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3 Organizational Elements of Knowledge Transfer in Hungary: Towards a Functional System of Innovation

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3.1 Introduction

Traditional economical theory recognized only land, labor and capital as the factors of production. Knowledge was formerly considered as the source of increasing returns since it can be reused without cost once created. This has seriously been changed recently because technology developments in the last century transformed the majority of wealth-creating processes from a physically-based platform to a knowledge-based one. Due to the increased mobility provided mainly by the Internet, information can be transported instantaneously around the world and any advantage gained by one company could be eliminated "overnight". The only comparative advantage is companies' ability to derive values from the information flow resulting knowledge. In this emerging new era technology and knowledge became the key factors of production.

According to the OECD researchers, knowledge-based economy directly bottoms "on the production, distribution and use of information and knowledge" (OECD 1996: 7). This definition emphasizes the importance of two elements of an emergent continuum represented by the sequence of data → information → knowledge (Miller 1999: 87). In order to demonstrate their differences, we have to distinguish knowledge from information and data.*

Since information requires the relation among different data, the collection of data itself may not be considered information (Fleming 1996). Such relation strongly depends on the actual context and has little implication for the future. As this relation is dependent on the emerging associations influenced by prior cognitions of the recipient, various kinds of information can be derived from the same data. Actually, as Bellinger (1997) defined it, *information* relates to description, definition or perspective (what, who, where, when).

Beyond the relations, there is a pattern (Bateson 1988) amidst data and information with the potential to represent *knowledge*. It only becomes functional, however, when one is able to realize and understand the pattern and its implication.

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Referred to information, such pattern has more completeness resulting that knowledge includes strategy, practice or method (how).

Knowledge theory makes a fundamental distinction between explicit (codified) and tacit knowledge. Boutellier (2000: 208) described codified knowledge as embodied in products or documented knowledge. He characterized tacit knowledge also as of two categories: experienced (know-how) knowledge and social knowledge. The transfer processes of codified knowledge are undoubted unlike in the case of tacit, which is not easily transmitted, and thus is not an obvious source of increasing returns. On the contrary, Langlois (2001) has proven that even so knowledge does not have to be codified to generate economic growth.

Beyond the increase of economic growth, knowledge can even lead to structural changes in economy and in life-styles on a global scale. Neef (1998) stated that new products and emerging services resulting from the knowledge-mediated growth may bring about profound changes in the nature of work, e.g. from low skill to high skill. Due to this change, the traditional dominance of old industrial classes was transformed into a knowledge-based manufacturing in which considerable proportion of labor force was employed as knowledge workers. High-tech industries became predominant and for smaller firms specialized knowledge serves as the principal factor of growth. The absorptive capacity of new technologies and the informational asymmetry can determine the new roles of nations in globalization.

3.2 Development path on a company level: a managerial approach

As was pointed out by Amidon Rogers (1996), the global marketplace is influenced by five major forces that must be understood in order to take advantage of the business opportunities provided by the global economy: the shift from information to knowledge; from bureaucracies to networks; from training to learning; from national to transnational; and from competition to cooperation. All these forces result in the emergence of (virtual) networked organizations working with collaborative learning systems which enable the flow of knowledge throughout the organization.

The reference above describes such changes in the five-step evolution of *R&D management*, but it can easily be extended towards the *general business strategy* of firms because such changes radically affect even the strategic management of companies. As a result of this extension we can document the evolution of management approaches leading to a knowledge-driven economy comprising knowledge-based companies through four generations below.

In the first generation mainly *tangible assets* had to be managed. In those old days the strategy was to manage equipments and production lines effectively to provide the maximum value for the owners. The core strategy was operating in isolation and tangible assets provided the majority of the economic value of a company.

In the second generation the combination of different functional areas first the *project* was the asset to be managed resulting successful product development and greater market focus. Later, with the stabilized formal linkages between functional areas, the *enterprise* became the asset to be managed and managers considered risk minimization and sharing rewards across the firm as their main task.

