

The Role of Technology Support Centres in stimulating Entrepreneurship and Innovation in SME Clusters

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Abstract

The Innovative Product Development Centre (IPDC) was established at the University of Wolverhampton in the West Midlands region of the UK with a mission “*to help small and medium sized companies improve their business, secure jobs and contribute to the economic regeneration of the West Midlands Region*”.

Since 2000, the IPDC has helped several hundred enterprises to develop their businesses through innovation and new product development. Demand for help is high, which reflects a healthy desire by the SMEs to innovate. The assistance given is time limited, but its impact on the business is extremely varied.

This paper will discuss the role that a university based product development and technology centre can play in supporting a regional agenda for developing entrepreneurship and innovation in SMEs. Using case studies drawn from the experiences of working with SMEs from the West Midlands region, the paper will consider key issues such as:

- Entrepreneurial leadership in SMEs
- Formalised approaches for managing NPD
- Technology support for innovation
- Product innovation
- Business networks and entrepreneurial clusters

The paper will conclude that university based centres like IPDC can play a vital role in regional development programmes by helping minimise the risks for entrepreneurs to develop new products or adopt new process technologies. Importantly, investments in such centres by regional development agencies can be pivotal for stimulating access to new technology for the exploitation of entrepreneurial clusters and creating attractive inward investment opportunities.

Introduction

By 2007, the European Union will have expanded to 27 member countries, which creates “*an unprecedented challenge for the competitiveness and cohesion of the Union*”. In establishing its guidelines for Cohesion Policy for the period 2007-2013, the Commission of the European Communities recommends that the resources available to cohesion policy should be concentrated on promoting sustainable growth, competitiveness and employment. The Commission recognises that greater ownership of the cohesion objectives is necessary, involving regional and local actors and social partners – particularly important in areas such as innovation and support for small and medium-sized enterprises (SMEs). The Cohesion Policy 2007-2013 will target three priorities including encouragement of innovation, entrepreneurship and growth of the knowledge economy.

The funding from the EU to support its cohesion policy is devolved to the Member States through funding mechanisms such as European Structural Funds. In 2007-2013, for example, the UK anticipates some €9.4 billion of funding from this source. The UK’s Department of Trade and Industry (DTI) has already developed its strategy for the use of the European Regional Development Fund (ERDF). This strategy identifies four main priorities including: promoting innovation and knowledge transfer; and stimulating enterprise. Within this framework, the English Regions have started producing regional Operational Programmes for ERDF, working with regional partners to produce plans for local deployment of these resources.

The University of Wolverhampton has historically played a significant role in the West Midlands region of the UK as an agent of change in the local business community. It has used ERDF funding to help create new infrastructures that support innovation and to engage in knowledge transfer with local entrepreneurs and SMEs through its business support programmes. For example, the Innovative Product Development Centre (IPDC) is based in a purpose built, €10m facility at the University’s Telford campus. The IPDC was established to provide product development support to local SMEs and since its launch in 2000, several hundred SMEs have benefited from its rapid product development technologies and the knowledge of its specialist consultants, researchers and academic staff. Furthermore, initiatives like the Advanced Engineering Cluster (AEC) seek to promote innovation and entrepreneurship amongst SMEs through clustering - an approach to economic growth and development strongly favoured by the Commission of the European Communities and the local Regional Development Agency (RDA) alike.

From our experience, we believe that the establishment of technology support centres, such as IPDC and AEC, are pivotal to creating the links between the science, technology and business knowledge base of the university and the innovation and entrepreneurial base of the SMEs necessary to achieve the economic growth objectives of the ERDF. Demand for help from SMEs is high, which reflects a healthy desire amongst SMEs to innovate, however the impact that the support has on the businesses has been extremely varied. If the objectives of the 2007-2013 ERDF programmes are to be met, then it is imperative that technology support centres and SMEs work together more effectively to achieve the expected economic growth results demanded of the European Structural Funds.

