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CAN LOCAL KNOWLEDGE WORKERS SIGNIFICANTLY CONTRIBUTE TO THE GROWTH OF THE NATIONAL LEVEL OF INNOVATION?

Abstract

This paper systematically examines the role of knowledge workers on the level of innovation development in Poland. Specific hypotheses on the importance of the collaboration of knowledge workers for the growth of national innovation in two areas: knowledge creation and knowledge exploitation are examined. The study is based on a survey and interviews with 40 IT workers in small Polish businesses. The results show that cooperation between knowledge workers enables an improvement in the amount of human resources in science and technology and an increase in the number of high- and medium-tech Polish manufacturing enterprises. Specifically, the results confirm the hypothesis that the greater the amount of collaboration between knowledge workers, the higher the level of national innovation measured in these two indicators.

1. INTRODUCTION

The concept of innovation involves the production and the transfer of technological knowledge into new products or new processes. Innovations can be distinguished as various types: social, organizational, administrative or technical, incremental or fundamental, product or process [10]. It has been argued that countries can achieve higher rates of growth by specialising in knowledge-intensive products with higher added value [14]. Hakansson and Olsen (2011) [8] stated that innovation is the result of interaction among several actors like firms, suppliers, customers, universities, laboratories, technology centres, trade unions, service providers and financial institutions.

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The author believes that the determinants of the level of national innovation output, as defined actors, mainly consist of innovation inputs. Studies from a macro-perspective investigate the impact of innovation networks on macro systems in which a single actor has a secondary role [12, 13].

Innovative firms and R&D policies have identified knowledge workers as a key resource. According to Fabrizio 2009, [6] personal knowledge networks are critical for innovation development. On the other hand, Lechner and Dowling (2003) [11] stated that IT firms need a specific mix of networks in different developmental phases; and unfortunately collaboration within this network decreases with the firm's development.

According to Archibugi (2005), [2] the national innovation system (NIS) is a state network encompassing all science and technology resources and organizations related to innovation and the interaction between them. I agree with Altuzarra (2010), [1] that the primary innovation activities and resources of regional innovations systems include: research activities, infrastructure, human skills, capital, and many other components. A regional innovation strategy (RIS) examines how various elements, actors and networks influence regional success in innovation.

This paper combines considerations of the diversity of the actors: knowledge workers within personal knowledge networks, as well as of the outcomes deriving from them, in order to call for more research on the role that knowledge workers play in the processes of the growth of the national innovation level. The subject seems to be relevant because, starting from a micro-perspective of observation - including the features of actors and their interaction, can be helpful to understand the effectiveness of the growth of the national innovation level.

This paper aims to address these issues by systematically examining the relative significance of IT workers (information technology) on the growth of the national innovation level. The results are based on a survey and interviews with 40 IT workers – including technology managers, and managing directors in a number of micro businesses. The paper tests whether the role of personal knowledge networks varies the growth of the national innovation in the field of knowledge creation.

The remainder of the paper is structured as follows. First, the existing literature is critically discussed, gaps are highlighted and the hypotheses are developed in Section 2. Section 3 outlines the material and methodology used in the study. Afterwards, Section 4 presents and discusses the results. Finally, Section 5 concludes and reflects on the implications and limitations of the study.

2. THEORETICAL BACKGROUND AND HYPOTHESES

2.1. Knowledge Workers within Personal Knowledge Networks

Knowledge workers create, distribute or apply knowledge within their jobs. Based on the example IT workers, this study aims to define the collaboration of knowledge workers within personal knowledge networks in a way that that can be exploited for the growth of the level of Polish innovation.