In the third generation the management turned to customers because the best way to achieve rapid changes in the global marketplace was seen as the concurrent learning together with customers. New product ideas were validated already at an early stage by using customers' feedback. In this phase the *customer* was the asset to be managed and customer satisfaction was the overall focus.

Nowadays, at the dawn of knowledge-driven economy, *knowledge* is the asset to be managed. Business performance in this emerging phase can be measured by the ability to create and apply new ideas. This "knowledge production" makes demand on the special knowledge management tools, such as monitoring knowledge flow the same way the flow of capital or raw material is managed in a company. Customer relationship management is also transformed into customer knowledge management (Gibbert 2002) as a new knowledge sharing process in which the new focus is on customer success rather than on customer satisfaction. In this new age of technology the main share of company value is attributed to intellectual property and companies should use strategies to manage their intangible assets.

Due to the changing value of knowledge, the way of technology transfer and the institutions involved have also been changed recently. The traditional model of technology transfer in which technology moves from a well characterized economic unit to another one has been transformed to a complex knowledge transfer process (Amesse and Cohendet 2001) resulting in special knowledge sharing platforms, such as technology clinics in Finland (Autio and Wicksteed 1998) or Cooperative Research Centers in Hungary (Buzás 2002). Market players with significant knowledge need to access complementary forms of knowledge from other players to ensure the most efficient use of their internal knowledge. These knowledge-sharing networks can reduce the risk of overspecialization.

As a consequence of the functional description of the knowledge-based economy and the managerial approach towards its development, as well, the main features can be summarized as follows:

a) technology and knowledge are the main factors of production,
b) intangible assets are the primary subjects to manage,
c) networks are characterized as knowledge-based partnering with constant trade-off by the accession of complementary forms of knowledge.

3.3 Knowledge-based economy in Hungary: state of the art

As the spread of knowledge has changed the patterns of the global division of labor and comparative advantages have been rearranged or eliminated by new technologies, the relative position of actors in the new global economy is mainly determined by their capacity to absorb and modify knowledge. For a small Central European country like Hungary, the emergence of a knowledge-based economy means a special double challenge: during the economic transitions, the additional requirements of a knowledge-based society must also be taken into account but at the same time the broadening of the economic gap has to be avoided. After several decades of planning economy, government had to recognize that its role should be to facilitate rather than control technology and the knowledge transfer process.

Considering financial and legal issues, Hungary is in the most advanced group of candidate countries together with the Czech Republic, Estonia, Poland and Slovenia. In this group serious efforts were made to restructure and reorganize science and technology facilities (Meske 2000) creating new bodies, newly established institutions including financial ones, changes in activity profiles and novel legislative elements (a substantive new Act of Innovation is in progress).

However, these changes did not really result in a new revolutionary innovation system as far as effectiveness is concerned. Although the importance of research and development became a watchword, the related expenditures did not increase satisfactorily. In the 70’s and 80’s, about 2% of the GDP was spent for R&D, which arose mainly from state-owned enterprises. After the transition the economic stabilization resulted in the dramatic decrease of R&D expenditures. In 2000 this value was still up to 1%. The number of researchers employed in the knowledge intensive sector is still low and the knowledge transfer between academic and business spheres is incidental (Lengyel 2002).

More than a decade after the onset of economical and political transformation, the deficit in cooperation between science and economy, the lack of diffusion-focused elements (mainly at universities) in the innovation system and the non-functioning organizations prevent the evolvement of an effective innovation system that would be appropriate for a knowledge-based economy in Hungary.

For the characterization of the necessary key institutions in a less developed country, one may be tempted to adapt existing institutions which would be recommended based on international comparison. However, such institutions have usually worked in a developed economy for many years; hence their adaptation with smaller modifications in a transition economy could not live up to the expectations.

