,1	5,9	3,8	13	11	12
Imports of ultra-high-tech products <i>per capita (USD)</i>	19,7	18,2	18,0	171,2	201,2	214,0	11	13	13

Source: Own calculations based on Main Statistical Office Data-Base.

Table 7. Region of Łódź. Imports structure of high –tech products

	Imports' structure of the region of Łódź in 2004 – 2006 (in %)			Imports' structure of Poland in 2004 – 2006 (in %)		
	2004	2005	2006	2004	2005	2006
High-tech products	100,0	100,0	100,0	100,0	100,0	100,0
• Aerospace	0,4	1,1	0,2	6,7	4,2	3,2
• Computers-Office machines	4,4	3,3	2,6	21,9	22,8	23,2
• Electronics-Telecommunications	18,5	17,5	17,5	38,5	37,9	41,0
• Pharmacy	43,0	45,9	49,1	9,1	8,4	8,5
• Scientific instruments	8,8	12,3	11,2	9,0	9,7	9,9
• Electrical machinery	2,9	2,3	2,4	2,9	4,5	2,9
• Non-electrical machinery	4,4	2,4	5,6	3,9	3,6	3,3
• Chemistry	17,5	15,1	11,2	7,1	6,9	6,8
• Armament	0,0	0,0	0,1	0,9	2,1	1,3
ultra-high-tech products /	29,2	27,2	23,2	72,8	73,6	72,4

Source: Own calculations based on Main Statistical Office Data-Base.

Table 8. Region of Łódź. Imports' Dynamics of High-Tech Products

	Imports' dynamics in the Region of Łódź in 2004 – 2006 (in %)		Imports' dynamics in Poland in 2004 – 2006 (in %)	
	2005/2004	2006/2005	2005/2004	2006/2005
High-tech products	98,6	115,8	116,3	107,9
• Aerospace	257,0	24,5	72,7	81,7
• Computers-Office machines	74,0	91,7	121,2	109,8
• Electronics-Telecommunications	93,3	115,8	114,4	116,7
• Pharmacy	105,4	123,8	106,9	109,0
• Scientific instruments	138,2	105,7	124,5	110,9
• Electrical machinery	78,0	119,8	179,8	69,7
• Non-electrical machinery	53,7	270,8	107,6	97,5
• Chemistry	84,9	85,9	112,2	107,3
• Armament	328,0	153,8	284,1	65,0
ultra-high-tech products /	91,9	98,7	117,5	106,3

Source: Own calculations based on Main Statistical Office Data-Base.

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