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Role of the Techno Parks in Clustering of High-Technology SMEs

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Role of the Techno Parks in Clustering of High-Technology SMEs

***Abstract*—This paper first provides a review of the science and technology park phenomena and analyses the recent trends in the relevant literature. It specifically aims to examine advantages of clustering and role of the networks of high growth firms within a technology park. By using a case study of an emerging South-East Queensland technology park to provide insights, the paper will focus on the nature of relationships and exchanges between firms and their stakeholders.**

***Index terms*—Science and Technology Park (STP), networks, clusters, Brisbane Technology Park (BTP).**

I. INTRODUCTION

In recent years several concepts have found their way in literature regarding innovation infrastructure support for high growth firms, notably the notion of 'embedding' and the idea of a favourable 'milieu' or culture for innovative activities, and more recently the emphasis on community development (see, for example, Cooke & Morgan 1998; Enright 1998; Seline 2005). It has been argued that the promotion of these concepts can enhance the regions' competitiveness and can help businesses to foster an identity in a cluster market. Innovation infrastructure support such as Science and Technology Parks (STPs) are physical aspects of promoting these notions and developing specialised clusters and infrastructures in an urban environment.

In general, two broad categories of infrastructure investment can be distinguished in the literature. On the one hand, special spatial investment zones were established, in which the co-location of specific types of firms was expected to trigger interaction and the shaping of a local 'innovative milieu'. A second, non-spatial set of initiatives focused on promoting networking and 'institution building' through bringing firms together in groups and the formation of associations.

The results of the spatial zoning initiatives are visible in almost any city or region in industrialised countries: business parks, incubator centres, science parks, technopoles. Most of these sites are dedicated to high growth firms, with emphasis on hi-tech development, although some also include subsidiaries of larger companies and research centres (especially in the city-based technopoles). In terms of fostering local dynamics and innovation, there are cases of success, such as the Stanford and Cambridge science parks, however some initiatives did not show the expected level of internal 'chemistry' in terms of knowledge exchange and commercial interaction (Park 2002). One core reason for this failure seems to lie in the fact that it was assumed that co-location of firms, often combined with the presence of a key technology source such as a university, would trigger such interaction. However as emphasised in the case of the Sophia-Antipolis technopole in France: "it has taken a long time for a local organisation to have sufficient trust in the other components of the project to be interested in developing local collaborative processes" (Longhi 1999).

At the same time, it has been argued that the provision of physical infrastructure and its associated network assets can support the entrepreneurial culture as well (Löfsten & Lindelöf 2003). For example, businesses will have recourse to faculty and to workforce and training development that the region's universities and technical colleges can provide. They will have an opportunity, as the regions will keep improving the capital infrastructure, of having forums, meetings and presentations to the private sector and the larger community. Moreover, they will have a market opportunity with the partnerships and the

parks will help them market and create awareness of their programs and products that they are trying to develop.

This paper aims firstly to present a review on the science and technology park phenomenon through tracing a broad range of literature. In this regard it probes the terms and definitions of science park schemes, and analyses development and recent trends of the science and technology park phenomenon. Secondly it provides example of clustering within a technology park and examines the nature of network relationships of high growth firms within an Australian technology park by focusing on the relationships and exchanges between Small and Medium-Sized Enterprises (SMEs) and their stakeholders.

II. SCIENCE AND TECHNOLOGY PARK PHENOMENA

Studies of science and technology parks and innovation infrastructures can be divided into studies that focus on the companies located within these facilities, those that attempt to provide an assessment of the science parks and incubators themselves (both hard and soft infrastructures), those that focus on the systemic level of the clusters, region or country, and those that examine the individual entrepreneur or teams of entrepreneurs in these facilities (see, for example, Bigliardi et al. 2006; Phan et al. 2005).

In addition, the continuous debates on the tendencies toward creation of sustainable clusters, role of public and private sectors, economic value of these clusters, the importance of incubation, the delicate theme of the relationships between universities and entrepreneurial development or the themes on networking, social capital and advantages of geographical concentrations offer crucial elements for understanding how the concept of science and technology parks are developing (e.g. Fromhold-Eisebith and Eisebith 2005; Pinch et al. 2003; Asheim and Coenen 2005; Baptista 2000). In what follows a summary of major findings are presented.