In the literature we can find that knowledge relationships with (local or non-local) external partners are considered to be essential for innovative geographical clusters [3, 4, 5, 9]. Personal knowledge networks refer to the interactions of a set of knowledge workers, whereas personal knowledge contacts refer to the person with whom somebody has a knowledge relationship. Factors of collaboration between IT workers within personal knowledge networks in the Polish companies in study were based on feedback surveys and their sources are listed here:

Collaboration between IT workers within personal knowledge networks: The degree of contact between an IT worker from one company with an IT knowledge worker from another company and by which one employee can help to share the knowledge of another:

- **Collab-factor1**: I share my knowledge from work with colleagues in my organization and in other organizations infrequently.
- **Collab-factor2**: I share my knowledge from work with colleagues in my organization and in other organizations frequently.
- **Collab-factor3**: I share my knowledge from work with colleagues in my organization and in other organizations very frequently.

2.2. The Level of Polish Innovation

Poland, together with Slovakia, Lithuania, Hungary, Romania, Latvia and Bulgaria is among those countries who have a low share of innovative enterprises (from 27% to 36%). In 2010, the leaders of innovative activity were Germany and Luxembourg, whose share of innovative enterprises were respectively (79%) and (68%) (*Eurostat Statistics Database).*

In line with theoretical considerations on the structure of a local innovation index [3, 16] this study focuses on the two key dimensions of the level of Polish innovation, namely: knowledge creation and knowledge exploitation. The following set of innovation measurement indicators were used to define the level of Polish innovation in this area:

Knowledge Creation (KC):

(1) Government R&D expenditure (per capita),

(2) Basic research expenditure (per capita),

(3) Human resources in science and technology (HRST) (per capita),
(4) Number of graduating students in Science and Engineering per capita (per capita).

Knowledge Exploitation (KE):

(1) Average number of valid home patent applications for four years (per capita),
(2) Corporate R&D expenditure (per capita),
(3) Applied research expenditure (per capita),
(4) Experimental research expenditure (per capita),
(5) Number of high- and medium-tech manufacturing enterprises.

Therefore, based on data from the Polish Central Statistical Office, the values of the indicators were defined which would be the result of the cooperation of knowledge workers within personal knowledge networks (see Table 1).

Tab. 1. Set of indicators which result from knowledge workers within personal knowledge networks

	2007	2008	2009	2010	2011
Knowledge Creation (KC)					
Gross domestic expenditure on research and experimental development (GERD) per capita in PLN	175	202	238	207	303
Basic research expenditure per capita in PLN	66.15	77.16	91.39	82.18	110.29
Human resources in science and technology (HRST) per capita	159.97	165.14	179.75	189.97	194.45
Number of graduating students in Science and Engineering per capita	49.83	49.81	47.23	44.74	41.49
Knowledge Exploitation (KE)					
Patent applications to the Patent Office of the Republic of Poland	2392	2488	2899	3203	3878
Average intramural expenditure on R&D in Polish enterprises and entities which conducted research and experimental development in millions of PLN	-	-	-	-	2.01
Applied research expenditure per capita	41.83	45.25	44.98	42.23	72.72
Experimental research expenditure per capita	67.03	79.59	101.63	82.39	119.99
Number of high- and medium-tech (innovative) Polish enterprises	-	-	302 908 18.1% of the total number of enterprises	291 806 16.9% of the total number of enterprises	301 597 16.9% of the total number of enterprises

It is clear that many aspects of innovation activities are indeed local [15]. Therefore, an attempt was made to examine the relative significance of Polish local IT workers (information technology) on the growth of the Polish innovation level.

The factors of the examination of the Polish innovation level were based on feedback surveys and their sources are listed here:

The Polish innovation level – the degree to which the growth of the Polish innovation level is affected from the knowledge sharing of local IT workers:

