

Mecanismos para a Transferência de Tecnologia do “Núcleo de Tecnologia da Informação” (NIT) para a Região Sudoeste do Paraná - Brasil

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Resumo:

Estudos teóricos sugerem que a capacidade inovadora das empresas contribui para o Desenvolvimento Regional e conseqüentemente para o aumento da competitividade local. Por abranger as relações entre o social, econômico, tecnológico e cultural, este estudo aponta a importância de um modelo participativo ancorado pela liderança e sociedade, em busca da disseminação e transferência do conhecimento tecnológico. Dessa forma, este artigo propôs investigar os mecanismos de Transferência de Tecnologia do APL de TI, denominado Núcleo de Tecnologia da Informação (NTI) da região Sudoeste do Paraná-Brasil, mapeando as empresas participantes, identificando esses mecanismos e analisando quais são suas influências para o Desenvolvimento Regional. A pesquisa definiu-se como qualitativa e quantitativa e se fundamentou com base em entrevistas e análise de documentos para levantar as atividades prestadas pelo NTI e confirmar os resultados desses mecanismos de transferência de tecnologia às empresas associadas. Concluiu-se que, com os resultados apresentados e confirmados pelas empresas atuantes, os mecanismos de transferência de tecnologia disponibilizados pelo NTI contribuíram para as Inovações e conseqüentemente para o Desenvolvimento Regional.

Palavras chave: transferência de tecnologia; desenvolvimento regional; mecanismos; inovação.

Mechanisms for Technology Transfer from the “Núcleo de Tecnologia da Informação” (NIT) for the Southwestern region of Parana - Brazil

Abstract:

Theoretical studies suggest that innovative capabilities of enterprises contribute for the Regional Development and consequently increase local competitiveness. By covering social, economic, technological and cultural aspects, this study highlights the importance of a participative model based on leadership and regional development in order to spread technological knowledge. The purpose of this study was to investigate the mechanisms of Technology Transfer at the *Núcleo de Tecnologia da Informação* (NIT) in the southwestern region of Parana, Brazil, mapping the participating companies, identifying this transfer of mechanisms and analyzing the influences for Regional Development. This research is defined as both qualitative and quantitative, and is based on interviews and document analysis to set up the activities offered by the NTI and confirm the results of these technology transfer mechanisms to the associated companies. As a conclusion, with the aid of the presented results and confirmed by the acting companies, the technology transfer mechanisms provided by the NTI have contributed for the Innovations and consequently for the Regional Development.

Key-words: technology transfer; regional development; mechanisms; innovation.

1. Introduction

To influence in the development of a region is contributing for the Region's advancing in Innovation and Technology. The scenario of global competitiveness brings the need to manage effectively the mechanisms which help the regional development, because this will consequently influence in a country development indexes.

Technology Transfer is a way to help the use of resources and potentialities required so that a region develops, ensuring the participation of the citizens in the process.

Regional Development starts from actions that mobilize companies to search within knowledge and technology transfer the resources for innovation, and consequently, the sustainable development, based in three pillars: economic, social and environmental.

Through the Technology Transfer there is a greater development and acting from local companies. Technology transfer is the starting point so that a Region achieves competitive advantages and applies technological innovations, as well as the ability to compete in new markets.

So, this paper aims to analyze the technology transfer mechanisms of the *Núcleo de Tecnologia da Informação* (NTI) from the Southeast Region of Paraná, to identify the favorable factors for the Region's development, as well as possible actions to improve those mechanisms, serving as a basis to other regions which want to potentiate their development for innovation.

The NTI or *Núcleo de Tecnologia da Informação* is a Non-profit association which aims to promote the economic and technological development of its associates and the involved local community, with a proposition of planned disclosure of all the area's technical and marketing information, promotion and interchange of experiences among professionals and associated companies, as well as entrepreneurial actions which create employment and wealth. It started as a political proposition in one of the cities belonging to the cluster, however, as the time passed it went on to become autonomous, acting independently of local political support.