A. Definition:

A broad definition for spatial support for high growth sectors and firms is a managed spatial environment set up to leverage and support local science and technology or knowledge resources to enhance a region's economic base. These specialised managed work spaces have grown rapidly in industrialised nations and are found in increasing numbers in developing economies. This may involve science and technology parks (STPs), research parks, innovation centres or technology/innovation precincts, which all have become an established part of the innovation infrastructure in those economies. They are an economic development tool that is particularly suited to developing regional knowledge economies. In appropriate regional environments, these spatial developments can provide a specialist mechanism to promote and stimulate commercial and industrial innovation, encourage re-industrialisation and foster sustainable regional development infrastructure options.

However, looking for a uniform description of a definition it seems necessary to report some of the most considered definitions given by national and international organisations related with the science and technology parks (STPs). This is because the term Science and Technology Park refers to a range of innovation infrastructures, with common characteristics. For example, as defined by the IASP (International Association of Science Parks) "a science/technology park is a property-based Initiative which:

- has operational links with Universities, Research Centres and other Institutions of Higher Education;
- is designed to encourage the formation and growth of knowledge-based industries or high value-added tertiary firms, normally resident on site; and
- has a steady management team actively engaged in fostering the transfer of technology and business to tenant organisations".

This definition of a science and technology park, which is now broadly accepted and used, encompasses not only the different models currently existing in the world, but also other labels and expressions such as research park, technopole, technology or innovation precinct. Although there may be some differences among the projects under these labels, such differences are not as significant as to allow defining different projects or "categories", but rather of different subtypes of one concept. However, it is possible to mention some of the general characteristics of these 'smart innovation infrastructures', which can be applied to other subtypes as well:

- Generally, it is a physical property, often laid out like a park, to which new or existing research-based of small or larger companies are attracted by the working conditions, either the physical proximity of a university or a research institute or simply the pleasant nature of the area.
- The parks/precincts may be managed by specialised professionals, whose main aim is to increase the wealth of its community by promoting the culture of innovation and the competitiveness of its associated businesses and knowledge-based institutions.
- The principal purpose of park/precinct is to deal with innovation in terms of research, development and design, conceiving new products and developing them to the marketing stage. The research and development (R&D) work conducted by firms in the precincts is often limited to designing prototypes, while the manufacturing side of the business is located elsewhere, though some firms do engage in the production of one-off sophisticated items, and some parks do have manufacturing facilities.

B. Advantages of Geographical Concentration and Clustering:

Geographical concentration has been central to the cluster idea such as a technology park. Even though some approaches have tried to disprove the importance of physical agglomeration, there are both hard and soft aspects motivating why geographical proximity remains at the core of the cluster concept.

First, there are 'hard aspects', of which some were identified long time ago by Marshal (1890), associated with benefits derived by firms from co-locating in certain areas:

- The availability of specific natural resources or other unique local assets may contribute to co-location.
- Geographical proximity provides opportunities for lowering transaction costs especially in accessing and transferring knowledge.
- Economies of scale and scope may be optimised most effectively by a limited number of efficient-scale plants in a given geographical area.
- Specialisation of supply from factor markets with respect to labor, capital, or technology sources, may be facilitated within a specific area.
- The means for accessing and sharing information on market and technology change may become more effective within a given area.
- The interplay with local customers triggers learning processes and more sophisticated demand.

For such reasons, firms may experience that their belongings to a set of inter-related actors which – in a given region – can serve to enhance efficiency, underpins productivity growth and raises innovativeness, especially due to better access to knowledge, ideas and skills.

Second, there are very significant 'soft aspects' related to the localisation in *social capital* (Meyer 2006; Ergazakis, Metaxiotis and Psarras 2006). Geographic proximity between firms and research institutions tends to facilitate informal exchange and accumulation of tacit knowledge [10]. As confirmed by the various definitions, STPs are systems naturally related with different partners. The networks created and/or participated by the STP are aimed at creating fruitful interactions with firms, SMEs, skilled people, universities and financing bodies like governments, Venture Capitalists (VC) or private firms (Meyer 2006).

