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MEDICAL TECHNOLOGICAL SPECIALIZATIONS OF CENTRAL AND EASTERN EUROPEAN REGIONS

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ABSTRACT. The article discusses the issues of technological medical specializations in the regions of Central and Eastern Europe. Using a tool in the form of a proprietary concordance table *f:IPC→MedTech* and the index of relative comparative advantage – *Balassa's Revealed Comparative Advantage* – it seeks to answer the question about the trends and dynamics of medical technology in 56 regions of 11 countries which acceded to the European Union after 2003. The main objectives of the research are: The identification of technological medical specializations of regions of Central and Eastern Europe, and evaluation of their differentiation by interregional arrangement. The main findings derived from this research are: (1) The regions with the highest number of medical technology, where comparative advantage is maintained are mainly capital regions, (2) out of the 28 selected fields of medical technology, 10 of them are not developed in the regions covered by the survey.

JEL Classification: O33, O34 ***Keywords***: medical technologies, medical technological specialization, index of relative comparative advantage.

Introduction

Technics and technology are microeconomic characteristics. Their transposition to the level of regional analysis raises many problems. Recognizing that technology means all processing of tangible and intangible assets into usable goods, and in particular it constitutes an accumulated stream of scientific and technical knowledge on the practical use of the achievements of a specific area of science, in particular healthcare, its transposition and aggregation in regional terms will rely on the summing up of unit records of the rise of new medical and technical knowledge regarding healthcare. It is assumed that individual records materialize the accumulation of medico-technical knowledge. They lend themselves to quantification. The process of technological learning promotes the formation of medical technological potential, understood as a set of scientific and technical solutions, available to regional economic operators in many fields of science, including medicine.

This terminological context leads to two main research goals. These are: the identification of technological medical specializations of regions of Central and Eastern Europe, and evaluation of their differentiation by interregional arrangement. In order to

achieve the defined scientific objectives a proprietary concordance table *f:IPC→MedTech* and a *Balassa's Revealed Comparative Advantage* (RCA) index have been used.

The structure of the study is as follows. Section 1 discusses the literature in the field of technological comparative advantage. Section 2 describes the methodology and primary data used to achieve the goals of the study. Step 3 presents the results of the empirical analyses. Part 4 shows the possibilities and limitations of the research methodology used. The last section is a summary of the study.

1. Literature Review

The concept of technological potential has wide connotations. It can be understood as the set of technical solutions and procedures that domestic entities possess, but also as the ability to create streams of new or improved technological solutions (Stern *et al.*, 2000). The ownership of new (or improved) solutions can remain under the control of various players in the market. The development of technological capacity in various fields of industry (and science) is a result of the absorption capacity of the technology transferred from outside (the country/economic sector) and the efficiency of the process of its development.

The accumulation of capacities and capabilities of technological development embodied in the title deeds for new technical solutions has been more dynamic in recent decades, with radical changes in the approaches and methods for carrying out process managements, which is increasingly based on intangible resources. It should be clearly stated that depending on the cultural or institutional circumstances the accumulation process has a different course and dynamics. "It seems justifiable to assume that the relationship between technological change and the cultural and institutional characteristics of a given nation is one of the most important causes of the observed differences in the rates of inventiveness and economic growth between countries" (Gomułka, 1998, p. 14).

The results of research on the relationship between scientific achievements, industrial developments and structural changes in the economy initiated by J. Schumpeter (1934) emphasize particular skills and technological competence as a prerequisite towards obtaining comparative advantages (Malerba, Orsenigo, 1995). Compared with the traditional assumptions (R. Torrens, then D. Ricardo), the theory of comparative advantage should be regarded now as a logically cohesive structure of generalizations that explain the mechanism of mutually beneficial exchange of goods under the conditions of diversified costs and applicability of specific technologies for the production of a given good, including medical services (bundle of medical services).

D. Ricardo's theory is a useful economic model to this day, although S. Golub and Ch. Hsieh indicate that despite its large educational usefulness, in recent decades the model has been ignored in the professional literature, mainly because of its initially adopted assumptions. They indicated the 1960s, when the model was extensively used in economic studies (Stern, 1962; Balassa, 1963, 1965). Since the beginning of the 21st century a renaissance of empirical research on comparative advantages has been observed (Eaton, Kortum, 2002; Kerr, 2009; Chor, 2010; Levchenko, Zhang, 2012). The wide range of applications, in terms of measuring the comparative advantages, is the index of Revealed Comparative Advantage (RCA) proposed by Ballas (1965). Costinot, Donaldson, Komunjer (2012), and further Leromain, Orefice (2013) emphasize the importance of differences in access and use of technology as determinants of the diversity of patterns of trade (and patterns of services).

