

Detecting innovation opportunities: the development of an online innovation tool and process for university - business engagement

Dr. Elly Philpott
University of Luton, UK
erindors@ntlworld.com

Eur. Ing. Keith Bevis
University of Hertfordshire, UK
k.bevis@herts.ac.uk

Abstract: This paper describes work conducted for the i10 organization (www.i10.org.uk): a collaboration of universities in the East of England. It describes the development of a proactive process to facilitate engagement between universities and manufacturing SMEs and the subsequent tools and proficiencies developed by the universities involved for doing this. The outcomes are of value to other universities tasked with engaging with business and those interested in the development and usefulness of on-line tools. It is also of interest to any institution developing tools for identifying innovation opportunities; innovation benchmarking and company profiling.

INTRODUCTION

"Small and medium enterprises are Europe's growth engine: they account for 66% of private sector employment, as opposed to 46% in the USA and 33% in Japan. They need easier access to knowledge, finance and commercial partnerships. But they also need cutting edge technologies: know-how makes the difference in the marketplace..." (EU Research Commissioner (Busquin, 2002))

This paper addresses the issue of 'easier access to knowledge', particularly that which supports innovation in business directly. It describes work carried out by a group of East of England universities (See:www.i10.org.uk) that has provided easier access to knowledge. In carrying out this work we have responded directly to the UK Government's Lambert report that purported:

"It is clear that much more needs to be done to persuade business of the economic benefits to be gained from innovation, and of working in collaboration with university departments to achieve this goal. This applies especially to SMEs, which have few resources to risk on reaching out to find new ways of developing products and services." (Lambert, 2003)

"... Individual companies may not have the time or capacity to find out which of the many university research departments around the country are doing work that is relevant to their needs. This problem applies especially to SMEs..." (Lambert, 2003)

The UK Department of Trade and Industry (DTI) responded to Lambert describing how companies had reported that support for innovation was patchy and inconsistent; confusing; lacking in specialist advice (innovation, design and marketing); bureaucratic and long-winded; and remote. Further to this, there is evidence that 'easier access to knowledge' in itself is not enough.

YTKO, The Cambridge-MIT Institute et al., (2003) reported that SMEs clearly represent the biggest opportunity for economic growth; however in the Eastern region [of the UK] smaller firms were less innovative and more risk averse than larger firms and that the level of innovation was declining.

This represented a challenge to the authors. Firstly to overcome the perceived level of existing service; secondly to identify companies that could benefit from university help, and thirdly the engagement process - access- itself.

Recognizing the importance of SME activity to Europe and Britain in particular, the paper sets out the work of the i10 MAPSME project. This paper describes the development of a process and online tool for identifying companies that could benefit from university help by concentrating on companies that represented innovation opportunities. Further, it established and piloted a process of university - SME engagement.

The following section describes the client population and its characteristics. Subsequent sections describe the development of an online tool that facilitates innovation profiling of the client base and the subsequent engagement process.

EAST OF ENGLAND MANUFACTURING SMES

The pilot group for this project was manufacturing SMEs in the East of England. This group therefore is our unit of analysis.

The manufacturing sector contributes a fifth of our national [UK] income (nearly £150billion per year) and nearly two thirds of our exports. It also employs 4 million people (DTI, 2002). The East of England is a £68 billion per annum economy employing 2.7 million people. GDP per head is ... below the EU average (DTI, 2002). Small Business Service (SBS) figures (SBS, 2002) report 387K enterprises in the East of England. 99.9% are 0-249 employees. 10% (38.7K) are in category CDE. This includes manufacturing.

Research for EEDA performed by Ford and McNiven (2001) mapped the industrial activity in the East of England. The researchers found that attempting to compile a map of manufacturers was more difficult than anticipated, mainly due to poor availability of data. To overcome this they used a number of different data sources. Dun and Bradstreet, whose database compiled from VAT registrations, indicated at that time that there were 13,803 manufacturing companies in the region. The Dun and Bradstreet figures included large companies and SMEs.

There were two possible ways of estimating the number of SMEs from these figures. The Small Business Service indicates that there are 250 large manufacturing enterprises within the region. This provided an estimate of 13962 SMEs in the region.