The NTI can be described as an IT cluster. This core is the result of efforts from business leaders, and includes enterprises, public agencies, IT entities and professionals from the local community interested in the development of IT issues. Currently, this entity has been granted the State and National acknowledgement as one of the main actors in software technological development.

Its mission is "To provide the organization and improvement of IT sector, searching for new opportunities, partnerships and policies to achieve international acknowledgement." Through the technology transfer mechanisms provided for the association 's 45 partners, the NTI staff seeks to contribute for Regional Development and local competitiveness.

The Technological Development is a result from the competitiveness which resounds in the economic scenario, in which an organization might be considered as outdated if it doesn't follow the knowledge era. Allarakhia & Walsh, (2010), assert that: "technological development is more and more directed by the market advance".

The Technology factor, which, in the concept of Reis (2004) corresponds to a bunch of knowledge from a society based on scientific methods and knowledge, setting dominium on materials and processes useful for production. That factor became a relevant factor for competitiveness. The organizations arrange the access to technology and technology transfer mechanisms, improving the innovative potential. Lima (2004) asserts that the technology transfer encompasses the introduction of a new technology or the knowledge associated to it

in an environment different from the one which created it, or also can be referred to the import of technology.

Technology transfer also comprises the interactions between stakeholders interested in the profits originated in the process. For McAdam *et al.* (2012), the relation between stakeholders comprises the exchange of knowledge and abilities transferred between universities, organizations and community.

In this matter, there is a set of interests that can be divergent. However, there must be a point that satisfy all the involved: “the organizations must adopt a different position from their preferred option when they are dealing with peer-to-peer relation, where the interests of both are satisfied, and the subsequent decisions are in harmony with their common interests.” (McADAM *et al.*, p. 03, 2012).

And that may occur in four steps, according to Park, Ryu & Gibson (2010): first, there is the recognition on the information concerning an invention developed by researchers; after that, there is the identification of when the selected inventions are submitted to the patent office; in the third step, the individual or organization interested guarantee a license from the patented technology; then, with the license agreement executed, it can engender royalties of the transferred technology.

So, it can be observed how the technology transfer is an important tool in the success of innovation objectives, allowing the application of improvements from the institutions that generated the knowledge, to the ones interested in its use, corroborating the main objective of innovation, which is its commercial applicability, highlighting the gains in scale.

Rogers, Takegami & Yin (2001), highlight the main mechanisms for the technology transfer execution: spin-off of an organization; license (permission or right to use, design or process); publications; meetings which involve peer-to-peer interactions on technical matters; cooperation arrangements in R&D. As it can be observed, there are many ways by which the technology transfer may happen.

Park & Lee (2011) present three mechanisms: when acquired from an external source (licensing-in); contrary, the selling of technological knowledge for other companies (licensing-out); and the technological cooperation, which is a bilateral relation, in a strategic alliance. In this cooperation, the roles are set (generator and user and the cooperation channel is set).

The main aspect of the technology transfer process is called by Elpida *et al.* (2010) the “commercial exploitation of ideas”, which is linked to the utility of that idea, the involved interests and the problems in its transfer and application. The author highlights that the “selection” of ideas involves a subjective aspect of choice from the proponent. In this sense, there is a judgment which takes into consideration the level of maturity of that innovation and the visible yields. (ELPIDA *et al.*, p. 55, 2010).

2. Regional Development

Regional space can be defined as the place where the relations among the social, economic and cultural occur, being experienced in constant changes which happen at fast pace. Because of that, Veiga (2006) points the need of a participative model in the development planning, because the region is in the center of strategies which seek for competitiveness and economic attractiveness, and it can be engendered with popular participation, anchored in local institutions and society leaderships.

For Pellegrin *et al.* (2010), the territory (or region) has a central importance in the processes of innovation and transfer, since the potential of social and cultural fabric may be appropriated by organizations and become part of its assets. For the authors, the territory (region), as 'allocation vector of production' becomes a 'great organization' and a source of innovation at regional level. Regional development must start from points that result in a planning application in order to make this sustainable.

