

# The Influence of Knowledge Transfer on Outputs of Innovative Process – Case Study of Czech Regions

J. Stejskal, P. Hajek

**Abstract**—The goal of this article is the analysis of knowledge transfer at the regional level of the Czech Republic. We show how goals of enterprises' innovative activities are related to the rate of cooperation with different actors within regional innovative systems as well as in other world regions. The results show that the most important partners of enterprises are their suppliers and clients in most Czech regions. The cooperation rate of enterprises correlates significantly mainly with enterprises' efforts to enter new markets and reduce labour costs per unit output. The meaning of this cooperation decreases with the increase of partner's distance. Regarding the type of a cooperating partner, cooperation within an enterprise had to do with the increase of market share and decrease of labour costs. On the other hand, cooperation with clients had to do with efforts to replace outdated products or processes or enter new markets. We can pay less attention to the cooperation with government authorities and organizations. The reasons for marginalization of this cooperation should be submitted to further detailed investigation.

**Keywords**—Knowledge, transfer, innovative process, Czech republic, region.

## I. INTRODUCTION

THE current period of regional policy, dated from about the 70's of the 20th century, is characterized by a completely different concept and targeting [1]-[3]. This "institutional" approach views and analyses three areas in particular - the first is technology and innovation as such; and the second is the concept of the firm and finally the third are institutions. In particular, the firm theory is being supplemented by an increasingly important element which is cooperation and its economic context, respectively benefits. Originally, the enterprise is seen in the neoclassical view as the relatively independent economic entities operating in a market which is true given the unique mechanical and rigid - historically given the rules of supply and demand. The institutions then brought into the economic mechanisms the elements of values, habits and the scope for cooperation, however, anticipating a new and crucial element in establishing confidence between different actors (further and detailed in [4]). It seems at first free goods, over time it can be described as economic goods.

This fundamental change in the concept of economic entities and their function in the marketplace has given rise to other sub-theories, which the theory of production districts [5], and later business chaining and networking. Finally, in the early 90's of the 20th century were the foundation of

economic prosperity and competitiveness, put the knowledge, skills and ability to learn [6]. This helped to extend the original concept of Weber's factor (A - L - K) of technology and knowledge and ability to learn [7]. This helped to lay the foundation of the knowledge economy, where the learning organizations - namely, learning organization and learning regions - play a crucial role [8].

The process of learning and knowledge transfer must take place in a favourable economic environment that is characterized by the proximity of subjects, the existing positive relationships and ties and have already mentioned the necessary confidence between the parties. It should be noted that the mere spatial proximity and established links are not a guarantee of the initiation process starting and learning organizations, learning regions respectively the horizontal transfer of knowledge [9], [10].

Given that the examination of relations between enterprises and organizations (institutions) to bring knowledge about only formality of relationships, dysfunction, or unwillingness to share information and knowledge, it was necessary to reinforce these concepts with new features. Industrial district and networking was discovered already more than a hundred years ago by A. Marshall. The new knowledge of knowledge economy has been implemented into already well-known frameworks, which gradually gave rise to industrial clusters as a holistic concept, which was based on collaboration - proximity (not just geographically) - knowledge and the resulting innovations [11].

The knowledge transfer is thus realized best in the environment where strong linkages between actors exist. The previous studies showed us that even regions provide necessary networks and a framework for communication and cooperation. The knowledge transfer begins with individuals' knowledge which is being expanded over a spiral firstly within teams, divisions and entire enterprises up to partners in a chain store (clients, suppliers, consumers) and other private or public organizations in a region. The result of this transfer is usually an origin of new knowledge, respectively its application which can have a form of various innovation types, whether product, process, marketing or organizational ones. The current literature shows that cooperation at the level of individual enterprises as well as other partners leads to the increase of an innovative activity [12]. In this study, we focus on the regional meaning of this cooperation and use the Czech Republic as an example. Except for this fact, this article studies dependences among various forms of knowledge transfer and targets of enterprises' innovative activity. The remaining parts of this study cover the definition of regional

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innovative systems, explanation of the used methodology and presentation of gained results.