The UK Innovation survey, (Stockdale, 2001) found that 95% of businesses surveyed had less than 250 employees. This provides a similar estimate of 13501.

Ford and McNiven also conducted a search with Findlay Publications, who were the largest UK publisher of manufacturing journals. This produced figures similar to those from Dun and Bradstreet.

In a separate earlier study using data available from MAS East, sourced through the National Statistics Office at Sheffield (1999), there were 10872 manufacturing companies in the East of England region. A further analysis of SIC codes against EEDA-interest-sectors showed there to be 3872 companies in the region the majority of which were SMEs. This information was based on the FAME database.

Bringing Ford and McNiven's work up to date, and encompassing all three data sources, a similar exercise conducted with 2002 figures for MAPSME Plus (Bullock and Milner, 2003) and a custom search of the Government's Inter-Departmental Business register (IDBR) (IDBR, 2003) provided the following summary:

Table 1 showing manufacturing sme population in East of England from various data sources

Data source (accessed June – July 2003)	Size band			
	Total	1-9	10-99	100-249
FAME ¹	4084	1020	2126	453
Dun and Bradstreet	12869	6096	3503	308
IDBR	16940	12395	4165	375

This analysis showed there to be 16940 manufacturing SMEs in the East of England.

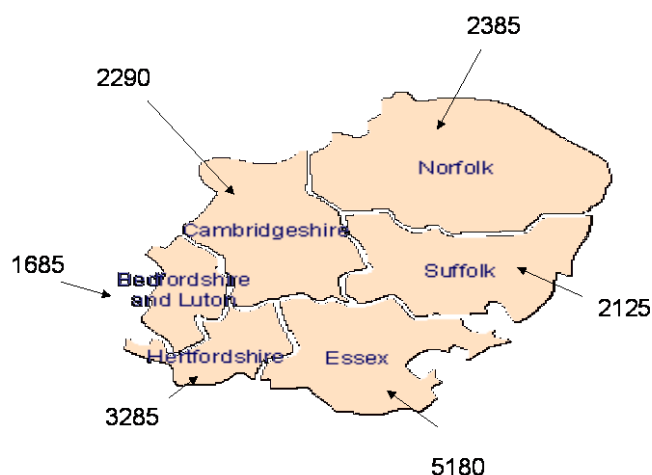


Figure 1 - illustrates the number of manufacturing SMEs in the region, source IDBR (2003)

The work concluded that it is becoming increasingly difficult to monitor companies accurately via publicly available information. This is a particularly acute problem for HEIs who are continually encouraged to service regional need more actively but who do not normally have access to the business detail on the Interdepartmental Business Register that local councils and government-run advisory agencies have.

The UK's Interdepartmental Business register (IDBR) is a comprehensive list of UK businesses that is used for government statistical purposes. As the most comprehensive data source it provides a sample frame for surveys of businesses. IDBR includes most businesses but still may exclude some very small businesses.

Dun and Bradstreet data are drawn from a wider range of sources and therefore includes firms not always registered at Companies House e.g., sole traders and firms employing a low number of staff. As one would expect there is a larger proportion of firms employing 1-9 staff than in FAME. In addition to this, we have not accessed the FAME data on firms with low numbers of employees and this explains the difference between our figure and the 1999 figures mentioned earlier.

Where data are drawn from information on record the problem is that large chunks are often absent, inaccurate or incomplete. Similarly, where data is presented based on survey work, survey

methods often specifically exclude subsets that may be of interest to HEIs e.g., firms with under 10 employees.

Missing data is often down to firms that decide to take advantage of the disclosure rules for small and medium accounts. In simple terms, if a company meets certain criteria (particularly relevant to microbusinesses) they need not file a profit and loss account or reveal the number of employees. E.g.,

1. Turnover of less than £2,800,000
 2. Balance sheet total of less than £1,400,000
 3. Average number of employees of less than 50
- Etc.