This study uses the concept of comparative advantage, giving it a new original meaning and interpretation. Balassa's RCA index is used here to measure the potential sources of advantage, i.e. those medical technological resources not fully disclosed and used in the

regional context. These resources are the hard to quantify results of the activities of human capital in the form of a new medical and technical knowledge, which, analysed from a technological perspective, allow us to determine the potentials of regional economies (R&D competences, continuity in the development of specific fields of medical technology), or the lack of them.

2. Methodology

The classifications of technologies and areas of technological development have been created and developed by many institutions (OECD, 2014). Creating technological taxonomies raises substantive dispute because it is a difficult task, including in the process of measurement. However, this task is accomplished as it brings new knowledge about the diversity of streams of technological development of countries and regions, acting as a characteristic challenge in the process the acquisition of scientific knowledge. The use of technological taxonomies is particularly difficult in respect of regions. This article presents the results of such research. Starting with the general assumption that the description of a new technical solution is part of the process of technological development, concordance tables are created linking sectoral classifications of the International Patent Classification (*IPC)* – a hierarchical system for classifying inventions. An important contribution in creating the concordance tables was introduced by Schmoch (2008), whose table became the basis for creating the concordance table of the World Intellectual Property Organization (WIPO). Creating technological fields using the IPC scheme should be assessed as a valuable way of addressing the problems in measuring the direction and dynamics of changes in technological developments in each layer of economic analysis. The defects in patent metadata are compensated for by the possibility of working with full collections, often reaching hundreds of thousands of items (when they are considered for national economies).

This study will use a proprietary concordance table covering 28 fields of medical technology (hereinafter: MedTech) plus an additional area associated with veterinary medicine, which can be analysed. The idea of the proposed research approach is based on the functional relationship *f:IPC→MedTech*, i.e. the assignment of the International Patent Classification (IPC) to the proprietary classification of medical technology fields.

$$MTS_{ik} = \left(\frac{P_{ik}}{\Sigma_k P_{ik}}\right) / \left(\frac{\Sigma_i P_{ik}}{\Sigma_{ik} P_{ik}}\right) \qquad \text{Equation (1)}$$

where: *MTSik* – potential relative medical technological advantage of the *i-th* region.

Using the concordance table (see *Appendix*, *Table 1*) connecting the areas of technology and international patent classification we can give the following meanings for individual parameters of equation (1):

P_{ik} – the number of technical solutions of the *i-th* region in the area of the *k-th* medical technology,

$\Sigma_k P_{ik}$ – the total number of technical solutions of the *i-th* region in all the medical technological areas considered,

$\Sigma_i P_{ik}$ – the total number of technical solutions within the *k-th* medical technology of all the investigated *i-th* regions,

$\Sigma_{ik} P_{ik}$ – the total number of technical solutions within all the areas of medical technology in all the regions investigated.

The index value belongs to the set MTS $\in (0, +\infty)$. A value above unity indicates the relative technological advantage within the surveyed population (e.g. the specific set of European regions). A value below unity indicates a relatively weak competitive position in a

particular field of medical technology against others. This equation can be logarithmised, then we have: log(MTS) ∈ ℝ. The threshold value for the interpretation of advantages/weaknesses is then zero. Positive values for a given country indicate areas of potential technological advantage, negative values of disadvantaged areas. When we perform the simple modifications: (MTS - 1)/(MTS + 1) = MTS*, then MTS* ∈ [-1; +1]. The value MTS is the resultant effect of two factors: the dynamics of the relative partial sizes and changes in the structure of these factors.

3. Results of empirical analysis

Using the ratio of the absolute measure of dispersion standard deviation (σ) and the mean value (μ) we obtain the classic coefficient of variation (V_i) which determines the degree of diversification of a specific medical technological specialization in the time and space studied. The higher the dispersion, the narrower the technological specialization of the region. Low values of this characteristic can be interpreted as a relatively equally spread technological competence throughout the population of the considered areas of technological development. In examining the abovementioned relationship from the technological perspective, we can identify the relative technological advantage of a region and give an indication of its diversity within the group. A higher variability index value indicates an emerging technological specialization; a weakly exploited area or one exploited by all countries in a similar range and with similar search results.