This notion that the innovative capability of firms is influenced by regional factors has become an interesting analysis. Rocha & Dufloth (2009) report that regional differences in the levels of innovation activity can be substantial, and identify key characteristics and factors that promote innovation activity and the development of specific sectors within the region can assist the understanding of innovation processes and be valid for policy making. These regional innovation systems can be developed alongside the national.

Thus, regional development is linked to technology transfer, as it binds to innovation systems. Innovation systems are an important element in the transfer process, because they understand innovation as a "system composed of a network of different actors (stakeholders) who are working towards achieving the objectives of innovation." (ASHEIN & COENEN, pp. 166-167, 2006).

Corroborating this idea, "the importance of networks in disseminating information and ideas, giving access to resources, capabilities and markets, bringing together 'pieces' of knowledge, has become of central importance to innovation and, by extension, the economic competitiveness "(VONORTAS, p. 04, 2012). This competitive advantage is linked to the region that is embedded in and contributes to regional development.

That development is the result of the relationship between the stakeholders involved and the innovation system created by them, "the approach of Innovation Systems assumes economic environments in geographically defined areas in which companies, institutions and a range of other agents are connected on a supposedly dynamic model that influences the ability of a region to innovate."(TORRECILLAS & FISCHER, p. 46, 2011).

Assuming that regional development is one of the objectives of innovation, through the idea that the commercial success of innovations produces the real increase in income, creating social and economic effects, Gonçalves & Fajardo (2011), demonstrated in their studies, that geographical proximity and similarity are fundamental in generating technological innovations.

For Wei-Zhong & Duo (2010), the region has more power than the state itself, due to the greater flow of knowledge and sharing of ideas that have worked previously at the local level. Moreover, the authors claim that a system of local companies makes it possible for governments and support institutions to promote the endogenous growth of clusters. The proposal for an innovation project can be a tool in achieving this goal. Therefore, it is important for regional development to deal with the issue of productive enterprises in clusters.

It can be observed through this fragment that the clustering facilitates the process of technology diffusion through the **joint representation** of the sector before the funding entities. It also involves knowledge of the particularities on the socio-economic region. Thus, it allows the formulation of policies and a methodology, efficient for a sector in a given region, corroborating the objective of regional development.

So the best guidance for the formulation of a methodology for a particular industry should start from the knowledge of the characteristics where the industry develops, meet its problems and issues, study the industry in a joint analysis so one can get the best diagnostic framework and propose joint solutions.

In Fritsch, Stephan & Werwatz (2004), it can be observed how the innovative activities rely heavily on local conditions. Corporate profits derive from applications of local knowledge of other companies or the public. The proximity to other actors in the process helps reduce the uncertainty that rise by the innovation activities, mainly through cooperation and exchange of ideas. Innovative organizations prefer to install in places where other innovative companies and research institutions are already operating and where the labor market provides skilled personnel to meet the needs of business innovation.

The authors continue, saying it could lead to the formation of regional clusters of productive organizations and other institutions (universities, research centers, technology transfer offices) which are characterized by an intensive network formation and a high degree of access to external knowledge. These clusters promote "conditions for the development and commercialization of ideas." (FRITSCH; STEPHAN & WERWATZ, p. 02, 2004). Thus, it increases the probability of a project to be successful, because the cooperation enables experience and ideas sharing on a scale that would be difficult to achieve alone. Therefore, this reunion in clusters facilitates this interaction, along with research and funding institutions, finally achieving the goals described on the technology transfer mechanisms.

3. Technology Transfer and Innovation: Foundations for the Regional Development

Regional innovation systems comprise a complex of mechanisms and policies for innovation, diluted at a regional level, so that the needs and interests of a specific region and the stakeholders involved are attended. Veiga (2006) explains the importance of regional development as the starting point for application of an innovation-driven culture. The culture of a region is a key factor to the technology transfer, but it may also become a barrier. (BJERREGAARD p. 106, 2010). Regional development seeks sources of knowledge in technological and innovative capabilities, mainly stemming from companies.