For this reason, what seems to be the best way for Hungary is an obstacle-based and not an institutional-based adaptation of the necessary elements. Within the scope of this strategy, the real economic functions of the institutions implemented by developed countries must be revealed first. When these functions are clarified, those obstacles, that impede the effective environment for a knowledge economy and that should be overcome by the institutions, can be characterized. As the next step, by comparison of such obstacles coming from developed economies and the internal economic background of a transition economy (for example Hungary), the challenges for the latter one, which must be overcome by its own institutions can be defined. Finally, by taking into account social and economic traditions, the optimal institutional system can be established for the less developed country. For the reasons above, the features of these institutions could be different from those serving as models in the initial phase.

Following this train of thought, with the help of a comprehensive institutional survey some challenges below have been determined which have to be faced up in creating the appropriate environment for knowledge transfer in Hungary:

a) encouraging entrepreneurial activity in the knowledge-based industry,
b) intensifying knowledge flow from universities to the industry and knowledge sharing within triple-helix (university-industry-government) relationships,
c) increasing the rate of private money in R&D expenditures,
d) boosting knowledge-based regional development and specialization.

The related key organizational elements that are either missing or recently established will be discussed in the followings.

3.4 Cooperative Research Centers: increasing private money in R&D

The traditional theory describes innovation as a linear process of consecutive phases starting with scientific research followed by stages of development and production, and terminating with distribution of a product or technology. In the last decades it was recognized that innovation is not straightaway because in order to be successful it needs interactions among actors, e.g. academic institutions, product developers, sellers and consumers (OECD 1996). These inputs and feedbacks result in the emerging network characteristic of the innovation process including sorely cooperative partners.

Before the economic transition in the central planning system of socialism there was regular contractual cooperation between public research institutions and state-owned firms, which more or less assured the transfer of results from research institutes to the industry. After the transformation, the ownership structure of the economy has been seriously changed. Based on the institutional development towards a market-driven economy, Hungary is characterized as one of the most progressed countries in Central and Eastern Europe where the share of the private sector is over 80% (Tihanyi and Roath 2002).

The emerging institutions of the market-driven economy among others were private ownership, commercial banking and liberal foreign trade. Beside privatization and monetary policy, the limited government intervention was also prioritized in the transition. Accordingly, instead of the state the major industrial investors desired to finance the high-risk scientific research projects on the basis of long-term interest in

a) results coming from research and becoming the financer's property,
b) persistent human resource supply by using the research project as "training site",
c) cost-effective research facilities by sharing the use of devices.

The integration of private firms into common research projects is substantial also for that, because the rate of private money in R&D expenditures is much lower than in the EU. While in Western Europe the average rate of private money in R&D expenditures is about 65%, moreover in Sweden it approaches 75%, in Hungary the contribution of private companies to the research costs is only 40%. This is not typical for all post-socialist countries because in the Czech Republic the composition of R&D appropriations shows a similar pattern to that of the EU (Eurostat 2002).

In spite of preliminary expectations, traditional bigger firms had limited interest in research networks and showed little willingness to build up any R&D infrastructure outside "fences" for fear of loosing control over their investments. For these reasons, the public sector still has to play a particularly important role in creating a business environment which can serve as the model of the European practice of scientific research in order to enable SMEs to keep their competitiveness after the integration. Such governmental interventions, on the other hand, result in an increased integration of the academic, public and private sectors.

In order to reinforce Hungarian scientific and technological excellence through the integration of R&D capacities and activities, the Hungarian Ministry of Education (R&D Secretary) provided financial assistance through an application process to establish thematic *Cooperation Research Centers (CRC)* in 2001. Host institutions had to be universities with a certified Ph.D. program and criteria for participation of business partners also included involvement in the center's activities. As for "seed capital", government provided half of the budget for the first three years in the range of USD 200.000 to 1 million. During this initial period centers have to develop a cooperative way of business in order to make returns which cover at least the burn rate of the CRC for the next 3-6 years.