## II. INNOVATIVE ENVIRONMENT IN REGIONS

The innovative environment, sometimes specified as an innovative milieu, is defined differently. Reference [13] defines it as an incubator for the origin of innovations in the environment where the carrier of innovations is not an economic subject but the milieu itself (environment). This environment consists of economical and sociological backgrounds presented by the region where networks of various subjects are set in. These subjects come from a corporate as well the public sector (university and research sectors are sometimes defined separately – they include only selected types of public institutions and organizations).

There are many interactions among involved economic institutions, carriers of knowledge, its owners and public institutions, which is favourable for knowledge and consequently also for innovations in this environment. These interactions have to take place among several various subjects of the environment which assumes a certain level of trust (it decreases uncertainty). The result is a transformation into an innovation (literature sometimes speaks about so-called technological paradigm which output is an innovation). The transformation itself is also a process of learning, then a desirable production factor. There is a reciprocal exchange of knowledge, origin of tacit knowledge and mostly thanks to the mobility of manpower, respectively its geographical proximity. The proximity can be and is also often replaced by technologies. But this doesn't replace the labour synergy in a collective in one place.

The innovative environment creates a functional and organizational framework where the following elements belong, according to [14]:

- Owners of technologies and knowledge (physical entities or enterprises, research organizations and institutions). These subjects work independently and have to decide on cooperation independently on the basis of their own economic analysis,
- Knowledge and technological infrastructure (hard – buildings, technological parks, innovative and incubation centres, etc.; soft – know-how, patents, utility designs),
- Public authorities (organizations which have decision competences which can influence the owners of technologies and knowledge e.g. by aiming of public policies, allocation of financial resources, etc.),
- Relations, linkages, interactions (these have to originate on the basis of trust and effective outputs of cooperation which can gradually create firm linkages and so increase the dependence of originally independent subjects),
- Atmosphere of mutual learning (individual economic subjects have to involve an element of continual learning into their behaviour).

According to [15], the environment is represented by a complex or dense network of relations (mainly informal social relations) inside a limited space unit (region). This unit is

considered by the authors as a profiling and creating specific image of the entire network. Inwards, the domicile of subjects in a given region can then help create fellow-feeling, feeling of proximity which helps create functional relations and linkages and initiate processes of continual learning.

Public institutions and mainly regional authorities have to help create a defined favourable innovative environment so that it helps reach publicly defined targets of the regional development. The creation and cultivation of the innovative environment are clear components of the regional policy and have to be included in strategic documents modifying the regional development.

Reference [16] defines such targets of the regional development that can be fulfilled even by the existence of knowledge networks as follows:

- Growth of regional performance and employment,
- Existence of an interregional and international network (networks) and competitiveness,
- Creation of local networks among various branches and enterprises,
- Origin, growth and expiration of local enterprises,
- Investment, innovation of products and processes, productivity increase,
- Creation of knowledge, learning processes, competences and human capital,
- Quality of the physical environment,
- Political framework and decentralization of governance.

These targets can be met so that nonlinear and multiple linkages originate among individual subjects and elements of the innovative environment in a region. Therefore there is an effective interaction in the environment. But the question is which role the proximity of subjects plays in the presented interaction, respectively how we can ensure it or influence it positively.

## III. RESEARCH METHODOLOGY AND DATA

For the collection of necessary data, a harmonized questionnaire of the member countries of the EU was used for the innovative investigation of the CIS community (Community Innovation Survey). The investigation was realized for the period 2006-2008 in the form of a combination of sample and area surveys considering the regional dimension NUTS3. Enterprises with at least 10 employees and from selected production branches and services (financial as well as nonfinancial ones) were included into the research, concretely key and supplementary branches of NACE: B, C, D, E, F, G45-47, H, I, J58, J61-63, K, L, M69-74 and N.