Liu, Zhu & Tang (2008), explain that, due to the importance of technology transfer in generating new knowledge and its further application, creating innovations, and leading to regional development, it becomes a challenge, both for developed countries and for developing ones. The authors show that technology transfer holds intrinsic interaction with innovation, because it "is important in all economies, because it generates knowledge, and this knowledge generates more innovation." (BAS, AMOROS & KUNC, p.53, 2008).

Molero & Garcia (2008), point that due to the advancement of science and technology and increasing globalization, technology transfer is combined with innovation, experiencing a remarkable change in recent years. "Technology transfer becomes an effective tool for companies or countries to acquire the technologies needed for their development" (JR, PIO & ANTUNES, p.126, 2009). It is through the technology transfer that regional innovative companies can be consolidated, seeking global competitiveness, as well as advantages in innovation (ROBERTSON; SORBELLE & UNSWORTH, p. 2, 2009).

In this search for policies and mechanisms to encourage innovation and technological research, technology transfer becomes relevant, especially through the establishment of partnerships between companies or company clusters, by encouraging the public to formulate and implement policies that give special attention to technology transfer for local development (JR; PIO & ANTUNES, p.126, 2009).

This public support, concerning the formation of partnerships between companies, turns its attention to technology transfer due to the fact that beyond the need for knowledge transfer, it is essential that the receiver be in the same technological capability level of the institution that springs the technology (PLONSKI, p.07, 2005). Since this step is, in the true sense, what the

technology transfer demands: the absorption of knowledge, adaptation, improvement, innovation and diffusion (Longo, p. 03, 1984).

Plonski (2005) indicates that public mechanisms to improve training and increase the level of transfer and internalization of technologies, making a group of companies able to spread this knowledge, ensures that the results will be favorable to development. And it is not the matter of acquiring a new technology, the organizations must know how to manage it (internal skills and technological capability), so the technology is fully utilized, not partially, fulfilling the objectives of regional development.

4. Methodology

The study is built based on interviews and document analysis, aiming to raise the activities provided by the NTI and confirm the idea that the results of technology transfer mechanisms contribute to regional development. First of all, the analysis was carried out by searching documents and interviews with the coordinators of the NTI to obtain which of the mechanisms of technology transfer targeted by the organization are applied to the participating companies, and what improvements and results rise from these actions.

After identification of the mechanisms, actions and expected results, interviews were held to 45 members, followed by a script, considering the claims of the coordinators of NTI to confirm that the technology transfer mechanisms are actually applied, and bring improvements to their development as organization and consequently, the regional development.

5. Results and Discussions

According to the interview applied to the coordinators of the NTI, it was possible to raise a total of ten (10) technology transfer mechanisms, which, according to them, would be used in 45 companies. These mechanisms can be visualized in table 1.

1	HR training and capacitation
2	Promotion of integration events
3	Resource gathering qualification
4	Promotion of interchanges among companies
5	Promotion of seminars for technological innovation
6	Knowledge of the existing laws and public policies
7	Logistics Support
8	Disclose the cluster through a marketing plan
9	Establishment of a regional technological lab
10	Stablish a governance model

Source: NTI (2012)

Chart 1 – NTI Technology Transfer mechanisms

Based on these 10 mechanisms reported in interviews, the coordinators of the NTI believe they express positive actions for the development of the organizations involved and therefore the area concerned. Fiates *et al.* (2002) reports that through technology transfer, the learning process occurs, as well as the application of successful practices, making possible the implementing of innovation. And the learning capability is critical for innovation (GUO, GUO, pp. 03-04, 2011). According to respondents, these mechanisms provide the basis for

technology transfer and consequent exchange of knowledge, generating new knowledge that would lead to innovation. These companies have the common goal of innovation development, which, according to Hu (2007) encourages technology transfer.

With regard to mechanisms accessibility, the coordinators reported that it may occur at any time, since the benefit sought is available, such as the mechanism “development and training of human resources”, because it is necessary that a training program is being implemented, so it can be used. Barbieri (1990) reinforces the importance of a supply chain organization to assist others through the distribution of information.