This data access problem is about to worsen for universities with the introduction of further legislation, intended to ease the burden on small business, which will relinquish an SME's obligation to divulge information often relied upon for successful business classification and mapping -

The threshold for relieving medium sized businesses from the provision of onerous non-financial information in their accounts will rise from £11.2m to the EU maximum of £22.8m. The small companies' threshold will rise from £2.8m to £5.6m... At present companies with a turnover below £1m, escape the statutory audit. The new proposals would increase the limit, in line with the accounting requirement change, to £5.6m. (Anon, 2003)

Given these known problems with data completeness and knowing that the problem is set to increase, it was fortuitous that MAPSME undertook a mapping exercise for the East of England region at this time. After all, if universities are to be more proactive regionally - they need to know the size of their market.

Because of data problems previously described the Government's IDBR figures were used as the source of statistical population in each of the East of England counties. However, the identification of specific companies against these figures was based on three elements:

- Access to information held by public and private bodies
- The accuracy of the data available (e.g., had the data been actively maintained?)
- A sanity check against known commercial databases for each region

The MAPSME team opted to identify the manufacturing SME population in the following way:

- 1992 SIC code - section 4 (D) manufacturing.
- Size - as measured in terms of employment, i.e. up to 249 employees

In approaching the work in this manner, we opted for a broad definition of 'manufacturing' in that a manufacturing firm's output can be goods and/or manufacturing services. In an era where western manufacturers are being encouraged to move downstream, in order to remain competitive on a global stage, firms within a broader definition of manufacturing SME could potentially benefit from i10 help.

Secondly, within this definition we were able to offer manufacturing expertise to additional companies in two key East of England Development Agency (EEDA) priority areas - biotechnology and new media industries. In doing this, we acknowledged that success for some of these firms might not mean manufacturing in this region. For this reason, we introduce the caveat that our prime aim is to help a manufacturing firm be competitive, and secondly to facilitate growth through innovation in the region where this is appropriate.

In order to support business effectively this project identified the real population of manufacturing SMEs in the region then concentrated its efforts in areas related to the local Regional Development Agency's (RDA) priorities. This ensured continuity of purpose between the RDA and the region's universities.

The East of England Development Agency (EEDA) defines its key sectors as: ICT, life sciences (including biotech), media and cultural industries, financial and business services, agriculture and food processing, tourism leisure and heritage, automotive, high-technology manufacture and advanced engineering, transport gateways. (Miller, Botham et al., 2001) provide a wider review of

clusters in this region where clusters are defined by standard statistical measures of localisation (LQ)² and local qualitative measures based on 1999-available data.

Having identified the population and then the identity of over 50% of these companies from other sources, we then set about understanding the characteristics of this population in terms of innovation in order to understand its innovation needs. This was done in two ways. Firstly we researched the parameters used to measure innovation on a regional, national and international level and established how the East of England compared. Secondly, we distilled up to date economic theory and practical experience to determine a model of innovation for manufacturing SMEs against which individual SMEs could be assessed.

DEVELOPMENT OF A MODEL FOR INNOVATION OPPORTUNITY

In this context, we define 'innovation opportunity' as a combination of:

- a company's residual innovativeness - here defined by an econometrically defined innovation score;
- characteristics which align the company to existing university offerings, and
- whether the company should be targeted by the universities based on the region's growth needs as defined by the local RDA.

A workshop involving the Government's Manufacturing Advisory Service in the region (MAS-east) and industrially experienced academics defined the parameters of an innovation profile. That could be used to assess which companies should be targeted. These parameters were:

- Innovation-score
- Company sector
- Customer sectors
- Changes to manufacturing processes
- Changes to manufactured products and services
- Changes to business processes
- Marketing methods
- Skills needs

East of England statistics on innovation

The European 'Innovation scoreboard' for 2002 compares the innovation performance of European countries. It contains 17 main indicators, selected to summarise the main drivers and outputs of innovations. These indicators are divided into four groups: Human resources for innovation (5 indicators); the creation of new knowledge (3 indicators of which one is divided into EPO and USPTO patents); the transmission and application of knowledge (3 indicators); and Innovation finance, outputs and markets (6 indicators). (Cordis); (Hollanders, 2002). Based on these indicators, the UK's manufacturing performance is as follows:

The UK's performance was average for the percentage of sales by manufacturing SMEs that are 'new to market products'. The highest performer being Malta (a candidate country) closely followed by Ireland. The UK's performance was high for the percentage of 'value added' from high technology. Existing EU countries that performed better were Ireland, Denmark and Sweden.