The highest share of cooperating enterprises was in the Pardubice region where they cooperate with partners from the Czech Republic and other European countries (Fig. 1). There are interactions with partners from other world countries in the Plzeň region and Praha.

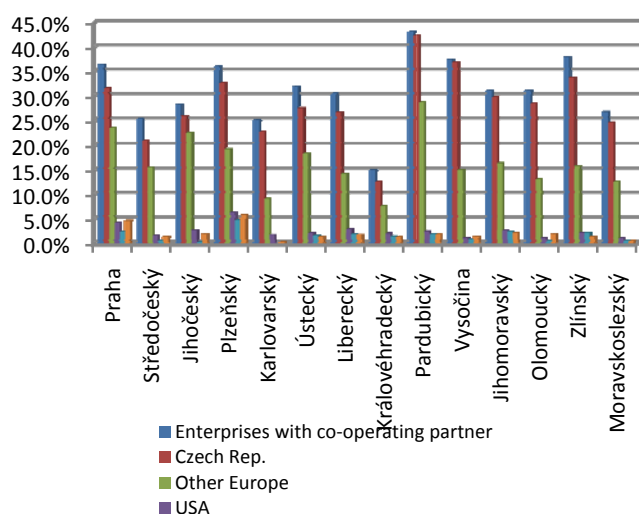


Fig. 1 Cooperation for innovative activities by location of a partner – enterprises with technological innovation during 2006–2008

The most important partners of enterprises are their suppliers and clients in most regions (Figs. 2 (a) and (b)). Only in the Zlín region, the most important partners are universities, private consultant and R&D organizations. The highest rate of cooperation within the enterprise is in Praha. On the other hand, the regions of Karlovy Vary and Hradec Králové showed the lowest rate of enterprises' cooperation with surrounding partners.

#### IV. RESULTS

The results of technologies and knowledge transfer can be know-how, technological procedures, production innovations and their patent protections. The correlation analysis between the location of the source of knowledge transfer and the number of patent applications showed that the increase of patents was reached by cooperation with national partners and also with partners from China / India (Table I).

TABLE I  
CORRELATIONS BETWEEN THE PARTNER LOCATION AND PATENT APPLICATIONS

Location of a partner	Patent applications
Enterprises with a cooperating partner	,2143
	p=,482
Czech Rep.	,1829
	p=,550
Other European countries	-,2130
	p=,485
USA	-,1868
	p=,541
China / India	,1983
	p=,516
Other countries	-,2868
	p=,342

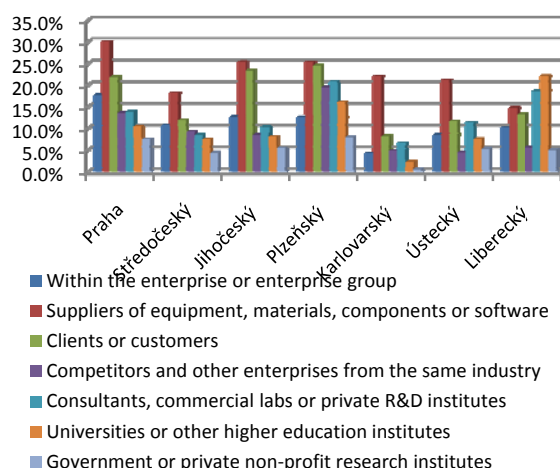


Fig. 2 (a) Innovation co-operation by type of co-operating partner – enterprises with technological innovation in some Czech regions during 2006–2008