The *Appendix* (*Table 2*) shows the cumulative (from the period 1994 to 2014) of the MTS index obtained through the use of a set of patent metadata of the European Patent Office (EPO) and proprietary technological concordance table (*Appendix*, *Table 1*). *Table 2* of *Appendix* leads to the following arrangements for the regions of Central and Eastern Europe:

1) the MTS indicator above unity indicates the relative technological advantage within the surveyed population (i.e. 56 European regions); considering this criterion the following leaders – i.e. the regions with the highest number of medical technologies should be indicated, where a comparative advantage is maintained: (1) Mazowieckie voivodship (7 fields of medical technology); (2) Zahodna Slovenija (6 fields of medical technology); (3) Praha, Jihovýchod, Közép-Magyarország (5 fields of technology); (4) 4 fields of medical technology are identified for: Małopolskie voivodship, Észak-Magyarország, Dél-Alföld, and Latvija and Estonia (i.e. the countries that meet the criterion of classification at the NUTS level 2);
2) 16 regions of Central and Eastern Europe do not have the competence development of medical technology, they are: Slovak – Východné Slovensko, Czech – Moravskoslezsko, 6 Romanian regions (Nord-Vest, Centru, Sud-Est, Sud – Muntenia, Sud-Vest Oltenia, Vest), and the voivodships: Podkarpackie, Świętokrzyskie, Podlasie, Zachodniopomorskie, Opolskie, Kujawsko-Pomorskie, Warmia-Mazury and Lietuva (the country meets the criterion of classification at the NUTS level 2);
3) the most intense and balanced development have been identified in the areas of: (1) hospitals, hospital equipment, medical transport, special – medical equipment, ampules, devices for special therapeutic purposes; (2) genome, genetic, organic macromolecular compounds; their preparation or chemical working-up; compositions based thereon, micro-organisms or enzymes; cells;
4) those in second place are: (1) specific therapeutic activity of chemical compounds or medicinal preparations, drugs, pills, tablets, vaccines; (2) electrotherapy; magnetotherapy; radiation therapy; ultrasound therapy; (3) surgical, orthopaedic treatment; (4) surgical instruments, devices or methods, e.g. tourniquets, eye and ear surgery, for transferring non-mechanical forms of energy to or from the body;

(5) instruments for auscultation; (6) health and care; (7) mutation or genetic engineering; DNA or RNA concerning genetic engineering, vectors, e.g. plasmids, or their isolation, preparation or purification; use of hosts therefor; (8) measuring for diagnostic purposes;

5) the greatest technological concentration is observed in: (1) instruments for performing medical examinations of the interior of cavities or tubes of the body by visual or photographical inspection, e.g. endoscopes; (2) laboratory equipment; (3) instruments for examination by percussion; pleximeters.
6) the variation in the number of developed fields of technology is generally determined by the size of the region's economy.

This analysis was further enriched by cluster analysis (Everitt *et al.*, 2011; Kaufman, Rousseeuw, 2005; Grabiński *et al.*, 1989; Grabiński, 1984). To determine the distance between the 28 technological groups indicated, the nearest neighbour method was used (Panek, Zwierzchowski, 2013; Sneath, Sokal, 1973). A graphical illustration of the sets of distance measures between the successive technological groups are given in *Figure 1*.

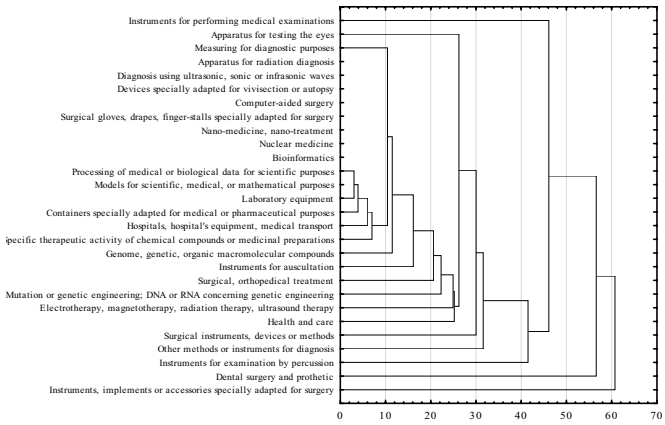

Figure 1. Dendrogram cluster of medical technologies among 56 regions of Central and Eastern Europe
Source: Own report.