Member companies can be kept updated with the actions developed by NTI through monthly meetings and via e-mail or mail. The meeting is held each time at a different city of the region, to facilitate access to all. The costs with transports are returned by the association itself, ensuring the participation of 100% of the companies. According to Matos (2002) the driving force of a system driven by technological innovation may be technology transfer. Therefore, this horizontal collaboration of companies (peer-to-peer), according to the classification of literature, is a way to disseminate knowledge and technologies arising from a higher instance, being the facilitator of the transfer process.

Below, in Table 2, some results reported by the coordinators of the NTI and searched in documents of the Association, which formed the basis for the questionnaire to managers of member companies.

Result
Training in 70% of the companies
80% of the companies participate in events for divulgation
Region divulgation
Support and Incentive from municipal government for Technological Innovation advance
Involvement of companies, learning institutions, government and non-governmental credits
10 registered patents
Innovation is present in 60% of the involved companies
10 projects sent to the government
Contribution to other sector of the region which demand IT
Creation and presentation of Laws concerning the matter Innovation
Advance in the development of involved companies

Source: NTI

Chart 2 – Related results, collected and based on information provided by the NTI

In accordance with the table, it is possible to view that the NTI believes to contribute to the advancement of the companies involved and the region as a whole, highlighting the importance of technology transfer for Innovation, which is the strength of this association. Matos (2002) cites that “continuous advances in computer science and information technology are at the forefront of the current wave of high-tech innovation”. The focus of NTI is to use information technology as a pillar for the transfer process, mainly by providing tools that aid in management.

Concerning the barriers described by the managers of the NTI, the greater was defined as the difficulty in spreading and characterizing the Innovation, because from this understanding (concepts) and its importance, it is possible for companies to focus on the importance of technology transfer and the NTI as a force of local development.

From these results, directed to the NTI staff, the collected data were then presented to the participating companies, aiming to observe if they shared the same information and agree with the mechanisms of technology transfer and the results cited.

Table 3 presents the percentage results of 45 companies that agree with the mechanisms of technology transfer cited by the managers of NTI as available and applicable.

1	HR Trainings and Capacitation	85%
2	Promotion of integration events	80%
3	Resource gathering qualification	75%
4	Promotion of interchanges among companies	80%
5	Promotion of seminars for technological innovation	80%
6	Knowledge of the existing laws and public policies	80%
7	Logistics Support	90%
8	Disclose the cluster through a marketing plan	90%
9	Establishment of a regional technological lab	65%
10	Stablish a governance model	80%

Source: NTI

Chart 3 - Percentage of companies that agree with the mechanisms of technology transfer cited by NTI

From the total number of companies participating in the cluster, it can be observed that most of them agree with the mechanisms of technology transfer cited by the cluster coordinators. The determinants that reached a higher level of agreement were: Disseminate the cluster through a marketing plan and logistical support to the region, with 90% of agreement. This logistical support to the region is based mainly by the opening of the airport in the city of Francisco Beltrão, belonging to the local cluster.

The technology transfer mechanisms that had lower approval were: qualification for fund raising with 75%, and the establishment of a regional technology lab with 65%. That happens due to the fact that the regional technology lab is still a project, in other words, it shows that even being only a sketch, firms attribute credibility in the implementation of this mechanism (technological lab).

In general, all mechanisms of technology transfer cited by the NTI coordinators have received approval from most of the companies participating in this cluster, demonstrating that the mechanisms are actually available.

Regarding the results cited by the coordinators of the NTI, the research verified the degree of agreement of the companies in each of these factors, as shown in the following table:

Result	Percentage
Training in 70% of the companies	95%
80% of the companies participate in events for divulgation	95%
Region divulgation	100%
Support and Incentive from municipal government for Technological Innovation advance	90%
Involvement of companies, learning institutions, government and non-governmental credits	90%
10 registered patents	95%
Innovation is present in 60% of the involved companies	95%
10 projects sent to government	95%
Contribution to other sector of the region which demand IT	90%
Creation and presentation of Laws concerning Innovation	90%
Advance in the development of involved companies	90%

Source: NTI

Chart 4- Percentage of companies that agree with the results reported and collected based on the NTI

This degree of agreement was high, in other words, companies actually agree with the results available through the mechanisms of technology transfer, obtaining 90% to 100% approval. This result indicates the autonomy and capability of the NTI in dealing with Innovation and Regional Development.