In this context, ideas like *the social capital* indicate more than a single link, it refers to a whole concept on how creating a social organisation to foster innovation, knowledge development in an entrepreneurial context. Often, fruitful, creative processes of exchange are associated with the emergence of a special environment, a 'meeting place'. Attractive condition for working as well as living may, for instance, play an important role. However, which kinds of places play an important role, as well as which values are conveyed and shared, vary. Concepts such as *Learning Villages*, "places where there is a proactive aptitude to continuously know", gives the roots to a knowledge based local development in a global society (Ergazakis, Metaxiotis and Psarras 2006).

Overall, social capital can be greatly beneficial for promoting joint efforts, but may also lead to immobility, exclusion and resistance to change; in fact not all network effects and externalities associated with shared values are beneficial. Therefore, questions arise how socially desirable interactions come to be and translate into social capital. While social capital is difficult to define and measure, not least due to data availability problems, fundamental cultural influences and institutions may help put in motion a gradually expanding pool of self-enforcing favorable interactions. For example, in the case of the Italian industrial districts, commercial inter-firm exchanges were found to grow out of membership of artisan and commercial associations, labor associations, and various community-based institutions. Information may also be diffused formally as well as informally, as when employees change workplace, take their children to the same school, or visit the same social events. Such spontaneous, market-led and informal communication channels have been instrumental in, for instance, Silicon Valley (Koh et al. 2005).

C. Emerging Trends in STP Movement

As it is clear the STP model is evolving and the emerging trends in recent literature include the following:

- There is a growing movement to drive public/private sector economic development in the direction of creating sustainable clusters. The cluster movement, with substantial public sector funding behind it, may provide a catalyst for the development of STPs over the next 5-10 years. Science and technology parks could find a unique role in providing the infrastructures that make groupings of businesses behave as highly creative and innovative clusters from which new economic activity will emerge.
- Increasingly, the private property sector (both developers and investors) appears to be working in partnership with government, universities and other research centres, in the development, procurement and property management of STPs. The challenge for STPs is the need to differentiate themselves from pure real estate developments through their service offerings and thereby adding tangible and intangible value to the STP brand.
- Increasingly, new Science Park developments are being financed by private capital, sometimes in the form of loans and increasingly in the form of direct investment. With fewer companies willing to enter into long-term lease commitments, it is likely that such property investors will become increasingly linked to the Science Park model.
- Proximity between host or affiliated research institutions and tenant companies has been a major issue for most STPs to date. Clusters also often depend on a geographical context but they primarily work because of the critical mass of resources and infrastructures that they gather around them. With modern IT, the need for close proximity, while still highly desirable, may become less important over time. STPs might accelerate the rate of technological creativity and innovation by the development of new forms of built space and novel infrastructures.

Some trends in STP practice and operations emerging from literature and conference presentations include (AURP 2006, 2005, 2004, 2003, 2002):

- Parks are generally providing a smaller proportion of generic office space in favour of more specialised space with tailored infrastructure;

- As the Park concept continues to demonstrate its worth, there is stronger public buy-in with more financing coming from state governments;
- More developers are building speculative wet-lab space and equipping/retrofitting new "smart buildings" with large capacity digital infrastructure and other high tech accoutrements;
- STP building design and efficiency is becoming more sophisticated (and expensive);
- There is a movement toward taller buildings on Parks with higher end land values and urban settings; and,
- Technology community "buzz" buildings are becoming a pivotal point in a Park site for encouraging informal business and social interaction.
- Parks are increasingly devoting their energies to creating space to accommodate the growth of successful small businesses in the years beyond incubation;
- Parks are emerging as leading providers of technology business incubation processes;
- Parks in which the partners see re-industrialisation and inner city regeneration as a primary goal are increasing in numbers; and,
- "Theme" Parks working to develop the bio-medical sector with specialist buildings and services focused on the needs of this single sector are also emerging.