As a result of assignments and calculations a matrix of Euclidean distances was obtained between the 28 medical technologies. In order to isolate the aggregates of medical technologies as much as possible similar to each other because of the variables used to describe them, a division of connectivity tree, taking into account a critical distance value of 30 (Stanisz, 2007).

Reading figure 1 leads to the deletion of the structures of clusters of regional technological medical specialties of the total regions analysed.

The first structure includes 10 medical technologies that are not developed in the analysed 56 regions of Central and Eastern Europe, they are:

1) apparatus for radiation diagnosis, e.g. combined with radiation therapy equipment;
2) diagnosis using ultrasonic, sonic or infrasonic waves;
3) devices specially adapted for vivisection or autopsy;
4) computer-aided surgery; manipulators or robots specially adapted for use in surgery;
5) surgical gloves; drapes; finger-stalls specially adapted for surgery; devices for handling or treatment thereof; containers, covers, furniture or holders specially

adapted for surgical or diagnostic appliances or instruments, e.g. sterile covers;
6) nano-medicine, nano-treatment;
7) nuclear medicine;
8) bioinformatics;
9) processing of medical or biological data for scientific purposes
10) models for scientific, medical, or mathematical purposes, e.g. full-sized device for demonstration purposes, investigating materials for medical purpose.

The second structure, the broadest, comprises 13 fields of medical technology that are relatively similarly developed in various regions of Central and Eastern Europe.

The third structure is a group of technological outsiders in which only a few regions exert their activity. These are: (1) instruments, implements or accessories specially adapted for surgery or diagnosis and not covered by any of the groups, protective face masks, surgeons' or patients' gowns or dresses, devices for carrying-off; and (2) dental surgery and prosthetics. The most specialized region in these areas is the Silesian voivodship (Poland). This group also includes additional technologies such as: (3) instruments for performing medical examinations of the interior of cavities or tubes of the body by visual or photographical inspection, e.g. endoscopes; (4) Instruments for examination by percussion; pleximeters; and (5) other methods or instruments for diagnosis, e.g. for vaccination diagnosis; sex determination; ovulation-period determination; throat striking implements.

4. Discussion

Methodological discussion on the scope and usage of patent statistics in economic research (Basberg, 1987; Pavitt, 1985; Archibugi, 1992; Griliches, 1990; Hinze, Schmoch, 2005; OECD, 2009) is not widespread compared to the methodological discussions in the areas of innovation or bibliometrics. The methodology of using sets of patent information was generally overshadowed by the research initiative which is innovation statistics using the methodological recommendations of the Oslo Manual, in particular the Community Innovation Survey international research programme. Although the disadvantages of patent indicators as measures of innovative activity are so often emphasized, they are consistently used as measures of one of the stages of innovative activity.

Innovation research does not provide direct knowledge of technological accumulation and technological changes. Patent information provides greater opportunities in this area, because it delves deeper into these processes compared to other alternative methodological approaches. Its main advantage is the high flexibility of aggregation and disaggregation of the processes analysed. It allows the identification of the strategy for directions of future development. Patent information and innovation surveys provide the most important knowledge on the trends and dynamics of technological change at the micro, meso and macroeconomic levels.

The results of this analysis allow for the formulation of the four types of conclusions. Firstly, the procedure used and the results obtained allow the regions in which medical technologies are developed to be specified. Secondly, they indicate the specific nature of this advancement – that is to say which specific technological advancement is concerned. Thirdly, because the analysis is based on patents, it is possible to conclude that we are dealing with solutions which were identified as of specific use in medical practice. And fourthly, the knowledge gained through the use of just such a procedure can assist the decision-making process for selecting Smart Specialization in the creation of Regional Development Strategies.

