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INNOVATION VERSUS STRUCTURAL CHANGES IN EMPLOYMENT IN THE LIGHT OF THE AVAILABLE STATISTICAL DATA IN PODLASKIE VOIVODESHIP

Summary

Aim – The study aimed at defining the role of innovation as a factor related to shaping the regional labor market. The Author, based on the results of the available data, attempted to define the relation between innovative activity companies and employment and to verify the hypothesis that the implementation of innovation has influence on the increase of working positions and results in a change in the structure of employment in the region.

Research methodology – The paper presents selected data from the Central Statistical Office, including mainly the results concerning the outlays on R&D, the activity of companies in Podlaskie voivodeship, and employment, including the division into PKD sections from 2007. On the basis of the conducted study there was conducted analysis of the impact that the implementation of innovations in particular sections has had on the increase of employment in them.

Result – The influence of innovation on employment is connected to so-called creative destruction, which means that on the one hand innovation destroys existing working positions, but on the other hand it creates new ones – more specialized and requiring new knowledge.

Originality/value – The analysis of the impact of implementing innovations on the employment level in particular sections of Podlaskie voivodeship.

Key words: innovations, employment, Podlaskie voivodeship

JEL: E24, O31

1. Introduction

Innovation and the activity of companies that is related to innovation constitute a subject of interest of both science and economic practice. The relation between innovations and structural changes in the economic reality shows that they constitute the main reason for the development of particular economies, especially ones connected with transferring economic activity from traditional spheres into modern ones. One of these relations are the links between innovations and employment, which are very complex. Moreover, the way of perceiving them is changing. Presently the analysis is focused on the impact of new solutions on the state and the structure of employment, which is particularly

complex because these relations are frequently indirect and their consequences are deferred in time.

The elaboration aims at specifying the relation between innovation activity and employment in Podlaskie voivodeship. The paper presents in brief the concept of innovation and the basic types of innovations and their impact on changes in employment. In a further part the Author characterizes changes in employment in Podlaskie voivodeship that were caused by the implementation of innovations, i.e. the state, dynamics, and structure of employment in the years 2011–2016.

2. Definition and division of innovations – selected issues

The concept of innovation is inextricably linked with the concept of change, novelty, reform, or an idea perceived as new (Latin words: *innovatio* or *innovare*). It is assumed that this concept was introduced in the economic sciences by J. A. Schumpeter who defined innovation as the introduction of a new solution into practical use as regards [Schumpeter, 1960, p. 104]:

- a new good that is unfamiliar for a consumer or a new type of a certain good;
- a new method of production that has never been tested in a certain industry sector;
- a new market where a certain type of national industry has not been introduced so far, regardless of whether the market existed earlier or not;
- a new source of raw materials or semi-finished products, regardless of whether this source existed already or it was necessary to form it;
- new organization of industry, e.g. formation or destruction of monopoly.

In accordance with the definition formed by J. A. Schumpeter, innovation denotes a new solution (either a new or improved product, market, source of raw materials) implemented in economic practice, whereas the subsequent usage of this solution (popularization) is termed as imitation, i.e. solely a copy of the earlier improvement. Authors are not unanimous in relation to this approach, owing to which there are distinguished innovations in a narrower and broader sense, thus they comprise either only the first implementation of the idea or both the first and subsequent implementations.

Innovation in a narrow sense means a change in production methods and products (or in the organization of the production process) that is based on new or not yet used knowledge [Janasz, Kozioł-Nadolna, 2011, p. 12]. In this case there are isolated [Szatkowski, 2001, pp. 17–65]:

- fundamental/radical change that includes the transformation of a new idea or invention of a technological type into a market product or process;
- first usage of science and technology in a new way that ensures success on the market as well as the first commercial introduction of a new product, process, system, or device on the market and first usage of the invention.

In a narrow meaning innovation constitutes the implementation of one type or several types of innovations. The minimum requirement for the existence of innovation is that a product, process, marketing method, or organizational method ought to be new (or considerably improved) from the point of view of the company. There are included products, processes, and methods that a certain company elaborated as the first one or that were assimilated from other companies or entities [*Oslo Manual*, 2008, pp. 48–49].