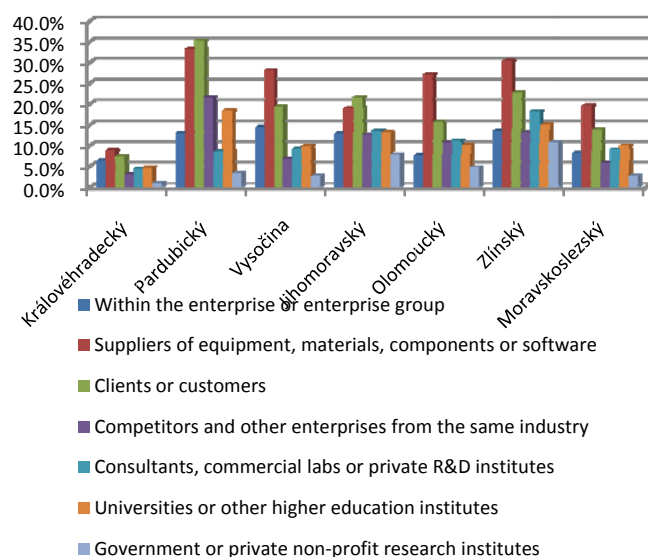


Fig. 2 (b) Innovation co-operation by type of co-operating partner – enterprises with technological innovation in the other Czech regions during 2006–2008

On the other hand, the knowledge transfer from other European countries, the US and other states didn't lead to the increase of patent applications. The reason is probably the composition of a target group of respondents who were recruited from a group of rather small and middle-sized enterprises. This group suffers usually from a lack of capital which could be invested into the extension of markets in another continent (surprisingly, this is also the case of markets in the US).

As regards the type of a cooperating partner, cooperation with government or private non-profit research institutes showed important correlation with the number of patent applications (Table II). Respectively, also cooperation with consultants, commercial labs or private R&D institutes and

universities or other higher education institutes correlated with patents strongly.

TABLE II

CORRELATIONS BETWEEN THE TYPE OF A COOPERATING PARTNER AND PATENT APPLICATIONS

Type of a cooperating partner	Patent applications
ENTERP	,0454 p=,883
SUPPL	,1000 p=,745
CLIENT	,0507 p=,869
COMPET	,0355 p=,908
CONSUL	,3033 p=,314
UNIV	,2835 p=,348
GOVER	,4822* p=,095

ENTERP - within the enterprise or enterprise group, SUPPL - suppliers of equipment, materials, components or software, CLIENT - clients or customers, COMPET - competitors and other enterprises from the same industry, CONSUL - consultants, commercial labs or private R&D institutes, UNIV - universities or other higher education institutes, and GOVER - government or private non-profit research institutes.

Mainly the result of cooperation with government authorities (including governments at regional levels) is interesting. It is caused by the current active expansion of the fiscal state policy which divides money received from the budget of the European Union for innovations' support, investments incentive and other development of economically weak regions.

Further correlation analysis should reveal dependences between cooperating partner's location, respectively a partner type on one hand and the target of innovation on the other hand (Table III). It turned out that the cooperation rate of enterprises correlated significantly with enterprises' efforts to enter new markets and reduce labour costs per unit output. Other targets of technological innovations correlated also positively with the cooperation rate of enterprises in the region. The target of cooperation with European partners was also to increase market share and replace outdated products or improve the flexibility of production or services, except for the entry into new markets. On the other hand, cooperation with partners from the US wasn't significantly connected with press for technological innovations. This confirms also the previous research findings. Strong correlation existed only in case when innovation should have contributed to the increase of market share. Similar results are valid also for other world countries. Nor cooperation with partners from China / India had an important connection with mentioned targets of innovative activities.