Conclusions

The analysis of potential technological medical specialties in 56 regions of the countries of Central and Eastern enables the following conclusions to be derived:

1) among all the regions covered by the survey, the regions with the highest number of medical technologies, where a comparative advantage is maintained, are: Mazowieckie voivodship, Zahodna Slovenija, Praha, Jihovýchod, Közép-Magyarország, Małopolskie voivodship, Észak-Magyarország, and Del-Alföld;
2) regions where there were no technological competences in the field of medicine include: Slovak – Východné Slovensko, Czech – Moravskoslezsko, Romanian – Nord-Vest, Centru, Sud-Est, Sud – Muntenia Sud-Vest Oltenia, Vest, and the voivodships: Podkarpackie, Świętokrzyskie, Podlaskie, Zachodniopomorskie, Opolskie, Kujawsko-pomorskie, Warmińsko-mazurskie;
3) The most intense and balanced development occurs in the following areas: (1) hospitals, hospital equipment, medical transport, special – medical equipment, ampules, devices for special therapeutic purposes; (2) genome, genetic, organic macromolecular compounds; their preparation or chemical working-up; compositions based thereon, micro-organisms or enzymes; cells;
4) a relatively high level of competitiveness (in the case of all the regions taken together) has been identified in: (1) instruments for performing medical examinations of the interior of cavities or tubes of the body by visual or photographical inspection, e.g. endoscopes; (2) laboratory equipment; (3) instruments for examination by percussion; pleximeters.
5) medical technologies which are not developed in the 56 regions of Central and Eastern Europe under discussion are: apparatus for radiation diagnosis, e.g. combined with radiation therapy equipment; diagnosis using ultrasonic, sonic or infrasonic waves; devices specially adapted for vivisection or autopsy; computer-aided surgery; manipulators or robots specially adapted for use in surgery; surgical gloves; drapes; finger-stalls specially adapted for surgery; devices for handling or treatment thereof; containers, covers, furniture or holders specially adapted for surgical or diagnostic appliances or instruments, e.g. sterile covers; nano-medicine, nano-treatment; nuclear medicine; bioinformatics; processing of medical or biological data for scientific purposes; and models for scientific, medical, or mathematical purposes, e.g. full-sized device for demonstration purposes, investigating materials for medical purpose.

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Appendices

Table 1. Classification of medical technology fields

	Medical Technologies	IPC
1	Instruments for performing medical examinations of the interior of cavities or tubes of the body by visual or photographical inspection, e.g. endoscopes	A61B0001
2	Apparatus for testing the eyes; Instruments for examining the eyes	A61B0003
3	Measuring for diagnostic purposes	A61B0005
4	Apparatus for radiation diagnosis, e.g. combined with radiation therapy equipment	A61B0006, G03B004202
5	Instruments for auscultation	A61B0007
6	Diagnosis using ultrasonic, sonic or infrasonic waves	A61B0008
7	Instruments for examination by percussion; Pleximeters	A61B0009
8	Other methods or instruments for diagnosis, e.g. for vaccination diagnosis; Sex determination; Ovulation-period determination; Throat striking implements	A61B0010
9	Devices specially adapted for vivisection or autopsy	A61B0016
10	Surgical instruments, devices or methods, e.g. tourniquets, eye and ear surgery, for transferring non-mechanical forms of energy to or from the body	A61B0017, A61B0018, A61F0006, A61F0009007, A61F0011, B25J, B26F, B26B001322
11	Computer-aided surgery; Manipulators or robots specially adapted for use in surgery	A61B0034
12	Surgical gloves; drapes; Finger-stalls specially adapted for surgery; Devices for handling or treatment thereof; Containers, covers, furniture or holders specially adapted for surgical or diagnostic appliances or instruments, e.g. sterile covers	A61B0042, A61B0046, A61B0050
13	Instruments, implements or accessories specially adapted for surgery or diagnosis and not covered by any of the groups, protective face masks, surgeons' or patients' gowns or dresses, devices for carrying-off,	A61B0090, A41D001311, A41D001312, A41D0019, A61M0001
14	Dental surgery and prothetic	A61C
15	Surgical, orthopedical treatment	A61F, B25C0005, B26B, B26B0005, B27F0007, B65D008308, B65D0085, C09J, D04B000952, D05B0085, F16B0015
16	Hospitals, hospital's equipment, medical transport, special - medical equipment, ampules, devices for special terapeutic purposes	A61G, A61H, A61K, A61L, A61M, A61Q, G02B0023, G06Q005022, E04H000308, F21W0131208, H04N0021214, G21K, A47B0067, B42D002528, B64D0013, B65D000109, F21W013120, G03B001514, A62B0031, B42D002528