Other trends identified by literature include:

- An orientation towards technology specialisation, and cluster-like STPs;
- Universities taking a more active role in creating smaller STPs;
- Expansion of the Learning Village / Science or Knowledge City concept that expends the scale of the STP from a facility to a community, integrating residential and municipal functions;
- Continued dispersion of the STP phenomenon, with more STPs in more countries;
- More involvement of the private sector in STP development, and in more creative ways; and,
- Higher level of integration between STPs and metropolitan/regional development strategies.

As emphasised in the literature not even the most successful facilities perform to "best practice" in all key performance areas. STPs are about achieving long-term and sustained economic development from their assets and knowledge. The establishment of STP facilities is complex. Like any business venture, the likelihood of success is enhanced by thorough pre-planning. Planning needs to incorporate the aims and objectives of the Park, its budget and timeframes, rents, revenue streams and cash flow, governance and management structure, services offered, an understanding of its market and demand, and much else.

III. THE CASE OF BRISBANE TECHNOLOGY PARK

A. Methodology

This case study examined the nature and strength of network relationships of high growth firms within Brisbane Technology Park. Drawing on interviews, questionnaires, including a network linkage survey, as well as documentary material, this study explored the role of cooperative networks and clustering in competency building and learning of high-technology SMEs in a planned cluster such as the Brisbane Technology Park (BTP).

The Brisbane Technology Park (BTP) has been purposely chosen to form the basis of this study for a number of reasons. Firstly, although the BTP has been in existence since the 1980s, it has experienced a number of fluctuations in terms of its membership composition and related cooperative relationships. It is envisaged that this variation in membership and cohesion will provide useful insights into processes for building and maintaining cooperative networks. Secondly, as BTP is not located in direct proximity to universities and other such research institutions, valuable network connections to such institutions will require purposeful establishment by BTP members. Furthermore, BTP is an initiative of the *Department of State Development, Trade and Innovation*, and forms part of Queensland's 'Smart State' program,

designed to create and stimulate growth in employment and state economy. The key objectives of BTP as outlined on its official website are to:

- Develop as a community that makes visible and evident, a range of business, economic and scientific skills;
- Provide resident companies involved in the commercialisation and exploitation of technology with a sense of identity; and
- Provide an environment that develops a sense of community in which all residents contribute to the healthy exchange of scientific and other knowledge between businesses and individuals [23].

For the review, a combination of quantitative and qualitative data was collected, by means of a questionnaire and face-to-face interviews. The structured questionnaire was designed to identify the nature and type of relationships of BTP firms, the perceived importance of these linkages, and to map the scope of cooperative networks. The questions were formulated in two different ways: (a) 'factual' questions requiring a dichotomous (yes/no) response; and (b) questions which were answered on scale-type responses, indicating intensity of the linkages, location and importance of the information and knowledge ranging from little importance to very important. Additionally, follow-up discussions and interviews held with senior managers of selected firms in order to investigate in more qualitative detail the nature of the their relationships and their experience of the learning and sharing processes within networks.

The sample of firms used in this study was drawn from the Directory of companies available on the BTP's website. The firms within BTP largely belong to the sectors of multimedia, software development, electronic services, telecommunications and biotechnology; the so-called high-technology firms. All 56 of the firms located with BTP at the time of this study were chosen to receive questionnaires. The five-page questionnaire was first e-mailed to companies in BTP. Follow-up telephone calls and emails were also made. In total, 24 usable firm responses were received, yielding a response rate of ≈ 43%. Out of these firms 13 are regular SMEs, while 10 are branch offices of existing firms and only one is a corporate spin-off. Among these firms 10 firms have less than 20 employees, nine between 20 and 100, and four have over 100.

B. Network Linkages

In order to achieve a detailed understanding of the type and nature of the relationships occurring between BTP members and their impact on the exchange of knowledge and the fostering of innovation within the park, a set of questions based on network linkages and relationships was administered. The first question, administered in the form of a network linkage survey contained within the questionnaire, provided a list of possible BTP members and asked respondents to indicate which organisations they had regular contact/exchanges with against a set of variables such as type of interactions (e.g. technical advice, informal contacts, etc.) (see TABLE 1).