TABLE 1

Types of innovations

Criterion of innovations' division	Type of innovations
reasons of forming an innovation	– of demand type – of supply type
the place where the innovation was used	– within a company – in the company's market surrounding
new solutions with regards to markets	– regional – national – international – global
original character of solutions, dimension of changes	– radical (pioneering) – imitating (adaptive)
origin related to the ownership of the innovation	– from the company – from outside the company – result of companies' cooperation in the process of innovations
the way of elaborating and implementing an innovation	– systemic innovation realized in accordance with the elaborated procedure – single
entity – performer of the innovation	– one person – team of workers – company – companies cooperating with one another within a network organization
result of performing certain activities in the innovation process	– idea for new solutions – concept of innovation solution – elaboration of the innovation – innovation implemented in a company sold as a product on the market

Source: [Dolińska, 2010, pp. 81–82].

Adversely, innovation in a broad sense comprises all the processes of creative thinking that strive for the usage of improved solutions in technique, technology, and the organization of social life – i.e. it does not imply direct usage of

the invention [Wyrwisz, 2003, p. 248]. This process of management comprises various activities that aim at creating, developing, and introducing values in products or new combinations of measures and resources that are entirely new in the case of the entity that either creates or introduces them [Niedzielski, Rychlik, 2006, p. 21]. The broad sense refers to each good that is perceived by someone as new, or it denotes each change in products and processes that improves the competitiveness of a company in relation to other entities functioning on the market [Wasilewska, Wasilewski, 2016, p. 23].

In the subject literature there are isolated many other types of innovations included in terms of various criteria. Owing to the limited character of the elaboration selected divisions are presented in table 1.

From the point of view of the aim of this elaboration it is also necessary to present the division of innovations in accordance with the subject criterion in which there are isolated [*Oslo Manual*, 2008, p. 19, 49; Węgrzyn, 2015, pp. 95–98]:

1) product innovations – introduction of a new product/service on the market or substantial improvement of existing goods (there are distinguished mainly changes of functional properties);
2) process innovations – improvement or introduction of a new method of distribution (changes of technologies, software or/and devices in the auxiliary activity, i.e. supply or book-keeping);
3) organization innovations – implementation of a new organizational method by a company (the aim is to reduce the costs or increase work efficiency, achieve access to assets that are not the subject of work efficiency, obtain access to assets that are not the subjects of trade);
4) marketing innovations – introduction of a new marketing concept/strategy, which has not been used by a company so far, in order to improve the effectiveness of satisfying the needs of consumers, open new supply markets, or increase sales.

3. Innovations versus structural changes in employment

Changes in economic structure (relations between its elements) constitute one of the key factors of economic growth. Structural changes in the economy denote both quantity and quality transformations of all the elements of an economy's structure, the consequence of which is the increase of economic structures [Kozłowska, 2010, p. 74]. Quantity transformations refer to changes in the significance of particular components of the system in which there is observed simultaneously the formation of new and the disappearance of old elements of the structure [Węgrzyn, 2013, pp. 210–211]. The main incentive for these modifications are those innovations that play a major role on the labor market – on the one hand – on the demand for labor (its dimension and structure), which, in turn, is the condition of changes in the labor supply.

In literature the factors related to the impact of innovations on employment include [Węgrzyn, 2015, p. 147]:

- type of technical advancement (capital–intensive, economical with capital, neutral, scale benefits);
- current and predicted preferences of consumers (magnitude and dynamics of the global demand, price flexibility of demand, income flexibility of demand);
- type and structure of market (competitiveness level, barriers for input and output);
- character and structure of the labor market (wage flexibility, the role of trade unions, preferences of employees – labor, free time);
- level and quality of human capital (education level, age of employees, territorial diversification, the mobility of employees).
- types of implemented innovations that determine the scale, dynamics, and direction of changes.

Analysis of the problem related to the innovative character of companies induces one to consider the effects of implemented innovations in the process of forming and liquidating working positions. Many economists have analyzed the relation of technological advancement and later also the relation between innovations and employment. On the one hand, attention was drawn to the fact that innovations chiefly contribute to the reduction of demand for labor and as a consequence they lead to reducing unemployment in a longer time perspective. Such an approach was represented by J.Ch. Simonde de Sismondi, who claimed that technical advancement usually reduces the demand for workers unless the introduction of new machines is preceded by increasing the income of the population [Sismondi, 1955, p. 56]. Another author with similar views was A. Sauvy, who claimed that on the one hand new solutions (mainly machines) contribute to the replacement of man's work, but on the other hand they constitute considerable development of the entire society [Sauvy, 1980, p. 78]. However, it needs emphasizing that both economists based their views on the then economic reality dominated by technological innovations. Owing to this it is very difficult to refer their views to contemporary economics.