	Medical Technologies	IPC
17	Containers specially adapted for medical or pharmaceutical purposes; devices or methods specially adapted for bringing pharmaceutical products into particular physical or administering forms; devices for administering food or medicines orally; baby comforters; devices for receiving spittle	A61J
18	Electrotherapy; magnetotherapy; radiation therapy; ultrasound therapy	A61N, G01N, H01J0035, G21G000408
19	Specific therapeutic activity of chemical compounds or medicinal preparations, drugs, pills, tablets, vaccines	A61P, B82Y0005, B41F001736, B65B006122, B65D008304, F23Q000224, A23F000332, A23F000512, A23F000538, A23P001020, A23P001028, A42B000124, A45C001502, B30B0011, B30B001134, B41F001736, B43L, B43L0001, B61L002324, B65D008304, C09B0067, C09B006702, B65D000109
20	Mutation or genetic engineering; DNA or RNA concerning genetic engineering, vectors, e.g. plasmids, or their isolation, preparation or purification; Use of hosts therefor	C12N0015, C40B0010
21	Laboratory equipment	B01L
22	Genome, genetic, organic macromolecular compounds; their preparation or chemical working-up; compositions based thereon, micro-organisms or enzymes; cells	A01H000106, C07H, C07K, C08, C12N0001, C12N0003, C12N0005, C12N0007, C12N0009, C12N0011, C12N0013, G06N000312, G10L002539, H01L0021108, G01N003315
23	Nano-medicine, nano-treatment	B82B, B82B0003, B82Y0005, G01Q0080
24	Nuclear medicine	G01T0001161, G01T0001164, G21G000409
25	Bioinformatics	G06F001910
26	Processing of medical or biological data for scientific purposes	G06F001912, G06F001914, G06F001916, G06F001918, G06F001924
27	Models for scientific, medical, or mathematical purposes, e.g. full-sized device for demonstration purposes, investigating materials for medical purpose	G09B0023, G01N003315
28	Health and care	A01K, A01K0013, A01L0015 A43B002322, A43B000700, G01S001908, G10L002566
29	Veterinary	A61D

Source: Own report.

Table 2. MTS within 56 regions of Central and Eastern Europe

Medical Technologies (see table 1)	Severozapaden	Severen tsentralen	Severoiztochen	Yugoiztochen	Yugozapaden	Yuzhen Tsentralen	Praha	Střední Čechy	Jihozápad	Severozápad	Severovýchod	Jihovýchod	Střední Morava	Moravskoslezsko	Estonia	Croatia - Adriatic	Croatia - Continental	Közép-Magyarország	Közép-Dunántúl	Nyugat-Dunántúl	Dél-Dunántúl	Észak-Magyarország	Észak-Alföld	Dél-Alföld	Lietuva	Latvija	Łódzkie	Mazowieckie
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	56,5	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	28,3	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	1,1	0	0	9,3	0	0	1,3	0	0	0	0	0	0	0	0	3,9	2,0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	16,1
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	18,8	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	2,9	0	6,5	0	0	0	0	0	1,6	0,5	8,7	0,9	0	0	0	6,5	0	4,3	0	0	0	1,2
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	22,6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,7
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3,3	0	0,8	0	56,5	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	1,0	0	0	0	0	2,0	0	0	0	0	12,6	0,7	0	0	0	0	0	0	0	0	0	1,8
16	1,9	0,9	0	0	1,2	0,9	0,8	1,9	0,5	0	1,1	1,1	1,5	0	0,3	1,2	0,6	1,3	0,6	0	1,9	0,2	1,4	0,8	0	1,1	0,3	0,4
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0,9	0	7,9	0	0	0	3,2	0	3,0	0,3	0	1,5	0	5,3	0	2,0	0	2,6	0	0	0,6	0,8
19	0	0	0	0	1,9	0	0	0	0	0	0	3,6	0	0	0	0,7	0	0,8	0	0	0	4,2	2,0	2,8	0	0	0	0
20	0	0	0	0	0	0	1,0	0	0	0	0	0	0	0	0	0,7	0	0	0	0	0	0	0	0	0	0	4,2	3,6
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3,0	0	0	0	0	0	0	0	0	0	0
22	0	3,0	6,0	0	1,7	0	1,8	0	0	6,0	1,2	0,6	0	0	0,4	1,4	0	0,3	4,0	0	0	0,8	1,1	0,5	0	1,5	3,1	2,0