Due to governmental intervention, the approach of private companies has been changed at one blow. On one hand, through the organization (votes in the CRC's board) the frame guarantees that the project can directly be influenced by all partners. Private companies, on the other hand, were benefited by different cost-based advantages. They have access to the low-cost university facilities and budget-prized Ph.D. students as well-trained human resource. Occasionally, private companies can use the "no-cost" side within universities or any other public institutions (e.g. hospitals). Last, but not least, special taxation benefits relating to cooperative research may also be enjoyed.

In the first round, five CRCs were established:

(a) *Trans-University Centre for Telecommunications and Informatics* was established in Budapest by three departments of two universities along with Hungarian subsidies of some multinational informatics companies (Ericsson, Compaq and Sun) and the market leader Hungarian mobile communication company, Westel among others. The main purpose of this CRC is to develop Internet-based and mobile communication systems for the 21st century.

(b) *CRC on Industrial and Medical Application of Lasers* was set up in the Southern Transdanubian region of Hungary by 5 partners from the academic sector in association with 13 private companies. Although the research center has its headquarters in Pécs, it covers knowledge not only at the local but at the national level as well because several expertise groups in laser technology located in Budapest and Szeged are also present among its academic and private partners.

(c) The University of Miskolc together with 30 industrial partners gave life to the *CRC on Mechatronics and Material Science*. Out of the five CRCs, this centre has the most diverse geographical coverage including representatives of the steel industry located at Dunaújváros or the subsidiaries of the household devices giant, Electrolux from Jászberény.

(d) Similarly to the infocommunication research centre above, the *CRC on Rational Drug Design* was also established in Budapest. The academic sector is supremely represented in this research centre because beside the 2 academic, 1 non-profit and 4 private pharmaceutical and biotech founding partners, other 10 academic departments joined as associated partners. The latter ones participate without financial placement, but in return make available their knowledge.

(e) *CRC for Chemical Industrial Development Based on Green Technologies* was established in Veszprém by the Institute of Chemical Engineering of the University, Hungary's chief oil company (Mol Rt.), and 5 other chemical and pharmaceutical firms. This research center is based on the long-time tradition of chemical industry existing in the city.

Due to the multiplicative effects, the first bunch was followed by other CRC-like organizations (for example the Renewable Energy and Green Technologies R&D Program Center in Szeged) working under similar conditions to those of supported CRCs.

All such organizations develop and use a joint research infrastructure and jointly manage any knowledge produced. Sharing of all rights related to products, technologies or intellectual property is contracted prior to the first step of joint development. A CRC offers the possibility to develop an excellent way of cooperative, interdisciplinary research to the parties involved stimulating new research directions. Last, but not least, the formation of CRCs and similar organizations has considerably increased the proportion of private capital in innovation processes.

3.5 Spin-off companies: diversification of the knowledge-based industry

The formation of spin-off (spin-out) companies occurs when a former employee of the parent company with a certain technology or essential knowledge leaves to start his/her own firm. Due to the features of the small technology-based companies, spin-offs are among the most promising ways to commercialize technology or knowledge. While established companies adopt only new technologies closely aligned with the company's existing products, spin-offs can take advantages to absorb early stage technologies and develop them in time for market entry. Technology start-up companies can have enough flexibility to change business directions if the market requires so while established companies have standard procedures and much less ability to adapt and tailor early stage technologies as necessary. Furthermore, proximity of spin-offs to the birthplace of technologies can assure ongoing support from inventors making the technology transfer process complete.

Spin-off companies can be categorized based on the attributes of the parent organizations (Oakey 1995): the major source of the new technology-based firm can be either higher-education institutions (university spin-offs) or industrial firms (corporate spin-offs). Since universities more frequently encourage the transfer of knowledge to be used outside the university than do private companies, the formation of university spin-offs is predominant.