Given this unremarkable performance at national level, an earlier empirical study carried out by the Cambridge Small Business Research Centre (SBRC) offered some useful insights into SME innovative behaviour in the UK. During the study, data were collected from more than 2000 SMEs on a range of issues relating to technology an innovation. The research found that 60% of the sample had initiated a major product or service innovation in the last 5 years. This result suggested that SMEs were highly innovative across sectors" (Neely and Hii, 1998)

Slightly later, a study conducted by Goffin, Szwejczewski et al. found a wide spread of development times and innovation rates within closely defined sectors within UK manufacturing companies – implying that some companies “were particularly efficient at product innovation whereas others needed to improve...” (Goffin and Szwejczewski, 2000)

Neely and Filippini (2001) then researched the innovation performance of SMEs in the East of England. Questionnaires were sent to managing directors of SMEs in the East of England across seven sectors. The questionnaires were sent in two batches to 2560 firms. 99 out of a total of 147 responses were used for the research, with an average firm size of 56. These were followed up through face-to-face interviews with 9 companies across 3 key sectors of Chemicals and Pharmaceuticals, High Technology Manufacturing, and Information Communications Technology.

The research looked at both the innovative capacity of firms and their innovation performance. Innovative capacity was examined in four dimensions (Culture, Resources, Competence, and Networking) with up to six key aspects of management in each dimension. For instance competence for innovation is measured by questions looking at new idea generation, project management, market knowledge, technical knowledge experimentation skills and problem solving skills. The innovation performance of firms is measured through counting the number of reported product, process and organisational innovations over a period of 3 years.

The statistical analysis within the research “supports the hypothesis that high innovative capacity leads to high innovation performance. However there needs to be a minimum level of innovative capacity (potential) for firms to generate positive innovation performance.”

Within the East of England “firms display strengths in areas such as intellectual resources, risk-taking attitude, leadership and support, and innovation strategy. In areas such as access to funds, performance measures, project management and innovation funding guidelines, firms were particularly weak.”

The Neely and Filipini study gave some valuable insights into SME characteristics within the East of England however there were a number of differences in the type and size of companies surveyed and those to be covered by the national and European surveys and the MAPSME Plus firm type and size. This implies that conclusions from earlier studies should be treated with a little caution when related to the MAPSME analysis. For example, in Neely's work, the average size of the surveyed firms was 56; the researchers' definition of SME is not specified. One of the interviews was with a company of 350 employees. In addition to this 31% of questionnaire responses were from the Financial and Business Services Sector (including R&D) (UK SICs J65, J66, J67, K73, K74). In MAPSME, our unit of analysis was manufacturing SMEs (0-249) in the East of England and within SICs 15-36.

The National Innovation Survey carried out by the DTI in 2001 showed that the South East led the way in novel product innovation along with the East Midlands, both with 10 per cent of companies having introduced significant product or process innovation.

The Eastern region performed below the UK average. The sample however, only covered companies with 10 or more employees. Results were based on the analysis of 632 responses.

The majority of manufacturing SMEs in the East of England is believed to be micro businesses, employing less than 10 employees. This section of the population does not appear to be represented by the National Innovation Survey results nor the European Innovation scoreboard where only firms employing over 20 are included.