TABLE 1
AGGREGATE LINKAGES BETWEEN BTP MEMBERS

Type of Interaction	Aggregate number of interactions among the whole sample (N=24)
Technical Advice	16
Informal Contacts	42
Exchange of Information	51
Formal Contract	42
Joint Funding	6

As TABLE 1 displays, BTP firms are involved in an array of linkages, of which exchange of information (51), informal contacts (42) and formal contracting (42) are the most frequent. In average, each of the 24 firms indicated that they engaged in formal contracts with only 2.33 other firms of the total

56 located in the BTP at the time of the study. Nevertheless, the existence of multiple ties is an indication of a level of strength of ties occurring between firms, providing a stronger basis for cohesive activity toward innovation outcomes. Further, a more detailed interrogation of the linkages uncovers the existence of a core group that is involved in multiple types of exchanges. This result provides some evidence that several park members have entered into relationships based on higher levels of trust, involving the exchange of information and technological advice, suggesting that some firms have been able to achieve strong ties within BTP.

Additionally, participants were asked to identify any major links with other outside networks and rate the importance of these in terms of their business activity; three rating levels, high, medium and low, were provided. It is clear from the data collected that networks for BTP firms extend beyond the local region (see TABLE 2).

Nearly 50 per cent of the firms reported the importance of national and global networks. Data suggest that most of these networks are between firms in the supply chain (suppliers and customers). This evidence suggests that despite acknowledging the value of local 'networking' between firms in the park, firms have not actively involved themselves in localised networking as a particularly important factor in their general business activities. This emphasis on external relations was underscored in interviews carried out with firms within the park. For example one respondent noted:

> Suppliers, most of them are international, ranging from Italy to Canada to the United States and the United Kingdom. Then my clients are basically Australian and New Zealand. (Interview)

TABLE 2
LINKAGES WITH OTHER NETWORKS

Networks	High	Medium	Low
BTP Network/Cluster	3	10	9
Local Network (Brisbane & surrounds)	11	6	6
National	13	8	3
Global	14	4	5

As well as providing specific support services and resource advantages, linkage to additional external networks can facilitate access to knowledge and opportunities. Because regional and broader institutions interact within relatively larger networks of linkages, they can act as innovation facilitators. Evidence of the utilisation of external networks to obtain knowledge has been identified in interviews conducted in this study, with one firm suggesting they had easier access to knowledge other than within the technology park:

> Inwardly we have a lot of knowledge within the company, so there are very few occasions where it would require me to go to anyone within the Park, not because they haven't got the knowledge, don't get me wrong about that. It's just that I have easier access to knowledge in other places. (Interview)

While this data does suggest some element of strong ties may exist between some BTP firms, in general, relationships appear to be established and governed principally by economic transaction contracts, suggesting a lack of trust within the technology park. Further, the findings broach the fact that BTP firms appear more interested in building on relationships outside of the park than tapping into the benefits

available locally; this phenomenon could be referred to as an 'innovation slippage' in which potential advantages to cluster members have 'slipped' out of the local network and entered the broader/distant network. This notion of *innovation slippage* within BTP may suggest that a lack of commitment to valuable knowledge exchange exists within the park.

To analyse the degree of willingness and commitment to knowledge exchange and economic advancement within BTP, respondents also were asked if they believed that friendly contacts with other firms in BTP were an important asset for their firm; approximately 65% of respondents indicated a perceived value in their relationships within BTP. Some uncertainty as to the source of this value, however, was evident, as indicated in the following interview extract:

> It's difficult to say just what the advantage will be but as I just said there are advantages. To discover that someone's got some products that you can use, or even that you can manufacture the product that the other guy wants to do, we've got software here, you've got developers, we've got testers and graphic parts, if a small company grabs that, there has got to be advantages. (Interview)

In this way, there is an evident recognition of the potential benefits of relationships within BTP, particularly given knowledge of other people and their products; however, due to the uncertainty of the advantages to be derived from relationships within the park, trust (or a 'leap of faith') is required to take steps to seek these advantages.