Irrespectively of their features, the entrepreneurial spirit is particularly important in the formation of spin-off companies. In terms of entrepreneurship, research shows that the European Union lags behind the United States (COM 2003). The aversion towards taking business risks among Europeans is a main contributing factor to this attitude. In the US the brightest young people establish their own businesses, and in case of failure they keep on trying to set up new companies until they either succeed or, after *several* failed attempts, apply for a job. In contrast, there is a European tendency according to which only those individuals start new businesses who do not find a decent job. This attitude resulted in a huge "entrepreneurship deficit" in Western Europe (COM 2003). Due to the entrepreneurial philosophy above mentioned, in the USA spin-offs were popularized many years ago and created legendary and prestigious places, like "Silicon Valley" and "Route 128" near Boston. On the contrary, due to the lack of motivation in many European countries spin-off companies are less favored among scientists and universities often opposed the launch of such firms.

In order to study how to prevail the European tendency in a developing economy and what the main obstacles impeding the establishment of new technology-based companies are, the spin-off formation process was investigated in Hungary (Buzás 2003). In the study, both scientists with marketable scientific results and university students were considered as potential entrepreneurs. The latter group provided valuable information about the deficiencies of the education system which focuses mainly on the needs of large multinationals and neglects the small-sized enterprise-specific topics. The results showed that there are three main obstacles preventing the spin-off formation: lack of motivation, competence and reputation.

Scientists often refuse to become businessmen and in order to save their independent position as researchers they express their preferences for invention over selling (motivation gap). The barrier of lacking motivation could only be overcome by reducing the fear of an uncertain future.

If a scientist is motivated enough, the academic career can serve as a good platform for launching a company, but limited experience in commercial matters (competence gap) blocks the business. Even commercially oriented researchers have limited capabilities in finance or intellectual property rights. They need an advisor with managerial abilities to transform the research results into business success.

A successfully launched spin-off company itself, however, can not guarantee prosperity because trustworthiness is essential (reputation gap) for business partnering. Entrepreneurs do not have much time to become well known and to establish a strong reputation. Young spin-off companies are in constant need for guarantors confirming their outstanding technical expertise and creditability.

In order to encourage the formation of spin-off companies, in 2002 the Hungarian Government issued a call for proposals for the financial contribution to their establishment costs up to 40.000 EUR per applicant. This support can be used for the preparation of a feasibility study, adaptation of research results, acquisition of know-how, protection of intellectual property rights or preparation of prototypes. The small number (34) of proposals confirms that the above mentioned result, according to entrepreneurship has not primary financial, but motivational obstacles in Hungary. For this reason, the main task is to create an entrepreneurial climate at universities by implementing training programs and disseminating success stories.

3.6 Missing TLOs: the imperfect Triple Helix

Over the last decade, a number of concepts were proposed for modeling university-industry-government relations. One of the better known models is the *Triple Helix* in which the three separate spheres are defined institutionally (Leydesdorff and Etzkowitz 1996). In this model for analyzing innovation systems, knowledge transfer is no longer considered as a linear process from origin to application, but a complex system with unique communication interfaces operating in distribute mode. In the model the interactions between the spheres are mediated by special organizations such as technology transfer offices and innovation agencies.

Prior to 1980, technology transfer offices were not remarkable in the university-industry nexus. The situation substantially changed when the Bayh-Dole Act came into force in the US at the end of 1980, allowing universities and other non-profit organizations to patent and commercialize the results of their discoveries made under government-funded research (Schmoch 1999). Because the majority share of research at US universities is funded from public financial sources, this act meant a breakthrough in the history of university-industry relations.

As a result of the Bayh-Dole Act, a lot of technology transfer offices were established at universities throughout North America in the 1980's perfecting the Triple Helix. Following the US practice, many other countries established their institutional framework to encourage university-industry technology collaborations and facilitate the commercialization of university inventions (WIPO 2002). Such establishments, which can universally be called *TLOs (Technology Licensing Offices)* regardless of their institutional arrangements, play a crucial role in identifying technologies with higher commercial potential and assisting inventors in licensing negotiations.