Adversely, E. Brynjolfsson and A. McAfee proved in their analyses that innovations contribute to decreasing employment and, later on, to hampering the increase of incomes. Furthermore, they may contribute to the creation of even greater social inequalities. The aforementioned consequences are the result of very rapid digital acceleration and a large number of implemented innovations because many working positions become dematerialized and disappear owing to the replacement of man's work by a computer. On the other hand, the labor market reacts too slowly to those changes and leads to a situation where many people are made redundant and unemployment increases [Brynjolfsson, McAfee, 2011, p. 28].

In the literature there is also another approach to the relation between innovations and employment – it is represented, among others, by H. Hazlitt.

This scientist in his works attempted to present the positive impact of innovations on employment. According to the Author the purpose of each change is improvement instead of increase of unemployment. The introduction of a new machine replacing man's work will only temporarily increase unemployment because machine operation requires work performed by man's hands but to another degree than it was beforehand. There will appear new working positions that require new skills and knowledge that would not be formed without the implementation of a certain innovation. Moreover, a new solution (the aim of which is to increase the effectiveness of labor) brings more profits for an entrepreneur that may be earmarked for extending the activity and thus for the increase of employment [Hazlitt, 2004, p. 53].

A characteristic phenomenon accompanying innovations is the increase of the number of working positions in the service sector and in highly paid professions as well as in professions that require expertise [Dziewięcka-Bokun, Zamorska, 2003, p. 43]. Each kind of technological change is synonymous with specific changes in the demand for labor. The changes of demand for labor in terms of qualifications are particularly clear [Węgrzyn, 2007, p. 136]. There is observed a constant growth of demand for highly qualified personnel. This phenomenon is the result of clear acceleration of the rate of technical and technological advancement. According to E. Kryńska the advancement and diffusion of new technological solutions are accompanied by new forms of labor organization that lead to considerable reduction in the demand for either low-qualified or unqualified personnel [Kryńska, 2004, p. 237].

Therefore, the impact of innovations on employment may be considered through the prism of [Szukalski, 2001, p. 43; Kwiatkowska, 2007, pp. 27–29]:

- the effect of employment reduction which is connected with the replacement of real labor by capital leading to the reduction of some working positions (especially in traditional and ineffective sectors and among low-qualified employees);
- the effect of employment compensation which denotes the formation of new working positions (in particular in the sectors of modern technologies) related to the emergence of new products or services, new sale markets.

The introduction of new products or services (product innovations) results in the increase of income from sales and as a consequence causes increased employment. In the case of using a new production process or offering service (process innovations) the effects are not so tantamount. There is an observed increase of work efficiency but on the one hand it leads to the reduction of employment, and on the other hand it leads to its growth by means of increased demand caused by reducing the product's price. The influence of innovations on employment is related to creative destruction because on the one hand innovations destroy work positions, whereas on the other hand they create them. Additionally, in the analysis of the impact of improvements on changes on the labor market it is important to take into consideration a number of such factors as: the type of implemented innovations, the usage of existing technologies

in new spheres, relations between sectors, and creation and diffusion of knowledge [Węgrzyn, 2013, p. 212].

The impact of innovations on employment may be different in the case of an innovative character manifested in the establishment of new companies and in the case of the innovative character in existing entities changing/modifying the offered products. Additionally, it is related to increased rotation on the labor market caused by innovations. In the case of small companies, it is connected with the uncertainty related to the innovative activity in the early stage of the company's functioning and to the high probability of failure, which is synonymous with greater formation/destruction of working positions [Bogliacino, 2014, pp. 142–143]. Yet, in the existing entities undertaking innovative activity there occurs a positive relation between the innovative character and both employment and rotation – innovative companies usually form more working positions while abstaining from the reduction of them [NBP, 2016, p. 82].

In the further part of this elaboration there will be presented conclusions from the analysis of the impact of particular types of innovations on employment in Podlaskie voivodeship. They will enable identification of the most essential types of innovations.

4. Influence of innovations on employment in Podlaskie voivodeship in the years 2011–2016

In the light of the aforementioned considerations, the assumption implying that innovations are conducive to the formation of working positions does not appear to be obvious. Below will be presented an attempt at empirical verification of this assumption. The available statistical data to a reduced degree enable precise analysis of the impact of innovations on the dimension of employment. The analysis will be conducted on the basis of statistical data from Local Data Bank of GUS concerning Podlaskie voivodeship in the years 2011–2016.