The 2002 Innovation scoreboard showed a positive relationship between innovation and performance at a regional level. The scoreboard also showed that the 'Eastern' region within the UK was amongst the highest performers for private R&D

A recent report generated by YTKO and CBR on behalf of EEDA presents some interesting challenges in terms of assumptions on the part of how SMEs are performing in an innovation context. YTKO, The Cambridge-MIT Institute et al. (2003) reports that:

- Smaller firms are less innovative and more risk averse than larger firms and their level of innovation is declining
- Smaller companies' growth expectations are lower and are declining faster than larger companies
- There is little difference in the level of innovation by age of company, but newer companies are twice as likely to have high growth expectations
- The Eastern region has lower growth expectations and is no more innovative than the rest of the UK
- Competition is the main constraint to growth overtaking market conditions and availability of finance as important barriers, while the number of firms exporting has risen rapidly
- Availability of finance as a constraint to growth and innovation has declined dramatically in importance over the past decade, while the number of firms seeking finance has also fallen substantially
- Shortages in skills and in particular management and marketing skills have risen significantly as a crucial constraint to growth and innovation, particularly in the Eastern region
- Sector differences are minor and variances are more a reflection of the age and size of a firm

The sampling conducted for national and European innovation surveys seems to specifically exclude firms with <20 employees. (Cosh, Hughes et al., 1998) discusses the desirability of including very small businesses in future national innovation.

However, the arguments for economic reporting do not in themselves justify the exclusion of SME bands from university help. Most manufacturing firms start small and grow with business success and / or market pressures. Precluding very small companies from innovation advice is counter-intuitive. Where the aim is regional economic growth, all companies need to be extended the invitation to engage; however, engagement resources are limited at the university side due in part to the universities' traditional role of teaching and research. Hence, a filtering mechanism is needed to increase the likelihood of positive engagement.

To ensure that we did not make assumptions with regard to positive engagement and business size, SMEs from all employment bands were included within our pilot process.

University - business engagement

Mindful of the third stream³ agenda, universities have a new found enthusiasm for reaching out to their communities. And, as one would expect have 'done their research'. Any number of innovation models is in evidence generally spanning traditional Institutional Regional Innovation System (IRIS) approaches and that of Entrepreneurial -based regional innovations (ERIS) systems. In the UK, i10⁴, The London Technology Network⁵ and North West Business Access⁶ are three examples.

Generally, the university approach has been to allow some market pull in the delivery of bespoke services, to actively encourage new entrepreneurial activity, to entice existing entrepreneurs as mentors and to tailor and market existing services to all of these groups of companies. Networking (town and gown) events in various forms have proliferated to varying degrees of success.

This represents two problems. The first is that the evidence shows that university services and therein support for innovation, is perceived as patchy and inconsistent; confusing; lacking in specialist advice bureaucratic and long-winded; and remote (DTI, 2002)

The second is that the majority of SMEs have never crossed the threshold of a university and would not think of doing so for help with their businesses. So therein lies a conundrum. The first group of companies find that universities' general level of service is unsatisfactory, the second group don't yet perceive universities as potential suppliers of services. Engagement and therefore access to knowledge is too difficult. The problem is therefore one of sales and customer service. A new process of engagement was needed to address both these issues.

The ability to match up business requirements with current or possible service offerings is crucial to developing the supply interface. This to some degree requires expertise in drawing out a

3

4

5

6

businesses tacit requirements (NB - SMEs rarely conduct formal strategy reviews) and then translating this into something a university can address.

A role for intermediaries in innovation

The ability to articulate tacit knowledge is also picked up to a degree by the work of Dodgson and Bessant, (1996). These authors describe one mechanism by which this process can take place made manifest in the role of 'innovation agents'. They describe how this has been prevalent in the UK since the 1980s when the government's MAPCON programme was introduced. Two important effects for UK industry were that it helped less experienced firms to learn about technology and provided a mechanism for mobilizing scarce resources. The eventual successor to MAPCON was the UK's Enterprise Initiative launched in 1988. Modern equivalents would be SBS and MAS services. The authors describe how the targeting of support - using consultants as active intermediaries - opened up the possibility of reaching user firms more directly than traditional financial support mechanisms which tended to lack focus and often failed to reach many potential users within a target group. Other examples of schemes are NIES in Australia, CIM in Switzerland and BUNT in Norway.