The Innovative Product Development Centre

The IPDC opened the doors of its brand new facility to SME clients in the year 2000. The Centre was equipped with modern computer aided design and manufacturing facilities that included:

- 3D CAD modelling and virtual prototyping
- SLS rapid prototyping
- 5-axis and 4-axis CNC machining
- 5-axis and 3-axis CNC EDM
- Co-ordinate measurement and Reverse engineering

The new building that houses the Centre and all of its equipment was partially funded through ERDF as part of a business support project to help innovation in SMEs across the West Midlands region. The selection and specification of the equipment for the Centre was very much based upon a perceived need that innovation would manifest itself through improved design and production processes, i.e. “process innovation” by the adoption of so-called “time compression technologies”. Importantly, the equipment specified was commercially available in the market place, though not necessarily being used by local manufacturers. However, by locating the equipment in the Centre, the technology is readily accessible to people who wish to see the equipment at work, learn about the production benefits that could be achieved, and evaluate its merits for the manufacture of parts to their own specification. This “technology push” approach was considered appropriate in the context of the traditional manufacturing base of the West Midlands region, where the competitiveness of manufacturing is continually threatened by overseas competitors’ ability to produce goods of higher quality and better value for money.

However, to support a broader innovation agenda, the current Director of the Centre introduced a holistic, market driven approach to new product development, which means that companies can get assistance to design and develop new products from a multi-disciplinary team of marketing, engineering, design and manufacturing specialists. This capability reflects the need for innovation through new product development, and in particular the need of manufacturers to diversify from traditional product sectors into new markets with new product offerings, i.e. “product innovation”. This type of support for businesses reflects the importance to economic growth of introducing new products into the market place and a sustainability strategy based upon the evidence that the most successful manufacturers are those that are product developers.

Furthermore, the use of a systematic product development approach with an integrated, concurrent engineering process ensures that design solutions are fit for purpose, will meet the market needs, and are ready for economic manufacture. In supporting SMEs design and develop new products in this way not only does the Centre help companies to design new products it also demonstrates the value of adopting a rigorous, market-led, milestone driven design and development process, i.e. “process innovation” where an effective, efficient, faster process produces more successful new products.

Revenue funding from ERDF through business support projects such as the Advanced Engineering Cluster (AEC) has enabled the IPDC to employ a team of product development specialists to work directly with SME clients, helping to identify and resolve their product and/or process innovation needs. The university has chosen to adopt a delivery model whereby the ERDF funding effectively allows eligible SMEs in the West Midlands access to the IPDC resources at little or no direct cost to the company. Because the assistance given by staff is free, there has been a high demand from local SMEs to use the resource and exploit the projects to help improve a process, access a new technology or design and develop a new product. The amount of time that can be given in support of an SME client is limited under these schemes, principally by the need of the project to meet its target for number of companies assisted. However, typically a company can expect 40-50 hours of assistance in a calendar year from a project like AEC. Whilst this may not appear to be a significant amount of time for a new product development project, used wisely by the company the support can be immensely beneficial, especially if it is sought early in the innovation process.

Since its opening in 2000, several hundred companies have been assisted by the IPDC and it is through our direct experiences of working with SMEs in the West Midlands region that we are able to discuss the value of a university based technology centre to innovation and entrepreneurship. The key issues discussed below and the subsequent remarks made about SMEs, however, reflect recurring themes that we have observed from the Centre’s client base. Whilst we cannot gauge the extent to which these observations apply to the SME manufacturing base as a whole, the issues are relevant to SMEs that typically are striving to sustain and grow their business through innovation.

World Class SMEs

The development needs of SMEs in the UK are well known. For example, the Royal Academy of Engineering in its P³I survey (1998) concluded that 50% of companies planned an increased frequency of introduction of new products, because the majority recognised the need for rework and improved product range. To increase sales volume, many needed new/better products and/or improved marketing, sales and market presence, but fewer saw need to reduce price or change organisation or systems. For many, new technologies or materials had potential to change product concept.

The P³I survey discovered that 75% of firms had problems in new product development programmes, with less than 50% of firms producing new products on time (Only 25% thought competitors produced on time), and 50% reported development costs were higher than budget (a significant number did not calculate costs).