Due to the traditional differences in innovation policies, countries could follow different models in the commercialization of domestic discoveries. The US (bottom-up) innovation policy principally focuses on creating incentives for universities so that they commercialize their inventions themselves. Federal actions foster experimentation in university policies with respect to how to best exploit the windfall of intellectual property rights brought about by the Bayh-Dole Act. On the contrary, the Swedish way of selling academic research ideas is far from those figured in the US because in Sweden the government attempts to directly create a mechanism facilitating commercialization (Goldfarb and Henrekson 2003). Bureaucratic interventions enforce Swedish universities to establish an internal policy focusing on the marketing of intellectual assets. According to the authors, the latter (top-down) model is similar to the models applied by most EU countries. This "European way" proved to be much less effective than the US pursuance of commercialization because of the lack of incentives for European scientists to get personally involved in the transactions.

In the second half of last century, Hungary's economic policy artificially separated research units from the industry, this way breaking the traditionally close relationship between research and production. After the economic change of the 90's, the knowledge flow from companies to universities intensified, but the opposite direction of information drift is not supported by the relevant institutions (Papanek and Borsi 2001). In spite of increasing governmental financial support for R&D, the lack of effective TLOs at the Hungarian universities results in an imperfect Triple Helix preventing the effective commercialization of the inventions.

This situation was primarily induced by the status of intellectual property rights related to inventions. Because of the shortage of capital, universities and public research institutes had no financial sources to cover the submission and maintenance costs of patents, as a result, universities had to refuse their primacy right for the in-house inventions. As a consequence of this, during the last decades the intellectual property rights were either awarded directly to the inventors or became public without protection. This is the opposite of the American practice, where patent rights are generally awarded to the universities.

Without a solid patent portfolio, units dealing with technology transfer at Hungarian universities could not establish fruitful industrial links over the last decade. For this reason, the emerging TLOs presently do not have an established business environment, thus they cannot act as effective knowledge dealers. In spite of their less efficiency, self-organized TLOs and their route-searching represent a bottom-up character of Hungarian policy towards the commercialization of university knowledge, while the governmental interventions described above (CRCs and spin-off encouragement) incorporate its top-down nature.

3.7 Science Parks in Hungary: 'seedbeds' of innovation or high-tech fantasy?

There is no uniformly accepted definition of a science park and, as was pointed out by Kung (1995), there are thirty terms used to describe similar organizations such as 'science park', 'research park', 'technology park', 'innovation centre' etc. without any clear distinction. MacDonald (1987) concluded that most of the above terms have two common features:
(a) a property-based development close to a place of learning;
(b) high quality units in a pleasant environment.

In addition, Westhead (1997) emphasized that such parks can serve as catalytic incubators for the transfer of research into production. Using a business-focused approach, Storey and Tether (1998) defined the role of science parks as enabling commercialization of the research ideas at the local universities and establishing businesses using sophisticated technologies. An overall definition was given by the UK Science Park Association describing the science parks as a property-based initiative which

- "has formal and operational links with a university or other higher educational institutions or major centre of research;
- is designed to encourage the formation and growth of knowledge based businesses and other organizations normally resident on site;
- has a management function that is actively engaged in the transfer of technology and business skills to the organizations on site."

The development of science parks in Europe received its impetus from the success of the early established parks in the USA. In many European countries until the 1980s there was not a significant number of science parks, but a sudden boom took place over the last decade. By the middle 1990s, 310 science parks were developed in the 15 countries in the EU where about 15,000 firms were located employing more than 230,000 jobholders (Storey and Thether 1998).