More recent work by Cooke, (2004) describes other forms of intermediary and how they work to promote innovation. He describes how recent studies in Silicon Valley are united in showing just how important, even in mature systems, 'knowledge brokers' like legal and investment firms are to generation and survival of new business enterprises and their subsequent stages of growth. A more tangible role, beyond that of knowledge broker, is that of 'knowledge attorney' where the knowledge attorney sells linkages often in exchange for company equity instead of fees. Venture capitalists then encourage inter-trading / transaction by linking together cross-holdings; mirroring some of the perceived activity of Japanese Keiretsus.

So how does one use the concept of intermediary for university - SME engagement? The first way is to establish links through the existing knowledge brokers, knowledge attorneys and innovation agents. However, the evidence to date suggests that this in itself has not been successful.

The second way is to create our own intermediaries who are able to translate the needs of universities and SMEs and broker a relationship that benefits both parties. Based on the characteristics of intermediaries described earlier, translators would need to be able to convert tacit knowledge within a business to an explicit requirement; link with other forms of intermediary in order to add value a business; match explicit requirements to that which a university can offer or develop within business time scales; show value to both the university and the business.

What do manufacturing SMEs in the East of England want from the region's universities?

Work done on the MAPSME project (working with a sample of 231 manufacturing SMEs in the east of England, employees 1-249) identified that of the 79 manufacturing SMEs who reported that they had used a university in the past, only 3 had used them for help with developing their business. When asked what services they would like to see from universities, in order of priority, the following services were cited.

- **R&D**
- **Short courses, training** - Marketing and market related issues, Design and design related issues, financial planning, operations, legal issues for businesses. Accredited courses were of little interest; solving immediate problems was more important
- **Provision of skilled labour** - specialised staff, manpower, qualifications for existing staff
- **Expertise** - engineering backup, cheaper alternative to existing consultancy, access to new thinking, access to experts
- **Networking**

Table 2 shows the internal validity of the survey sample. Table 3 shows the SME employment bands for survey respondents.

Table 2 - showing the internal validity of the survey sample

County	Total Population ⁷	Sample n (n/N)	Innovation-interested	Not innovation-interested	Percentage interested
Suffolk	2125	119 (6%)	43	76	36
Norfolk	2387	96 (4%)	25	71	26
Herts	3285	59 (2%)	23	36	39
Essex	5180	232 (5%)	89	143	38
Cambridgeshire	2280	263 (12%)	65	198	25
Bedfordshire	1685	128 (8%)	31	97	24
Total	16942	897 (5%)	276	621	31 (average)

NB - 231 of the 276 companies who were innovation-interested answered the full survey.

Table 3 - showing the SME employment bands for survey respondents

SME band	No of respondents (n=231)
0-9	9
10-49	120
50-249	102

A number of innovation models are actively being applied by organisations such as i10 in order to knowledge-transfer innovation expertise to small firms in the region. These include networking events combining research academics and companies in related fields, 'speed dating', on-line tools for common communication areas, and targeted workshops etc. Our results show that effort is best spent on activities that provide access to R&D and short courses to solve immediate business problems e.g., marketing, design, financial planning etc. The fact that there was no interest in accreditation raises some interesting questions for universities in how to financially support (and measure) such initiatives. The limited resources that SME have for external scanning and R&D suggests that such initiatives will never be self-sustaining and that some form of Government aid will continue to be needed. This makes the need for an effective process of engagement ever more acute.

Sustainability aside, a second problem for universities has always been Marketing these relatively new services to SMEs. Universities have tried a number of marketing methods in the past. These methods have included direct mailing, TV advertising, radio advertising and marketing through partner organisations. Judging from the recent DTI input to the Lambert report however, one can conclude that these methods have had limited success.

These methods are often costly and the hit rates relatively low. For example a £4K advertisement / direct mailing may perhaps achieve first contact from 15-30 companies. Each of these contacts then needs resource to allow follow up which can be both costly and time consuming. The problem with this approach is that the clients' needs are not understood before the first meeting and hence resource is expended with little guarantee that any of the companies has a prospect of ever working with the university.