The P³I survey shows that only 25% of firms had an accessible strategy that was clearly focused, well defined and documented, with 33% not having a clear and defined PD plan. Whilst, product development is considered to be a team effort, only 40% implemented product development in all departments. The driving force for change was mainly with top level management with only 25% reporting fast and successful product development. Where other levels were actively involved performance was better. Only 33% used checklists for monitoring time, spend or implementation, and only 25% systematically checked whether objectives of each step were achieved (c.f. 60% use of *Stage-Gate*TM in US). Two-thirds of firms planned lead times, but less than 50% mapped out time for each step before starting and lead-time remains a problem. Most used techniques for accepting or rejecting project proposals, though Risk analysis was not used extensively, and 17% used no formal techniques at all.

The P³I survey shows that 60% of firms frequently assessed skills and qualifications and regularly considered training in new tools and techniques. Only 50% considered or used external help in PD and only 33% recruited new post-graduates to aid product development. Less than 50% trained staff in product development processes and only 25% trained on how to keep to time and budget.

The P³I survey (1997) shows that most product development projects involved improvement of existing products (rather than development of completely new ones), and that most new products are based upon current technology. Many recognised they did not know: how to screen ideas for new products; how to generate new ideas for products; how to structure development process after building the first prototype; or how to obtain information on competitors or markets.

To support its mission, one of the aspirations of the IPDC is to help SMEs become “world class” product developers. The innovation strategies adopted by the IPDC (briefly described above) are the result of many years of working with industry and knowledge of the practices of world-class manufactures. For example, Simon (1996) has looked at over 500 SMEs that he considers world-class. His so-called “Hidden Champions” are world-class SMEs who are market leaders in Europe and either 1st or 2nd in the World. The term “hidden” is used because these companies are largely unknown and yet they are champions because many enjoy world market shares of 70-90%. He is convinced that the best companies in the world can be found among this group rather than large corporations. Characteristics such as leadership, motivation and reliance upon one’s own strength are important drivers of the success of these SMEs.

Simon observes that the Hidden Champions achieve their success by in several ways. Firstly, they are great innovators not just of the product, but also with their business practices. They create their own markets by defining a narrow product focus for global customers. They maintain extremely

close links to the customer, yet do not use large marketing, and develop unmatched internal competencies. The goals and strategy for the company come from authoritarian executives who actively participate in the product development process. They create positive working environments that ensure almost no employee turnover and are managed by long tenured individuals. These companies determine their competitive advantages to be in product quality; being close to the customer; and providing excellent service.

Simon says the “Hidden Champions” have a common, clearly stated goal to be the best or No.1, e.g. aim to be market leader. This goal is the primary interest and requires long term orientation and persistence. The need to innovate pervades the “Hidden Champions”. This is characterised by innovation in the product and in each aspect of the business, where the pursuit of improvement is constant. Creating a new market is the most effective way of innovating, but is difficult. To enable this, innovation in technology is most important and a core aspect of maintaining competitive advantage. An inventive environment pervades the company, with an international orientation of technology innovation. However, technology and the market drive innovation, and are integrated as equal forces. Closeness to the Customer provides the company with a valuable source of innovative ideas. There is a company commitment to innovation using high quality staff and a willingness to implement.

Simon observes that the Hidden Champions have developed a close relationship to their customers. This stems from a mutual dependence between the customer and manufacturer. Consequently, a high level of trust and long-term orientation of business activity evolves between the two where the customer is seen as a valuable source of information that can stimulate innovation.

Metrics for improved product development practice are inspired by the surveys that the Product Development & Management Association (PDMA) publish on a regular basis. In the 1997 survey, Griffin (1997) was able to identify ways in which “The Best” companies are distinguished from “The Rest”. The best companies are above mean in the relative success of new product development (NPD) programmes; are most successful or in top one-third in their industry for NPD success; and above mean in the market-financial success of NPD. Only 22% of 1997 survey sample outperformed across all three dimensions and so fell into “The Best” category.