A research has been performed, a question chart applied to the NTI, with the aim to identify the relationship between that IT cluster with the theme Innovation and Technology Transfer. First, the heads were questioned about the ways through which the NTI cluster collects resources: through SEBRAE; from courses ministered to the companies; through a monthly payment from participating companies; prefectures – the execution of seminars, lectures and meetings; Federal Government – Program “Learn and Grow” – Development of skilled labor; according to the heads of the NTI cluster, all those resources revert to the companies, in an indirect way, applying the received knowledge.

It is possible to observe that the resources are still very limited, what results in a great difficulty from the NTI in accomplishing its projects and effectively execute the technology transfer process.

After that, they were questioned on how the innovation activities are financed. The heads of the NTI cluster answered that there were no payments from external partners, only their own resources. But they also affirmed that the group has worked in a way to develop projects in order to collect those resources.

It becomes a difficulty, because, when trusting on its own resources, the NTI is limited, concerning project execution and conclusion. When they were questioned on the values invested on innovation, the coordinators affirmed that there is no mensuration of that value; there is no quantification of those investments. Also, they lack support and training.

That is another problem, once there is no mensuration on the invested amount, making it difficult to obtain an Innovation Diagnosis. It means that it is difficult to know which amount is being effectively used, and what are the benefits generated (in financial matters). The

amounts, unknown, are diluted, without knowing the resources degree of efficiency. Taking the generation of economic profit as the bottom line of the Innovation objectives, it is possible to propose, in subsequent works, the mensuration of applied innovation assets (in the transfer process) and the arising results from the mechanisms in a determined timeline.

Concerning the Government investments, the Municipal Government contributed with support in the organization of seminars and meetings, and the Federal Government, with the “Learn and Grow” project, aiming the development of skilled labor for the sector.

The Government investments, both in Municipal and Federal spheres, is limited, once it concentrates in support and organization activities, such as meetings and skilled labor formation, and neglects activities such as financing on innovation projects (funding), capital supporting to acquisition of machines and equipment (process), or even product development (design, features, etc.)

6. Conclusions

In this work it was possible to analyze the importance of technology transfer mechanisms for Regional Development. From the initiative and organization of a cluster in IT, there was a greater involvement and performance of local firms, and the technology transfer as the starting point for Innovation.

In this sense, with the results presented and confirmed by the operating companies, the mechanisms of technology transfer provided by NTI contributed to the innovations and consequently for Regional Development.

Indeed, in establishing the relationship between Technology Transfer and Regional Development, it was noted that the mechanisms described in this paper are in line with regional characteristics, which are the basis for regional development.

Being an IT operating core, the mechanisms perceived by the NTI involve intensive use of knowledge and, therefore, make clear the need to evaluate the ability of participating firms in using this knowledge effectively.

Also, the degree of importance attached to each mechanism was evaluated. At this point, it is denoted how the interests of organizations are crucial in the choice of mechanisms. The feasibility of each mechanism must also consider this element, once it identifies what companies believe as crucial, and what can be really useful internally.

It was possible to obtain the relationship between the concept of technology transfer and innovation. The items listed by the NTI provide a knowledge base, which may characterize technology, and is offered to the community of associates. The appropriation of this knowledge leads to internal improvements that can generate business results for those involved in the achievement of the innovation objectives.

For example, when dealing with the legal aspects, the access to a program of innovation or financial resources to facilitate the financing of productive structure or personnel can be encouraged.

Based on the literature, specifically on the importance of reunion in clusters, it was shown how the set of associated companies have more power before the government and other institutions, concerning the seeking of technology transfer mechanisms and their application.

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