Interestingly, when asked if they felt they could achieve the same outcomes if located outside of the park (16 respondents indicated they had developed new products and processes while located at BTP), 68% of respondents believed they could. This finding is particularly noteworthy, given the emphasis in the literature on the difficulties faced by SMEs operating autonomously; one explanation of this finding is that several of the interviewed firms were branches of existing firms, which may be capable of providing them with the required support for innovation. Finally, respondents were asked to detail the frequency with which they exchanged ideas or experiences with other firms - a majority of them (16 firms) responded only 'occasionally' and only three firms indicated 'often'. The responses of six firms, however, indicated that they have never exchanged ideas or experiences with other firms.

A. Cluster Governance

As well as stressing the importance of a cooperative or collective orientation, the literature also indicates that the structural aspects and operation characteristics of a cluster type arrangement such as a STP as to be essential for collective learning. In tis regard, the optimal structure combines both stability and variety. Arriving at such an optimal structural mix generally requires oversight and direction setting of a governance model or framework.

Based on this, in order to gain insights into the type of the mechanisms and structures that may provide effective integration strategies respondents were asked to rate the importance of possible mechanisms for the successful integration of a cluster like BTP. Specifically the respondents were asked to indicate those linking structures and/or processes that may assist in the way the BTP network functions**.** A list of eleven (11) possible answers was provided, with respondents asked to indicate those most relevant to their situation within the BTP. The replies to the questions are set out below in TABLE 3.

These findings, when coupled with other results indicate that although there is evidence of a market orientation, and some centralised authority by way of the BTP government sponsorship, the BTP is also guided by a relational based governance mode. This finding reflects the importance of relationships as a mechanism for development – indicating that there is an underpinning network governance element to the cluster.

TABLE 3
IMPORTANCE OF LINKAGE MECHANISMS

Linking Mechanisms	**Importance (N=24)***
Well developed rules and procedures	4
Ongoing liaison between members agencies	**9**
Coordination committees	7
Involvement of a facilitator (intermediary)	4
Involvement in working parties	4
Conferences to discuss issues & set joint direction	7
Workshops to develop mutual implementation strategies	6
Informal meetings between members	**13**
Participation in joint venture programs	6
Regular telephone contact	4
Regular meetings of cluster members	**8**

* Multiple choices allowed.

This result is consistent with the literature that stresses the importance of a relational element to network/cluster governance. Associated with this, the response also demonstrated a preference by respondents for highly personalised linkage mediums for example, ongoing liaison (9) and informal meetings (13), to provide the linkage mechanism to bind members of the BTP. These were bolstered by more formalised but nevertheless interpersonally orientated mechanisms such as regular meets, conference and workshop participations. One of the interviewees indicated that:

> When I first came that was my idea to get some networking going, but being focused on getting going I sort of dropped the ball in that respect and started to concentrate on my own business. But I do believe that somebody perhaps needs to provide the wherewithal to get people invited to a morning coffee where we could discuss common problems and from there grows the faculty exchange – 'Oh, you can do that and I can do this'! (Interview 23)

Based on a review of the data collected during the study of BTP, it is proposed that many of the members of this particular technology park may have entered for reasons other than just the collaborative advantage of cluster locales. While technology parks/clusters offer members a wide range of benefits, their propensity to facilitate networking amongst members is generally seen as their greatest advantage. Co-location within STPs additionally promotes the transference of more complex tacit knowledge, which may lead to opportunities for innovation, one of the primary goals of a majority of technology parks, including BTP. In the case of a number of surveyed and interviewed BTP members, however, their focus, at least initially, was on the establishment of their own businesses, rather than on networking (that is, establishing contacts and learning about the operations of others and their resources) and searching for potential synergies within the park.