- **InnovGERD-factor1**: I know that sharing knowledge with local IT workers is not very important for Polish gross domestic expenditure on research and experimental development (GERD).
- **InnovGERD-factor2**: I know that sharing knowledge with local IT workers is quite important for Polish gross domestic expenditure on research and experimental development (GERD).
- **InnovGERD-factor3**: I know that sharing knowledge with local IT workers is very important for Polish gross domestic expenditure on research and experimental development (GERD).
- **InnovBR-factor1**: I know that sharing knowledge with local IT workers is not very important for Polish basic research expenditure.
- **InnovBR-factor2**: I know that sharing knowledge with local IT workers is quite important for Polish basic research expenditure.
- **InnovBR-factor3**: I know that sharing knowledge with local IT workers is very important for Polish basic research expenditure.
- **InnovHRST-factor1**: I know that sharing knowledge with local IT workers is not very important for Polish human resources in science and technology (HRST).
- **InnovHRST-factor2**: I know that sharing knowledge with local IT workers is quite important for Polish human resources in science and technology (HRST).
- **InnovHRST-factor3**: I know that sharing knowledge with local IT workers is very important for Polish human resources in science and technology (HRST).
- **InnovSSE-factor1**: I know that sharing knowledge with local IT workers is not very important for the number of graduating students in Science and Engineering in Poland.
- **InnovSSE-factor2**: I know that sharing knowledge with local IT workers is quite important for the number of graduating students in Science and Engineering in Poland.
- **InnovSSE-factor3**: I know that sharing knowledge with local IT workers is very important for the number of graduating students in Science and Engineering in Poland.
- **InnovPATENT-factor1**: I know that sharing knowledge with local IT workers is not very important for the number of valid patent applications in Poland for four years.
- **InnovPATENT-factor2**: I know that sharing knowledge with local IT workers is quite important for the number of valid patent applications in Poland for four years.

- **InnovPATENT-factor3**: I know that sharing knowledge with local IT workers is very important for the number of valid patent applications in Poland for four years.
- **InnovR&D-factor1**: I know that sharing knowledge with local IT workers is not very important for Polish corporate R&D expenditure.
- **InnovR&D-factor2**: I know that sharing knowledge with local IT workers is quite important for Polish corporate R&D expenditure.
- **InnovR&D-factor3**: I know that sharing knowledge with local IT workers is very important for Polish corporate R&D expenditure.
- **InnovAR-factor1**: I know that sharing knowledge with local IT workers is not very important for Polish applied research expenditure.
- **InnovAR-factor2**: I know that sharing knowledge with local IT workers is quite important for Polish applied research expenditure.
- **InnovAR-factor3**: I know that sharing knowledge with local IT workers is very important for Polish applied research expenditure.
- **InnovER-factor1**: I know that sharing knowledge with local IT workers is not very important for Polish experimental research expenditure.
- **InnovER-factor2**: I know that sharing knowledge with local IT workers is quite important for Polish experimental research expenditure.
- **InnovER-factor3**: I know that sharing knowledge with local IT workers is very important for Polish experimental research expenditure.
- **InnovEnterprise-factor1**: I know that sharing knowledge with local IT workers is not very important for the number of Polish innovative enterprises.
- **InnovEnterprise-factor2**: I know that sharing knowledge with local IT workers is quite important for the number of Polish innovative enterprises.
- **InnovEnterprise-factor3**: I know that sharing knowledge with local IT workers is very important for the number of Polish innovative enterprises.

This paper aims to develop a model to evaluate the growth of the national innovation level in terms of the work of knowledge workers within personal knowledge networks, also it aims to investigate the relationship between the collaboration of knowledge workers and the Polish innovation level within two key areas: knowledge creation and knowledge exploitation. A research model can be presented, as shown in Fig. 1.

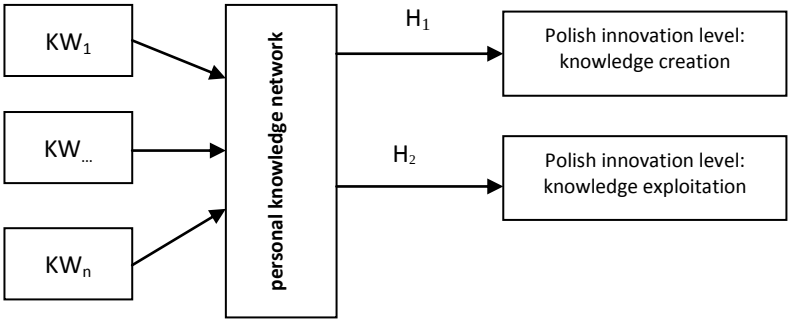

Fig. 1. A research model [source: own study]

where: KW – knowledge worker: IT workers – including technology managers, and managing directors in micro businesses.