	The Best	The Rest
% Successes	80 %	53 %
% Sales from New Products	49 %	25 %
% Profits from New Products	49 %	22 %
Number of ideas for 1 success	3,5	8,4
Number of New Products in 5 years	37,5	38,5
NPD Cycle Time	31 months	28 months
% Developing Financial Objectives	84 %	74 %
% with New Product Revenue Targets	65 %	47 %
Target New Product % Sales by Number of Years	44 % 3.1 years	25 % 3.9 years
% Assessing against objectives	63 %	48 %
% with Specific NPD Strategy	76 %	60 %

Table 1: Comparison of “The Best” versus “The Rest”, after Griffin (1997)

The best companies measure more and expect more, i.e. financial and revenue targets, % new product sales, assess achievement of objectives. They use more sophisticated NPD processes, i.e. more complex start with strategy-setting. They enforce strategy driven NPD, i.e. they do the “right”

project and require less ideas for success. They use multi-functional teams and use more NPD tools, e.g. qualitative market research, all engineering tools. In summary, “the Best” are more efficient and more effective than “the Rest” (see Table 1).

The mission of the IPDC is very much bound by the economic regeneration needs of the West Midlands region. Its emphasis is therefore directed to supporting SMEs to improve their business, secure jobs, create new sales, and generate economic growth through best practice new product development. However, the success that we can achieve with our client companies is highly dependent upon critical factors that we have observed in our limited sample of clients.

Entrepreneurial leadership in SMEs

Without doubt, the single most important factor in driving innovation in SMEs is the entrepreneurial quality of the business leadership. A key characteristic of the SMEs that the IPDC has supported is that they are, on the whole, privately owned companies that are therefore eligible for support under the ERDF schemes. Most likely the Managing Director will either wholly own the company (or at least have a significant stake in a partnership with others) and so is best placed to drive innovation through the development of new products or improvement of manufacturing processes.

What skill set defines an entrepreneur and their leadership? There is a clear emphasis on establishing a vision and communicating it to members of the organisation, leading from the front, inspiring, talking vision, creating a sense of adventure. There is also an emphasis on people related abilities associated with building relationships and teams; relationship building, listening skills, develop high expectation, can do culture, team creation, spotting and attracting good people.

The ability to establish procedures and controls, specific financial skills, financial grasp. To be persistent, have the mind set to take risk and be surrounded or be able to network into very high skills people.

Entrepreneurs consider the creation of vision and motivation of their staff to be central to their role, whereas more formal mechanisms of staff development are less prominent. Surveys that consistently show that SME’s are poor at providing training and development opportunities may obtain this result purely because of the formal way training and development is defined. The need for informal forums for sharing experiences and some form mentoring from a trusted individual are recurring themes in entrepreneurs.

While there is a rich diversity in the entrepreneur’s life experiences, there are patterns that could be identified regarding their development of management and leadership skills. Informal mechanisms of management and leadership are important, such mechanisms include: observing family members; culture; and opportunities to develop skills in a safe environment, like scouts, observing and learning from experiencing poor practice and arrange of different forms of mentorship. This also suggests that providing formal training or academic style management and leadership development is not the solution. Equally over-formalised mechanisms are unlikely to be successful, especially in smaller SMEs.

The common theme with entrepreneurs developing their organisation is that as the organisation grows it will pass through clear stages of development and that emphasis will shift from owner-manager and informal in the early stages towards more formal delegated systems in later stages. This evidence is supported by Gibb (1997), who suggests that education and training will need to move away from detached provision based around abstract/functional knowledge, towards imbedded provision based around context and process.

From our experiences of engagement with entrepreneurial MDs, an important function of the IPDC has been to support the MD by effectively acting as a business mentor. By forging a strong and mutual trust with the MD, we are able to gain very quickly a deep insight into the state of the business and their aspirations for its development. Through market research we can bring new information and data that can provide a deep contextual analysis of the company's position from which an appropriate innovation plan can be formulated. Usually it is only necessary to work in an informal manner with the MD because the insight that we develop will be very much richer than they would normally have themselves. Consequently, it is often easy to agree the process to move forward and obtain the means to deliver an effective solution.