TABLE III  
CORRELATIONS BETWEEN PARTNER'S INNOVATIVE TARGET AND COOPERATING PARTNER'S LOCATION

	REPL	NEWM	INCRM	QUAL
Cooperating	,4194	,5335**	,3885	,2246
Enterprises	p=,136	p=,049	p=,170	p=,440
Czech Rep.	,4873*	,5595**	,3267	,2735
	p=,077	p=,038	p=,254	p=,344
Other European countries	,6023**	,5576**	,6176**	,4348
	p=,023	p=,038	p=,019	p=,120
USA	,1414	-,2002	,4536	,0754
	p=,630	p=,493	p=,103	p=,798
China / India	,0868	-,5937**	-,5531**	-,3959
	p=,768	p=,025	p=,040	p=,161
Other countries	,0357	-,0719	,4657*	,2381
	p=,904	p=,807	p=,093	p=,412
	FLEX	CAPAC	HEALTH	LABOUR
Cooperating	,3687	,2557	,1391	,4715*
Enterprises	p=,194	p=,378	p=,635	p=,089
Czech Rep.	,3779	,3329	,1549	,5006*
	p=,183	p=,245	p=,597	p=,068
Other European countries	,5111*	,4211	-,1408	,2991
	p=,062	p=,134	p=,631	p=,299
USA	-,1203	-,0437	-,2537	-,1472
	p=,682	p=,882	p=,382	p=,616
China / India	-,1609	-,0870	-,0662	-,4780*
	p=,583	p=,767	p=,822	p=,084
Other countries	-,0721	-,0397	-,2612	,0047
	p=,806	p=,893	p=,367	p=,987

REPL - replace outdated products or processes, NEWM - enter new markets, INCRM - increase market share, QUAL - improve quality of goods or services, FLEX - improve flexibility of production or services, CAPAC - increase capacity of production or services, HEALTH - improve health and safety, and LABOUR - reduce labour costs per unit output.

Regarding the type of a cooperating partner, cooperation within enterprises was related to targets of market share increase and labour costs decrease (Table IV). Enterprises searched for cooperation with clients in case of efforts of replacing outdated products or processes or entering new markets. Cooperation with consultants as well as cooperation with universities and government organizations should have led to the increase of market share. The quality improvement and capacity increase of goods or services showed other strong dependences. This should have been reached mainly by cooperation with clients. Cooperation with universities served for the target of health and safety improvement. But this fact doesn't determine the usage of knowledge transfer on behalf of the economic development.

TABLE IV  
CORRELATIONS BETWEEN A COOPERATING PARTNER AND INNOVATIVE TARGET

	REPL	NEWM	INCRM	QUAL
ENTERP	,3887 p=,170	,4084 p=,147	,6062** p=,022	,1778 p=,543
SUPPL	,3221 p=,261	,4039 p=,152	,1536 p=,600	,1354 p=,645
CLIENT	,5330** p=,050	,4865* p=,078	,4232 p=,132	,3053 p=,288
COMPET	,3114 p=,278	,1749 p=,550	,2747 p=,342	,2168 p=,457
CONSUL	-,0963 p=,743	,0647 p=,826	,5868** p=,027	-,1768 p=,545
UNIV	,2982 p=,300	,4526 p=,104	,5494** p=,042	,1603 p=,584
GOVER	-,2019 p=,489	,1375 p=,639	,5692** p=,034	-,1512 p=,606
	FLEX	CAPAC	HEALTH	LABOUR
ENTERP	,0279 p=,925	,1939 p=,507	-,2972 p=,302	,4866* p=,078
SUPPL	,2947 p=,306	,1089 p=,711	-,1194 p=,684	,2392 p=,410
CLIENT	,2473 p=,394	,2673 p=,356	-,1698 p=,562	,2557 p=,377
COMPET	,0701 p=,812	-,0105 p=,971	-,2480 p=,393	-,0469 p=,874
CONSUL	-,0952 p=,746	-,1370 p=,640	,1197 p=,683	,1855 p=,525
UNIV	,2106 p=,470	,1043 p=,723	,3846 p=,175	,4028 p=,153
GOVER	-,1437 p=,624	-,1448 p=,621	-,2089 p=,474	,0831 p=,778

At the conclusion we can state that the strongest dependences were revealed among groups of innovative targets: replace outdated products or processes, enter new markets, increase market share. More attention has to be paid to these targets in the next research.