In the analyzed period the participation of innovative companies in the total number of companies in the sector of industrial companies increased only by 2.5%, whereas in the service sector it decreased by 5.5% (table 2).

In the analyzed period the difference between the participation of innovative companies in industry and in services increased from 8.19 percentage points to 9.12 percentage points in favor of industrial companies. In the years 2011–2016 in the industrial sector there is observed an increase in the number of product innovations by 23.68%, whereas in the case of process innovations there occurred increase oscillating at 13.8% in the analyzed period. In the service sector one may observe a decrease in the case of both product innovations and process innovations – respectively by 32.4% in the case of innovations related to products, whereas in the case of process innovations there was decrease by 6.43%. The results referring to organization innovations and marketing innovations

TABLE 2

Innovative companies in terms of introduced innovations in Podlaskie voivodeship in the years 2011–2016 (in %)

	Years					
	2011	2012	2013	2014	2015	2016
Industry						
total	17.09	21.95	23.37	18.73	20.59	17.53
product innovations	9.88	15.58	15.77	12.25	13.93	12.22
process innovations	12.68	18.13	19.23	12.54	16.30	14.43
organization innovations	3.03	3.15	4.10	4.45	3.90	3.89
marketing innovations	2.67	3.13	3.53	3.78	4.16	3.84
Services						
total	8.90	8.08	12.03	10.65	10.05	8.41
product innovations	7.47	5.38	8.08	7.15	6.64	5.05
process innovations	4.98	4.81	7.90	7.32	4.71	4.66
organization innovations	5.45	5.12	6.32	6.02	7.33	7.68
marketing innovations	4.56	4.98	5.65	5.15	6.05	6.78

Source: own elaboration based on: Local Data Bank of GUS, access mode: [https://bdl.stat.gov.pl/BDL/dane/podgrup/tablica, date of entry: 15.01.2018].

indicate a considerable increase of solutions of this type both in industry and in the service sector. In industry there was an increase of organization innovations by 28.4%, whereas marketing innovations increased by 43.8%. On the other hand, in the service sector one may observe an increase of organization innovations to 41%, while in the case of marketing innovations – at the level of 48.68%.

In Podlaskie voivodeship in the service sector a larger number of companies introduced organization innovations than in industry. Organization innovations are usually related to technological advancement. They are frequently an indispensable supplementation of implementing new technologies, especially technologies of information and communication [Brynjolfsson, McAfee, 2011, pp. 27–28]. It is visible in the dynamic increase of employment in the service sector, especially in those sections that require expertise.

An essential element of the analysis of the relation between innovations and employment are the expenditures on R&D activity (table 3).

In the analyzed years expenditures on R&D activity were recorded only in the case of several sectors. These sections included: sectors B, C, D and E (but mainly sector C – Industrial manufacturing), sector J (Information and communication) and sector M (Professional, scientific and technical activity).

TABLE 3

Expenditures on RD activity in accordance with sectors PKD 2007 Podlaskie voivodeship in the years 2011–2016 (in thousands)

Specification	2011	2012	2013	2014	2015	2016	2016/ 2011 (%)
Sector A (farming, forestry, hunting, fishing)	0	0	0	0	0	0	–
Sector B+C+D+E (mining and quarrying, industrial manufacturing, electricity generation and supply of electrical energy, water supply)	1 412.2	7 782.9	11 016	30 366.1	12 045.2	19 233.2	**1 361.9**
Sector F (construction)	0	0	0	0	0	0	–
Sector G (wholesale trade)	0	0	0	0	0	0	–
Sector H (transport and warehouse management)	0	0	0	0	0	0	–
Sector I (activity related to accommodation and gastronomic services)	0	0	0	0	0	0	–
Sector J (information and communication)	0	3 220.5	4 090.0	1 917.5	4 676.0	4 967.5	**154.3**
Sector K (financial and insurance activity)	0	0	0	0	0	0	–
Sector L (activity related to the real estate market service)	0	0	0	0	0	0	–
Sector M (professional, scientific and technical activity)	0	2 175.5	0.0	5 818.7	3 298.2	4 364.7	**200.6**
Sector N (activity related to administration services and auxiliary activity)	0	0	0	0	0	0	–
Sector O (public administration and national defense)	0	0	0	0	0	0	–
Sector P (education)	0	0	0	0	0	0	–
Sector Q (health care and social reflief)	0	0	0	0	0	0	–
Sector R (activity related to culture, entertainment and recreation)	0	0	0	0	0	0	–
Sector S (the remaining service activities)	0	0	0	0	0	0	–

Source: own elaboration based on: Local Data Bank of GUS, access mode: [https://bdl.stat.gov.pl/BDL/dane/podgrup/tablica, date of entry: 15.01.2018].