Thus, this paper proposes the following hypotheses:

H1. The collaboration of knowledge workers within personal knowledge networks positively influences the Polish innovation level in the area of knowledge creation.

H2. The collaboration of knowledge workers within personal knowledge networks positively influences the Polish innovation level in the area of knowledge exploitation.

As presented in Fig.1, the research model posits, from the preceding argument, that the collaboration of knowledge workers within personal knowledge networks will have a positive influence upon the defined level of Polish innovation.

The following section describes the item measurement and data collection carried out in the research.

3. MEASURES AND METHODS

A survey was conducted in Poland to test the research model. The data for this study were collected from 40 IT workers – including technology managers, and managing directors in micro businesses between April-May 2013 through the use of direct interviews with respondents. Each employee was required to complete a questionnaire. A three-point scale was used for all survey items, ranging: "disagree" (one point), "agree" (two points), "strongly agree" (three points).

4. RESEARCH RESULTS AND STRUCTURAL MODEL

The research model was analysed using a correlation approach in order to estimate the effect of the collaboration of knowledge workers within personal knowledge networks on the level of Polish innovation. A moderated correlation approach using Statistica ver.10.0 was used to test the hypotheses. The data were carefully examined with respect to linearity, equality of variance and normality. No significant deviations were detected. Table 1 presents descriptive correlations for the main variables.

Tab. 2. Correlations analysis

Construct	Item/Factor	Correlation	r2	t	p
Knowledge Creation (KC)					
Collaboration of local IT workers GERD	Collab-factor1/Collab-factor2/Collab-factor3/ InnovGERD-factor1/ InnovGERD-factor2/ InnovGERD-factor3	-0.097428	0.009492	-0.603456	0.549791
Collaboration of local IT workers BR	Collab-factor1/Collab-factor2/Collab-factor3/ InnovBR-factor1/InnovBR-factor2/InnovBR-factor3	-0.144053	0.020751	-0.897359	0.375178
Collaboration of local IT workers HRST	Collab-factor1/Collab-factor2/Collab-factor3/ InnovHRSTfactor1/InnovHRST-factor2/InnovHRST-factor3	0.203448	0.041391	1.280929	0.207981
Collaboration of local IT workers SSE	Collab-factor1/Collab-factor2/Collab-factor3/ InnovSSE-factor1/InnovSSE-factor2/InnovSSE-factor3	-0.071429	0.005102	-0.441443	0.661394
Knowledge Exploitation (KE)					
Collaboration of local IT workers PATENT	Collab-factor1/ Collab-factor2/Collab-factor3/ InnovPATENT-factor1/ InnovPATENT-factor2/ InnovPATENT-factor3	0.031010	0.000962	0.19125	0.849346
Collaboration of local IT workers Polish corporate R&D expenditure	Collab-factor1/Collab-factor2/Collab-factor3/ InnovR&D-factor1/ InnovR&D-factor2/ Innov R&D -factor3	-0.257465	0.066288	-1.64249	0.108739
Collaboration of local IT workers Polish applied research expenditure	Collab-factor1/Collab-factor2/Collab-factor3/ InnovAR-factor1/ InnovAR-factor2/ InnovAR-factor3	-0.073284	0.005371	-0.45297	0.653145
Collaboration of local IT workers Polish experimental research expenditure	Collab-factor1/Collab-factor2/Collab-factor3/ InnovER-factor1/InnovER-factor2/ InnovER-factor3	-0.073284	0.005371	-0.45297	0.653145
Collaboration of local IT workers Number of Polish innovative enterprises	Collab-factor1/Collab-factor2/Collab-factor3/ InnovEnterprise-factor1/InnovEnterprise-factor2/InnovEnterprise-factor3	0.316468	0.100152	2.05654	0.046645

The study tests the hypotheses using a correlation analysis because an interaction effect exists only if the interaction term makes a significant contribution.