However as have been identified in the literature firms in STPs need a variety of network ties ranging from loose/weak ties designed to identify new opportunities, through to strong ties based on trust and cooperation designed to facilitate the innovation process (Koh et al. 2005). Government policies designed to improve access to technological knowledge often encourage firms to develop strong ties with competitors, suppliers or customers. But although strong ties are valuable, especially when tacit knowledge needs to be communicated, firms may resist entering into close relationships with other firms, because of the potential for exploitation. As a result, policies that encourage such firms to form weak ties may be a more effective way of promoting the spread of technological knowledge.

IV. CONCLUSION

As mentioned, the STP models vary widely in industrialised countries according to the levels of the economy and the National S&T strategy to promote technology intensive and knowledge based enterprises. They are operating mostly as integrated organisations within hi-tech zones, innovation centres, and university/R&D institutions. The emphasis is on enterprise development with the focus on hi-tech ventures and high growth technology based SMEs.

Therefore within the broad tapestry of economic development tools, the special and unique role that the STPs perform is to:

- recruit and co-locate new and established knowledge-based companies;
- promote innovation based on 'smart' technology;
- provide an interface or shared research environment for research organisations and private industry; and,
- leverage local knowledge resources to enhance a region's economic base.

Also as mentioned there are advantages of networking within a cluster such as a techno park. In addition to an expansion of the available resources to the parks and clusters themselves, networking enables firms in each cluster to expand their access to knowledge and resources from broader range of sources. It becomes clear that a broad-based cluster/network-based system may have a strong impact in specific areas such as the following, which identified critical in this study:

- Access to new markets and marketing strategies.
- Access to capital: integrated access to services such as financial planning, support for obtaining grants, opportunities for access to venture, development, and seed-capital.
- Expansion of inter-firm linkages: a networked approach is ideal for maximizing the impact of programs and projects, such as partnerships, alliances, and linkages to outside suppliers.
- Technological support: access to services such as technology assessment and forecasting, assistance on technological choices, marketing assessment of innovative projects and assess to outside technical information.
- Technology transfer opportunities: networks may be used to stimulate investment in Science and Technology, R&D, technology transfer and spin-offs.
- Access to talent and know-how: networks may help in the process of identifying and hiring skilled people across regional boundaries.
- Strengthening local cluster governance structures: the establishment of linkages with other clusters/parks would enable a better understanding of stakeholder needs and markets and may be used to disseminate best practices in technology parks to improve the performance of firms in each cluster/park.
- Optimizing and sharing facilities: the operational support infrastructure may be optimized and many facilities could be shared over the network, including incubators, prototype centres, pilot plants, test laboratories, and online conferencing facilities.

Finally, it is important to consider the main critical factors of innovation success in the context of institutional linkages and cluster/technology park theory. In fact, although knowledge clusters are highly individual and differentiated, it is helpful to identify some common factors of success and, in particular, their innovative capability, linked to continuous learning at level of single firm and at the level of the systems of firms which refer to collective learning and learning by interacting. Some of these factors are mentioned in below. These factors can be grouped as 'favourite location factors', 'strategic micro-management' and 'supportive macro-management.

- Favourite location factors: This set of factors generally influence selection of business location for knowledge-based firms. As mentioned before they include availability of advanced IT infrastructure, R&D facilities, skilled and specialised labour force. Some of the factors also relate to the quality of the work inside and outside of the park such as access to the airport and business image.
- Strategic micro-management factors: These factors relate to the professional management of park and also to have a clear park objective. For this purpose, it is important to have a tenant-oriented management style. Park management team has to be aware of their tenants' needs so as to assist them when required. Besides, it is necessary to have a clear target about park achievements such as; number of R&D successes; tenants' growth, contribution to regional economy or number of technology transfers.
- Supportive macro-environment: Cooperative networks and support from various related and supporting industries and sectors are important for a technology park to achieve success. Linkages and cooperation can enhance firms' innovative capacity and effectiveness, and lead to their long-term competitiveness. Government also is a key player in constructing such a supportive environment. As emphasised in literature and through interview with tenants it is especially decisive for government to provide support in such aspects as securing an attractive park site; providing financial support not only for park establishment and development also for channelling firms to park through incentives and supports; and providing tenants with access to legal and technological support services. Government also can call on related and supporting industries to provide cooperation and support to knowledge-based firms within park.

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