TABLE 4

Employed people in accordance with PKD sectors 2007 in Podlaskie voivodeship in the years 2011–2016 (in thousands)

Specification	2011	2012	2013	2014	2015	2016	2016/ 2011 (%)
Sector A	3 846	3 878	3 983	4 047	4 071	4 112	106.92
Sectors B+C+D+E	52 533	51 725	51 556	53 335	54 393	56 846	108.21
Sector C	46 728	46 181	46 050	48 157	49 158	51 539	110.30
Sector F	15 871	14 460	14 105	14 429	14 863	15 578	98.15
Sector G	37 304	34 782	34 201	35 492	35 800	37 535	100.62
Sector H	8 028	7 924	8 487	8 997	9 303	9 797	**122.04**
Sector I	3 430	3 608	3 649	3 757	3 760	4 048	**118.02**
Sector J	1 578	1 459	1 665	1 830	1 810	1 928	**122.18**
Sector K	3 834	4 639	4 693	4 749	4 665	4 585	**119.59**
Sector L	3 463	3 257	3 239	3 363	3 312	3 393	97.98
Sector M	4 526	4 150	4 121	4 456	4 738	4 765	105.28
Sector N	3 853	4 521	3 879	3 585	3 554	3 881	100.73
Sector O	19 984	20 259	20 348	20 545	20 382	20 457	102.37
Sector P	33 044	32 549	33 096	33 117	33 170	33 357	100.95
Sector Q	19 963	19 808	20 148	20 439	20 679	21 077	105.58
Sector R	3 676	3 613	3 407	3 447	3 564	3 621	98.50
Sector S	2 595	2 550	4 116	4 001	4 127	4 724	182.04

Source: own elaboration based on: Local Data Bank of GUS, accesss mode: [https://bdl.stat.gov.pl/BDL/dane/podgrup/tablica, date of entry: 15.01.2018].

Adversely, in the years 2011–2016 the most dynamic increase of employment in Poland was characteristic for the following PKD 2007 sectors (table 4):

- sector J (Information and communication) – which comprises: editorial activity; activity related to the production of films, video records, TV programs, audio and musical records; broadcasting of publicly available and license programs; telecommunication; activity related to software and IT consulting and interrelated activity; service activity related to providing information;
- sector H (Transport and warehouse management) – which comprises: land and pipeline transport; waterway transport; air transport; warehousing and service activity supportive for transport; post office and delivery services;

– sector K (Financial and insurance activity) – which comprises: financial service activity, with the exclusion of insurance and pension funds; insurance, reinsurance, and pension funds, with the exclusion of obligatory social insurance; activity supportive of financial services as well as insurance and pension funds;
– sector I (Activity related to accommodation and gastronomic services) – which comprises: accommodation; service activity related to alimentation;
– sector S (The remaining service activity).

While comparing the results presented in table 3 and table 4 one may notice that only in sector J is there an increase of expenditures on innovation activity and increase of employment in the same period. In other sectors the identical relation does not occur. Owing to this the obtained results do not confirm the adopted hypothesis implying that the intensity of conducted innovation activity has influence on the increase of employment in Podlaskie voivodeship.

The changes in the data regarding employment in particular PKD sectors were accompanied by changes in the structure of employment in Podlaskie voivodeship (chart 1).