Medical Technologies (see table 1)	Severozapaden	Severen tsentralen	Severoiztochen	Yugoiztochen	Yugozapaden	Yuzhen Tsentralen	Praha	Střední Čechy	Jihozápad	Severozápad	Severovýchod	Jihovýchod	Střední Morava	Moravskoslezsko	Estonia	Croatia - Adriatic	Croatia - Continental	Közép-Magyarország	Közép-Dunántúl	Nyugat-Dunántúl	Dél-Dunántúl	Észak-Magyarország	Észak-Alföld	Dél-Alföld	Lietuva	Latvija	Łódzkie	Mazowieckie
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	19,9	1,1	0	0	0	0	4,2	0	0	2,5	0,8	0	0,5	0	13,3	0	10	0	0	0	0	0	0,9
29	0	0	0	678	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MTS >0	*1,9*	*3,9*	*6,0*	*678*	*4,8*	*20,9*	*9,6*	*1,9*	*14,9*	*6,0*	*24,9*	*12,6*	*4,6*	*0*	*17,1*	*8,8*	*21,9*	*13,1*	*4,6*	*75*	*1,9*	*23,7*	*4,5*	*39,3*	*0*	*77,9*	*12,1*	*31,5*
V_i	529	418	529	529	299	505	205	529	357	529	479	241	392	0	305	222	363	163	461	406	529	274	305	382	0	399	275	276

Source: Own report.

Table 2. MTS within 56 regions of Central and Eastern Europe, cont.

Medical Technologies (see table 1)	Małopolskie	Śląskie	Lubelskie	Podkarpackie	Świętokrzyskie	Podlaskie	Wielkopolskie	Zachodniopomorskie	Lubuskie	Dolnośląskie	Opolskie	Kujawsko-Pomorskie	Warmińsko-Mazurskie	Pomorskie	Nord-Vest	Centru	Nord-Est	Sud-Est	Sud - Muntenia	Bucureşti - Ilfov	Sud-Vest Oltenia	Vest	Vzhodna Slovenija	Zahodna Slovenija	Bratislavský kraj	Západné Slovensko	Stredné Slovensko	Východné Slovensko	V_i
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	755
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5,7	0	0	0	0	639
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,4	0	0	0	0	429
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	755
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	42,4	0	0	0	0	0	755
8	26,6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	537
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	26,1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6,5	0	0	0	335
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	6,6	56,5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	518
14	0	28,3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	533
15	2,2	0	0	0	0	0	4,2	0	0	12,6	0	0	0	0	0	0	0	0	0	0	0	0	4,7	0	9,4	0	0	0	302
16	1,1	0,3	0,6	0	0	0	0,4	0	0	0,6	0	0	0	0,9	0	0	1,5	0	0	0	0	0	1,3	0,9	0,5	0	1,2	0	106
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3,8	0	0	0	0	554
18	0,9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15,8	0	0	0	0,3	0	15,8	0	0	297
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4,5	0	0	0	0	290
20	0	0	0	0	0	0	16,7	0	0	12,6	0	0	0	6,3	0	0	0	0	0	0	0	0	0	1,3	0	0	0	0	357
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	755
22	0,7	1,0	4,0	0	0	0	1,3	0	0	0	0	0	0	2,0	0	0	1,2	0	0	0	0	0	0,8	1,3	1,5	0	2,0	0	159

Medical Technologies (see table 1)	Małopolskie	Śląskie	Lubelskie	Podkarpackie	Świętokrzyskie	Podlaskie	Wielkopolskie	Zachodniopomorskie	Lubuskie	Dolnośląskie	Opolskie	Kujawsko-Pomorskie	Warmińsko-Mazurskie	Pomorskie	Nord-Vest	Centru	Nord-Est	Sud-Est	Sud - Muntenia	București - Ilfov	Sud-Vest Oltenia	Vest	Vzhodna Slovenija	Zahodna Slovenija	Bratislavský kraj	Západné Slovensko	Stredné Slovensko	Východné Slovensko	V_i
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,7	0	0	0	0	348
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	755
MTS >0	*38,2*	*86,1*	*4,6*	*0*	*0*	*0*	*22,7*	*0*	*26,1*	*25,7*	*0*	*0*	*0*	*9,2*	*0*	*0*	*2,7*	*0*	*0*	*15,8*	*0*	*0*	*49,1*	*20,7*	*17,9*	*15,8*	*3,2*	*0*	
V_i	375	382	461	0	0	0	399	0	529	358	0	0	0	376	0	0	370	0	0	529	0	0	457	207	333	529	378	0	

Source: Own report.