Our conclusion based on these findings was that a new process of engagement needed to understand clients' needs and match this to university needs before first contact was actually made. The universities needed to be more proactive in going out and finding the companies whose innovation needs they could meet before expending valuable resource. We realise that we needed to sell i10 to manufacturing SMEs in order to overcome perceptions and experiences, and to reach those who had

never perceived a university as a supplier of services. The approach would be to profile companies prior to first contact; to select carefully the companies for direct contact, and then to mould a package specifically for the business based on the services and infrastructure already in place between the universities. All of this would be done using translators as a form of university-SME intermediary.

In order to profile companies we needed to reconcile the literature on innovation with questions that could be asked of manufacturing SMEs. To make profiling cost effective we would need to automate this process and the resultant data collection and analysis. Once companies had been selected, a translator provided improved access to innovation knowledge by firstly translating the SMEs requirements and then providing a complete package of universities' offerings. To ensure that the process was customer-focussed translators were academics with business experience. To ensure that value was perceived by all universities, translators acted for the group and all universities were treated equally.

A NEW PROCESS OF ENGAGEMENT

In order to address the marketing issues highlighted, the group adopted an ethos of 'proactivity'. The new engagement process needed to seek out companies from the known population who wanted to innovate, and then to offer support from the region's universities. The approach was radical in that it was knowingly proactive. It extended the familiar approaches of capability marketing, organising research dissemination events and organising network opportunities, and in doing so attempted to understand and serve customer need more fully.

The process of engagement between the i10 universities and manufacturing SMEs developed; we call the '6Is - identify, induce, individualize, instigate, initiate, innovate. Table 4 describes the process of engagement.

Table 4 - showing the MAPSME (6Is) process of engagement

Process step	Description
Identify	Identify the client group by first understanding the regional population and then locating companies based on regional or RDA priorities
Induce	Induce engagement by offering free innovation benchmarking, free sign-posting and appropriate marketing puffs, c.f. http://dev.i10.org.uk/mapsme
Individualize	Individualize by understanding the clients innovation profile - done by analysis of the data obtained and the matching of data with declared university expertise
Instigate	Instigate a meeting with potential clients to sell the organization (in this case i10) as a potential supplier of services, and to capture more specific business needs
Initiate	Initiate university contact based on specific business needs. In this case done through a collaborative brokering system. See www.aski10.org.uk This is followed-up with a report to each business on the services and opportunities available to this business.
Innovate	Work with the company to support their relationship with the institutions to ensure product, manufacturing process, or business process innovation

Identification and inducement

SMEs were identified using the mapping process described earlier. They were then engaged by offering free online innovation benchmarking - an innovation score compared to a national database of companies. They were also given company tailored sign-posting and a prize was offered for those who participated early (within the pilot study timescales). See Table 5 for benchmarking parameters.

Individualize

Using an online tool⁸ incorporating a wide range of innovation indicators that were particular to manufacturing SMEs (See Table 5), we were able to completely profile the company allowing the universities to decide which companies to engage more fully with.

Instigate, initiate, innovate

On selecting the companies face-to-face meetings were sought at the company's site to capture business innovation needs. Following these meetings, and in collaboration with the company, business needs were then translated for academic consumption. The 'Ask i10' system (online brokering for 10 East of England universities) was then used to initiate contact on innovation problems. Finally, the process of engagement was evaluated immediately in terms of 'first contact experience' for the company and subsequently, as to the success of innovation knowledge transfer.

Table 5 summarises how the literature informed the online benchmarking and profiling. Figure 2 illustrates the tool development methodology. For a more in depth analysis of benchmarking parameters see (Cosh, Hughes et al., 2003).

Table 5 - showing how the literature study informed the online innovation benchmarking and profiling

Nature of innovation indicator	Innovation indicator	Author	Used in innovation benchmarking (econometric model ⁹)	Used in innovation profiling (profile factors)
Econometric - innovation outputs	Patents and publications per resident/company - productivity growth, production growth	(Brouwer and Kleinknecht, 1996); (Neely and Hii, 1999); (Aiginger, 2001)	No	No
	Employment growth; turnover growth; profit as a proportion of turnover; exports as a proportion of turnover	(Keeble, 1996); (Kalantaridis and Pheby, 1999)	Yes- turnover and employee number	No
	Export	(Lefebvre and Lefebvre, 2002)	Yes	Yes