The role of science parks in the innovation processes is, according to the findings in literature, doubtful. Massey et al. (1992) found that geographical proximity between a university and a science park serves as only a weak promoter of the technology transfer. For this reason they consider such parks as "high tech fantasies". Based on an empirical survey of over 160 on- and off-park high-technology firms in Israel, the location of a science park is shown to have a weak relationship with the innovation level (Felsenstein 1994). Based on these results the innovation-entrenching role of science parks is primary to inducing innovation. In the survey of Surrey Research Park, Vedovello (1997) argues that proximity cannot strengthen the formal links between universities and the industry in a science park, but such closeness proved to be important for *informal* connections. Bakouros et al. (2002) also revealed mainly informal links between the firms and the local university in Greek science parks. The latter authors reveal the complete absence of research-type synergies between the on-park companies.

In contrast, Löfsten and Lindelöf (2002) recently described significant differences between on- and off-park companies in the linkages to the local university. Analyzing 10 science parks and 273 firms in Sweden with statistical methods they confirm the role of the formal university-industry links in the development of new technology-based firms (NTBFs). Concerning the effectiveness of NTBFs in science parks they have found, however, no greater R&D outputs for on-park firms compared to off-park companies.

The above contradictions of relation between the intensity of formal technology transfer and geographical proximity in science parks could be resolved by a service-based explanation. Science parks are a particularly suitable location for new business opportunities and generate a more motivated branch of entrepreneurs with respect to innovation than off-park locations. New technology-based firms, however, are generally not able to utilize such advances without the training and business placing programs and assisted networking organized by the park management (Löfsten and Lindelöf 2002). For this reason, the factor of success in a science park resides in managed business services creating more formalized technology relations, which result in more profitable NTBFs.

There are more organizations in Hungary defining themselves as innovation parks or research parks. Because of the lacking critical mass of private companies or the less developed technology-based relations to the universities, however, these parks cannot be considered as Felsenstein's (1994) "seedbed" of innovation. Considering the commonly accepted features, only one park seems to operate as a science park in Hungary: Infopark in Budapest. Infopark Incorporation was established at the end of 1996 by the Budapest University of Technology (BUT), Eötvös Loránd University (ELU), the Hungarian Ministry of Economy and the Prime Minister's Office. Two universities possess 25+1% of the voting shares, and with a golden share the Hungarian State assured the eternal use of the area as a technology innovation park.

The location of Infopark is optimal to create links between firms and universities and to exploit the possible synergies, because the park covers the field attached directly to the founder universities' locations at the side of the river Danube. Taking into account the existing technologies, research profiles and educational experiences at BUT and ELU, Infopark was specialized in information and communication technologies with the aim to collect companies with significant experiences in the field of computer technology, telecommunication and multimedia. The first settler was the biggest Hungarian telecommunication company (MATÁV), which established its new R&D center in the Park. The Hungarian giant was followed by Hungarian subsidiaries of IBM, Hewlett Packard, Nortel and Panasonic.

After five years of initiatives, Barta (2002) surveyed the functional linkages and real services in Infopark. She found that Infopark was not yet able to promote the founders with any technology information services, contract R&D services, market studies, auditing, quality management services or product promotions. The lack of accessible central services enforces founders to build up such services in-house constraining future cooperations inside the Park. Because of the absence of real services, Infopark cannot serve as intermediate and, notwithstanding its excellent facilities, functions in its present stage as an "office park" only.

Regarding innovation processes as key elements of regional development, two years ago the government decided to define various evolutionary paths for the large number of industrial estates in Hungary (Lengyel 2000, Lengyel and Deák 2002). One of the four desired outcomes of this progression would have been developing science parks with the participation of universities or research institutions. As Barta (2002) concluded, successful science parks in a transition economy need considerable and persistent governmental support in order to create the essential services giving life to them. Because of the limited sources, in transition economies governments should focus their attention on a limited number of estates where the conditions are really promising for a science park with value-added internal services; otherwise companies will keep away from the park.

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