Formalised approaches for managing NPD

Historically, manufacturing SMEs in the West Midlands region have been "make to drawing" suppliers. Consequently, these types of manufacturers often have little or no product development resources. However, the entrepreneurial SMEs that we have supported in the IPDC have recognised the value to their business of introducing new products to the market and have usually embarked upon a product development project of some kind when we first become involved. By working with the IPDC, the SME will be introduced to a formalised approach to new product development.

An integrated approach to product development is followed, using a concurrent engineering and multi-disciplinary approach. Specifically, three parallel activities in marketing, product design and manufacture will be undertaken in discrete phases with formal reviews at the end of each phase. However, where the companies have little or no internal NPD resource, the project will usually involve many other SME suppliers, which creates a further complexity to an already demanding process. The critical role for IPDC is to manage the process, controlling the progress towards the end goal (product launch) whilst ensuring concurrency across the three parallel activities. A second critical role is for IPDC to participate in the process itself using the knowledge and skills of its consultancy staff to bridge gaps in the process, inputting to the process where others cannot.

Whilst SMEs typically are very competent at preparing a product for manufacture (because it is their core activity), they often have a very weak understanding of the critical relationships between the product they are developing and the needs of the market. Where companies have little experience of NPD, it is not unusual for IPDC to become involved at a late stage of a NPD project, when the company has invested a lot of time, effort and resources to the development programme. However, inspection of the work to date will often reveal a weak knowledge of the needs of the customer and fundamental flaws in the design concept. For companies embarking upon NPD for this first time, it is very difficult for them to get the product to market quickly, indeed if at all!

As companies become more competent in NPD and begin to invest in design and development staff, it is possible to create more formalised management processes inside the company. We find most of our SME clients are in the first stages of maturity where:

- The necessary elements of NPD process are either missing or extremely weak.
- The approach is informal and ad hoc.
- Failure of NPD threatens the survival of the business or company.
- The company must improve its functional and basic project management and development skills to get benefit from other process improvements.

However, as companies develop and become more advanced product developers, we would expect performance improves, development cycle time reduce and the predictability of results gets better. To achieve these advances requires significant commitment from senior managers and change at all levels, which takes time to implement properly and embed in the routine and culture of the company.

Technology support for innovation

A key role for IPDC has been to introduce SMEs in the West Midlands to new technologies that can enhance either the product or the product introduction process. Being a university based centre, enables access to the knowledge base of academic, research and consultancy staff alike. Furthermore, partnerships with other universities and research centres from across the West Midlands region allow access to an extended knowledge network. This knowledge base provides a rich source of technology know-how, well beyond that found within the company itself that can be usefully deployed in the design and development of new products.



Figure 1 Rapid manufacturing facilities of the IPDC

The significant investments that have been made in “time compression technologies” e.g. computer-aided design (CAD), computer aided manufacture (CAM), and rapid prototyping, reflect a commitment to rapid product development practice (Figure 1). Through the IPDC the entrepreneurial SME can access the facilities to support their product development project at minimum risk to the company and zero investment on their part in the technology. For example, the development of CAD models of design concepts can quickly lead to prototype parts being made in the Centre’s rapid manufacturing facility – these prototypes allow for an early evaluation of design concepts and enable the “proof of concept” stage to be delivered quickly and effectively (Figure 2).

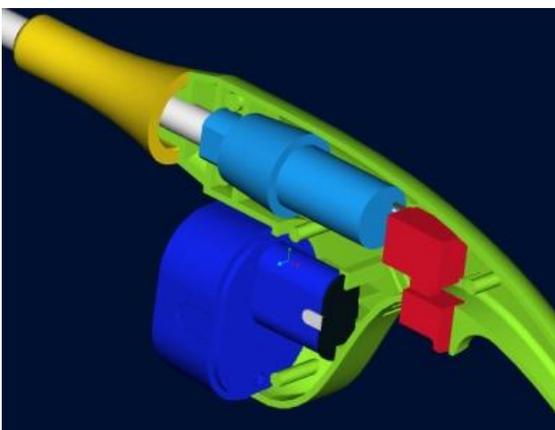


Figure 2 CAD modelling (left) leading to rapid prototype parts for proof of concept (right)

From a regional perspective, public money has been used to invest in expensive capital items. In some cases, the technology is well beyond the reach of our SME clients to afford. However, the

IPDC is able to introduce the companies to the technology and demonstrate the value of its exploitation in product development. Once demonstrated, the Centre offers a bureau service through which the company can continue to access the technology, albeit at a subsidised cost to them. This ensures that the SMEs are not disadvantaged in anyway to competitors that might themselves be investing in and/or exploiting these new technologies. In some cases, the extended use of these facilities has led to the companies making true value judgements of the strategic importance of the technology such that they invest in the technology themselves.