Table 2 presents descriptive correlations for the main variables. This includes the results of the correlation analyses which estimate the effect of the collaboration of local IT knowledge workers, as well as their interaction with the Polish innovation level. The primary interaction of the collaboration of local IT knowledge workers makes a significant contribution to one of the defined factors of the Polish innovation level: human resources in science and technology (HRST) (correlation = 0.203448). The second interaction of the collaboration of local IT knowledge workers makes a significant contribution to one of the defined factors of the Polish innovation level, namely: the number of Polish innovative enterprises (correlation = 0.316468).

The results of the analysis indicate that cooperation between knowledge workers enables an increase in the amount of human resources in science and technology and number of Polish innovative enterprises. This means that this cooperation, whether formal or informal, can lead to the creation of new work-groups and furthermore to the creation of new companies based on knowledge. Knowledge plays a special role in the innovation creation process. According to Garvin (2006), a knowledge-oriented company is one with the cooperation and collaboration of first-class professionals (knowledge workers) who possess the necessary responsibilities to achieve a competitive position for the organization. Therefore, it can be stated, that knowledge workers are one of the main determinants in the growth of the national innovation level. The results of the structural model are shown in Fig. 2.

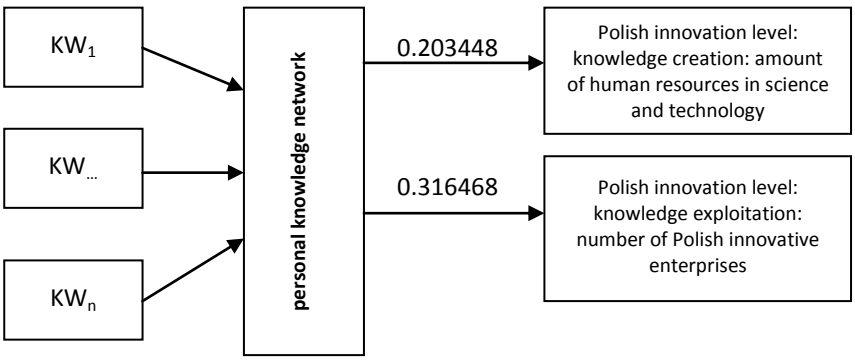

Fig. 2. Analysis of the results [source: own study]

5. CONCLUSIONS AND RECOMMENDATIONS

This section of the paper summarizes the new findings of this study and discusses the implications.

This research analyzes the effects of the collaboration of local IT knowledge workers on the Polish innovation level in two areas: knowledge creation (KC) and knowledge exploitation (KE). By proposing a model which addresses the influence of cooperation between IT workers on the national innovation level, this study contributes to filling the gap which exists in the literature. The empirical findings of this study confirm the general hypothesis. It is therefore clear that among knowledge workers, those with sound knowledge can create the innovations necessary for businesses. Innovation is defined as the introduction of new, improved ways of doing things at work. It can be stated that knowledge workers can enhance the innovation level, whether at the company level, or national.

Like all studies, this one has certain limitations that further research should aim to overcome. Firstly, because the intention is to analyze the Polish innovation level, this study focuses on Polish IT workers. It would be unwise to generalize the findings too broadly to other countries. Furthermore, all the variables are measured at the same moment in time. So, it would be useful to provide such research over a longer time period and at different stages. These conclusions and limitations suggest proposals for future research directions, such as exploring additional factors that could improve the effect of the collaboration of knowledge workers on the national innovation level.

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