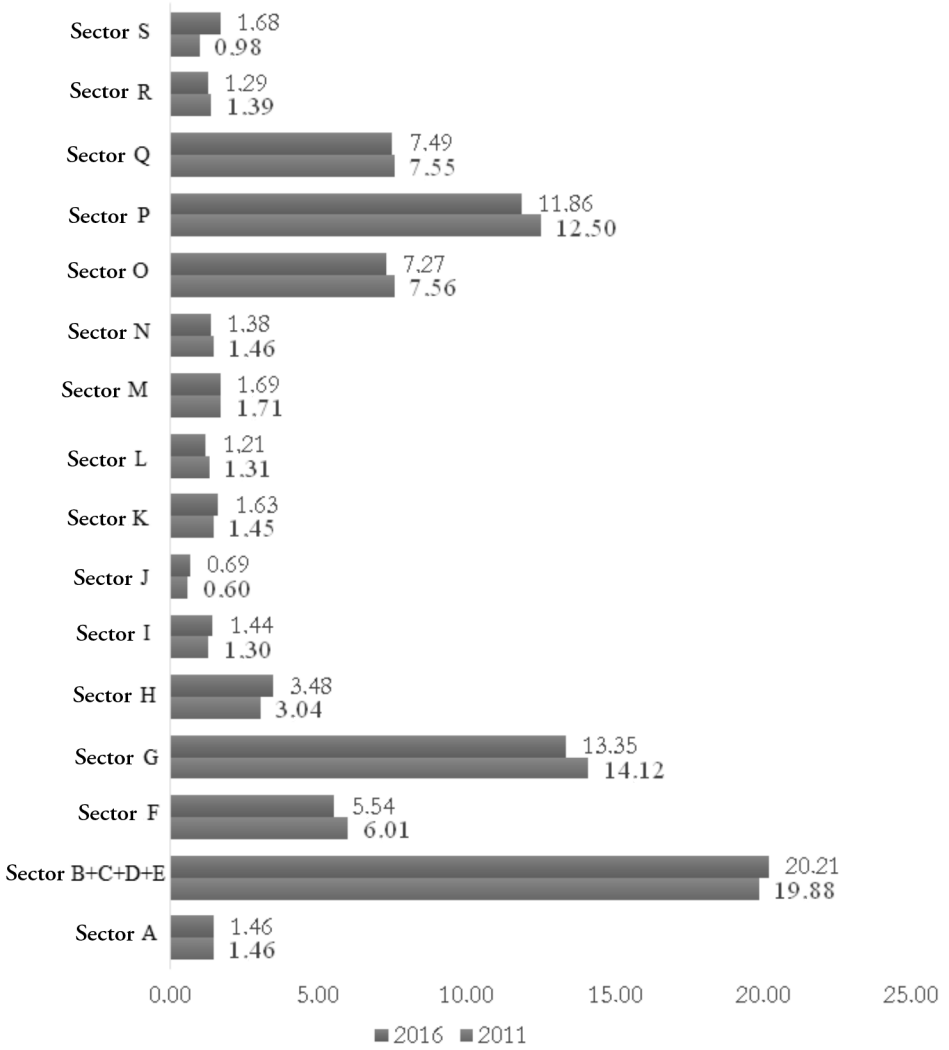
In industry the participation of employed people decreased clearly only in sector F (construction) – by approx. 8%. In other sections there is usually an observed increase in the participation of employed people in the general structure, but the increase is not very significant. On the other hand, in the service sector one may observe a considerable increase in the participation of employed people in: sector H, sector I, sector J and sector K. Other sectors are characterized by a reduction in the participation of employed people in the general structure of employed people.

There is observed the larger importance of service sectors in employment altogether, and particularly in sectors included into the so-called business services that require expertise from their employees. The increasing importance of this type of service is above all the consequence of the service-based character of the economy, i.e. penetration of services into all the economic spheres. The services based on advanced knowledge are among the most dynamically developing spheres of contemporary economies. They constitute considerable potential for the increase of employment, the usage of new technologies, and for both formation and implementation of innovations. Therefore, one may assume that innovations in the service sector may largely contribute to the increase of employment.

However, it needs to be stressed that the employment structure is still dominated by industrial companies as well as by wholesale and retail trade where innovative activity is characterized as rather not intense. Despite a dynamic increase of employment in the sectors based on innovation, there is also observed systematic growth in some traditional services. It results mainly from the fact that in some branches (despite either the lack or small number of implemented innovations) there may occur an increase of employment owing to specific properties, i.e. strategic character or indispensability in the economy.

CHART 1

Comparison of employment structure in accordance with PKD sectors in the years 2011 and 2016 (in %)



Source: own elaboration based on data from table 4.

5. Conclusions

The most frequently introduced innovations are process innovations and product innovations in industry whereas, as regards services, innovations frequently have a product or organizational character. On the basis of the dis-

cussed research one may assume that the innovative potential of companies in Podlaskie voivodeship is decreasing. It is due to the fact that the frequency of introducing various types of improvements is becoming lower. The hypothesis regarding the impact of innovative character on employment was verified negatively because the introduction of innovations takes place simultaneously with the employment of new employees in only one section: information and communication (sector J). In other sectors there has not been observed a clear correlation between these two variables. However, it does not mean that such dependence does not occur, because one needs to remember that the relation between the innovative activity of companies and employment requires measurement with longer time intervals and a longer perspective because the effects of implemented innovations are very frequently deferred over time.

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