Product innovation

Most product development projects involve improvement of existing products rather than the development of completely new ones, and most new products are based upon current technology. The challenge to the SMEs is to innovate not only in the product but also in each aspect of the business, where the pursuit of improvement is constant.

As Simon (1996) observed with the Hidden Champions, creating a new market is the most effective way of innovating, but it is difficult. To enable this, innovation in technology is most important and a core aspect of maintaining competitive advantage. However, technology and market driven innovation are integrated as equal forces. Developing closeness to the customer will provide the company with a valuable source of innovative ideas and a superior knowledge of their requirements. Competitive advantage is achieved with superior product quality, value for money and a detailed knowledge of their competitors.

In SMEs it is appropriate to adopt development programmes that focus on specific products with 1-3 year viewpoint. Research and development should be market driven, with direct contact with customers to identify appropriate core technologies for new products. The strength of this approach is its market focus, but a weakness is its lack of true science or knowledge driven discovery.

Furthermore, SMEs should design and develop a platform strategy for their product range, where core elements of the design are common to a family of derivatives. A good product platform should support 2-3 different generations of the product, but requires a development programme in its own right and a very clear understanding of the range of products it will support not only today, but also in the future. For most SMEs new to NPD, this is a daunting task and requires a precise knowledge of the product portfolio. Most SMEs are likely to innovate with variants derived from an existing product, but create many new bespoke parts that replace existing parts. Design for manufacture reviews seek to streamline design solutions, simplify manufacture and in so doing enhance product quality and reduce cost.

Business networks and entrepreneurial clusters

The remit of the regional development agency (RDA) is to support existing industry in the region but also facilitate inward investment into the region. The purpose of clustering from the RDA point of view is to foster growth in parts of the regional economy with the greatest potential for increasing “Greater Value Added” and long term “Competitive Advantage”, with the clustering initiatives requiring an “active” and ongoing contribution—they are not just networking events. This is achieved through fostering/brokering collaborations by business and other organisations on initiatives and activities, which address market opportunities through exploiting new technologies, improving skills, and legislative changes.

Clusters are the vehicles for implementing most of the innovation projects of the innovation and technology council. Four clusters are currently being supported in the areas of ITC focus, digital,

medical technology, and transport technology. An advanced materials proposal is being taken forward through cluster structures. Another, energy, is still at an early stage.

Inward investment and UKTI increasingly align a lot of their work with cluster priorities. Clusters are increasingly able to support this work. An early example is the support by the aerospace cluster for a very promising inward investment pitch to Airbus. The Advanced Engineering Cluster has also obtained funding for its international clustering activities through UKTI.

Ten clusters were established in 2002/2003 by AWM, and Cluster opportunity groups (COG) which are private sector steering groups to advise the clusters. Only 55% of the allocated funds for these clusters have been taken up to date mainly due to the slow and poorly development of projects, caused in turn by lack of experience of many of the cluster teams and their staff.

The work of Michael Porter in defining clusters has been instrumental in defining the approach of the Advance Engineering Cluster project. Porter (1990) defines clusters as geographical concentrations of inter-connected companies and institutions in a particular field. Clusters encompass an array of liked industries and other entities important to competition. They include, for example, suppliers of specialised inputs such as components, machinery, and services and providers of specialised infrastructure. Clusters often extend downstream to channels and customers and laterally to manufacturers of complementary products and to companies in industries related by skills, technologies or common inputs. Finally, many clusters include governmental and other institutions- such as universities, standard-setting agencies, think tanks, vocational training providers, and trade associations- that provide specialised training, education, information, research, and technical support.