## V. CONCLUSIONS

A significant attention is nowadays given to the knowledge transfer and its analyses are parts of many research tasks. The target of research efforts is to reveal which factors influence the knowledge transfer between the place of its origin and its usage. With the knowledge of these factors, it is possible to speed up the transfer by removing obstructions which cause significant inefficiency and to contribute significantly to the economic as well as social growth.

It resulted from the presented research that

- The most important partners of enterprises in regions of the Czech Republic are their suppliers and clients. No significant cooperation between carriers and creators of knowledge is developed in these regions where it would be possible to transfer available and commercialized knowledge further from the creators,
- An important relation was found out between the number of patents and cooperation with government organizations, NGOs research institutes. Also consultants, commercial labs or private R&D institutes and universities or other higher education institutes contribute significantly to the origin of patents,

- The cooperation rate of enterprises correlated significantly with enterprises' efforts to enter new markets and reduce labour costs per unit output.

In the next research, a particular attention has to be given to innovative targets such as replacement of outdated products or processes, entry into new markets, increase of market share because even these targets are met most significantly even by the knowledge transfer.

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## REFERENCES

- [1] J. V. Henderson, *Urban Development: Theory, Facts and Illusion*, Oxford: Oxford University Press, 1988.
- [2] P. Krugman, *Keynote Lecture, Association of American Geographers' Annual Conference*, Washington D. C., 2010.
- [3] M. E. Porter, *The Competitive Advantage of Nations*, London: Macmillan, 1990.
- [4] R. Nelson, "The agenda for growth Theory: a different point of view," *Cambridge Journal of Economics*, vol. 22, pp. 491–520.
- [5] A. Marshall, *The Economics of Industry*, Macmillan and Co., 1920.
- [6] B. A. Lundvall, "Introduction". In: B. A. Lundvall(ed.), *National Systems of Innovation - Toward a Theory of Innovation and Interactive Learning*. London: Pinter Publishers., 1992, pp. 1–19.
- [7] P. Maskell, H. Eskelinen, I. Hannibalsson, A. Malmberg, and E. Vatne, *Competitiveness, Localised Learning and Regional Development: Specialisation and Prosperity in Small Open Economies*. London: Routledge, 1998.
- [8] A. Malmberg, "Industrial geography: location and learning," *Progress in Human Geography*, vol. 21, 1997, pp. 573–582.
- [9] M. Fujita, and T. Tabuchi, "Regional growth in postwar Japan," *Regional Science and Urban Economics*, vol. 27, 1997, pp. 643–670.
- [10] V. J. Henderson, "Understanding knowledge spillovers," *Regional Science and Urban Economics*, vol. 37, 2007, pp. 497–508.
- [11] L. H. Dobkins, "Location, innovation and trade: the role of localisation and nation-based externalities," *Regional Science and Urban Economics*, vol. 26, 1996, pp. 591–612.
- [12] M. Frenz, and G. Ietto-Gillies, "The impact on innovation performance of different sources of knowledge: Evidence from the UK Community Innovation Survey," *Research Policy*, vol. 38, 2009, pp. 1125–1135.
- [13] R. Camagni, "The concept of innovative milieu and its relevance for public policies in European lagging regions," *Papers in Regional Science*, vol. 74, 1995, pp. 317–340.
- [14] D. Maillat, "Innovative milieux and new generations of regional policies," *Entrepreneurship & Regional Development: An International Journal*, vol. 10, 1998, pp. 1–16.
- [15] R. A. Boschma, and R. C. Kloosterman, *Learning from Clusters: A Critical Assessment*, Dordrecht: Springer, 2005.
- [16] R. Cappellin, and R. Wink, *International Knowledge and Innovation Networks: Knowledge Creation and Innovation in Medium-technology Clusters*, Cheltenham: Edward Elgar Publishing Limited, 2009.

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