Porter explains that clusters represent a new spatial form of organisation, significantly different from the traditional, hierarchal vertical integration of companies and markets. Clusters are a different way of organising the value chain. Companies that are clustered together in one region, where ongoing exchanges among them foster communication and trust, produce “*advantages in efficiency, effectiveness and flexibility.*”

Porter uses the California wine cluster as a good example of the broad strata of businesses, organizations and associations that compose a cluster. The wine cluster comprises of 700 commercial wineries, thousands of independent grape growers, and numerous industries that support the business of wine making, e.g. grape stock suppliers, barrels, harvest equipment.

The cluster also incorporates companies that create wine related media (advertising, public relations, and magazines). The University of California at Davis is known worldwide for its wine-related studies; there are special organisations (Such as the wine Institute) as well as legislative committees devoted to the regional wine industry. The wine cluster is also loosely connected to other California clusters in agriculture, wine country tourism, and food and restaurants.

Porter’s “Diamond of Advantage” relates to the four factors he determined create competitive advantage for firms. The four corners of the diamond include factor conditions, demand conditions, industry strategy/rivalry, and related and supporting industries. Porter used this diamond to determine which firms and industries had competitive advantages, and his emphasis of importance of related and supporting industries encouraged interest in clusters. While his original thesis was applied to nations as a whole, Porter recognised that the majority of activity takes place at a *regional level*. Thus, his ideas are commonly applied to cities and regions.

In parallel to the clustering initiative you have along side this, a group of entrepreneurs who themselves are a cluster, bring their own intellectual property through, networks/contacts to the table, and then identify avenues on how to leverage value from these. Evidence of this activity is coming to

the fore from our e-cluster. With just 6 companies on board we have identified what other skill sets are required to target other lucrative market sectors building on the core skill set of the e-cluster and the entrepreneurs' networks.

The role of social infrastructure in defining clusters is a theme prevalent in literature. Rosenfield (1996), in particular argues that information flow is critical in an effective industry cluster, and, in order to facilitate information exchange, a social infrastructure is required. He points out that while characteristics of a cluster may be present, it is not necessarily an effective cluster; an effective cluster must also include social interaction, trust, and a shared vision in order to create the dynamic nature of a cluster. The importance of social interaction is supported by the cluster definition developed by Jacobs and DeMan (1996), as well as by Saxenian (1994) in her discussion of Silicon Valley.

Clustering is a dynamic process, and as one competitive firm grows it generates demand for other related industries. Competition between rival firms drives growth because it forces firms to be innovative and to prove new technology, this in turn leads to new business spin offs, stimulates R&D and forces the introduction of new skills and services. The transfer of knowledge and technology among firms can lead to new industry growth, and therefore helps drive overall growth of the cluster.

From our own experiences, in parallel to this, is the intellectual property of the entrepreneur and his business networks, once you have created a "cluster environment" of trust and open communication and a lot of value can be exchanged and derived from the "*entrepreneur cluster*" and its "*business networks*" – a phenomenon that can be observed with the e-cluster.

Conclusions

The strategic need to improve the entrepreneurial quality of SMEs is at the heart of regional innovation policy. Technology support centres supported with regional development funding are critical vehicles of change for small and medium sized manufacturers. Technology support centres can provide:

- Access to new product and process technologies
- Access to the diverse knowledge base of the university sector
- Rigorous management of the product development process
- Mentoring to company managers and staff
- Networking and clustering opportunities.

Companies that engage with technology support centres like IPDC will enhance the strategic business approach, help instil systematic approaches to NPD, enable technology driven process improvement and ensure that higher quality products that are better value for the customer are introduced more quickly and more frequently into the market place. However, the aspiration of a technology support centre must be to enable SMEs to become world class, or at the very least start them on the journey of innovation in that direction.

University based centres like IPDC can play a vital role in regional development programmes by helping minimise the risks for entrepreneurs to develop new products or adopt new process technologies. Importantly, investments in such centres by regional development agencies can be pivotal for stimulating access to new technology for the exploitation of entrepreneurial clusters and creating attractive inward investment opportunities.

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