Nature of innovation indicator	Innovation indicator	Author	Used in innovation benchmarking (econometric model ⁹)	Used in innovation profiling (profile factors)
	Product innovation	(Griffith, Redding et al., 1998); (Mosey, Clare et al., 2002); (Acha and Salter, 2003);	No	Yes ¹⁰
	Process innovation	(Mosey, Clare et al., 2002)	No	Yes ¹¹
	Sales from new products	(Gundling, 2000)	No	No
	Value add per employee	(Neely and Hii, 1999)	No	No
	Productivity	(Griffith, Redding et al., 1998); (Gu and Tang, 2001); (Criscuolo and Haskel, 2002);	No	Yes ¹²
	Profitability and business longevity	(Geroski, 1994); (Cosh and Hughes, 2002)	No	No
Technometric (innovation inputs)	Public expenditure in education; working population with tertiary education ¹³ ; internet penetration; PCs per inhabitant - production growth	(Aiginger, 2001)	No	No
	Public support		Yes	Yes ¹⁴
	R&D expenditure	(Geroski, 1994); (Kleinknecht, 1987) (Mosey, Clare et al., 2002); (Acha and Salter, 2003)	Yes	Yes ¹⁵

Nature of innovation indicator	Innovation indicator	Author	Used in innovation benchmarking (econometric model ⁹)	Used in innovation profiling (profile factors)
Experiential (cumulative business process knowledge / application of strategy in a specific market)	Innovation integral to corporate activity; top management commitment; effective communication processes; participative style of management; using all skills at company's disposal; managing innovation on a project basis with multi-disciplinary teams, reporting mechanisms and measurement	(Zairi, 1995)	No	No
	Entrepreneurial leadership and a capability to learn	(Hull, Coombs et al., 2000); (Weerawardena, 2003); (Athreye and Keeble, 2000)	No	Yes ¹⁶

Nature of innovation indicator	Innovation indicator	Author	Used in innovation benchmarking (econometric model ⁹)	Used in innovation profiling (profile factors)
	Management skills (change, marketing, technical skills, risk, strategy (planning ahead))	(Hayes, Wheelwright et al., 1988) (Ashford, Dyson et al., 1992) (Hill, 2000); (Schroeder, Bates et al., 2002) (Probert, 1997);(Probert, Farruckh et al., 1999); (Probert and Shehabuddeen, 1999) (Hull, Coombs et al., 2000); (Schroeder, Bates et al., 2002); (Yoguel and Boscherini, 2003);	No	Yes ¹⁷
	Staff qualification	(Hoffman, Parejo et al., 1998)	Yes ¹⁸	No
	Devoted resources to the innovation process; innovation flows of information	(Neely and Filippini, 2001); (Criscuolo and Haskel, 2002); (Mosey, Clare et al., 2002)	No	Yes ¹⁹ -
	The type of market; customer orientation	(Kalantaridis and Pheby, 1999); (Oakes and Lee, 1996); (Jones and Tang, 2000); (Mosey, Clare et al., 2002)	No	Yes
	Marketing and sales methods, web-based trading	Workshop defined	Yes	Yes

17

18

19

Nature of innovation indicator	Innovation indicator	Author	Used in innovation benchmarking (econometric model ⁹)	Used in innovation profiling (profile factors)
	The type of product (novel .v. non-novel)	(Wood, 1997)	No	Yes ²⁰
	Geographic location and access to external knowledge/resources	(Ciborra C., 1991); (Dodgson and Bessant, 1996); (Lawson and Lorenz, 1998); (Love and Roper, 1999); (Kalantaridis and Pheby, 1999); (Athreye and Keeble, 2000); (Eckhardt, 2001);	Yes - collaboration	Yes ²¹
	Firm size	(Cosh and Hughes, 1998); (Cosh, Hughes et al., 1998)	Yes	Yes ²²
	Culture; resources; competence; networking	(Neely and Hii, 1998); (Neely and Hii, 1999); (Neely and Filippini, 2001);	Yes (co-operation)	No
Innovation score			Derived from above parameters	Yes ²³

20
21
22
23

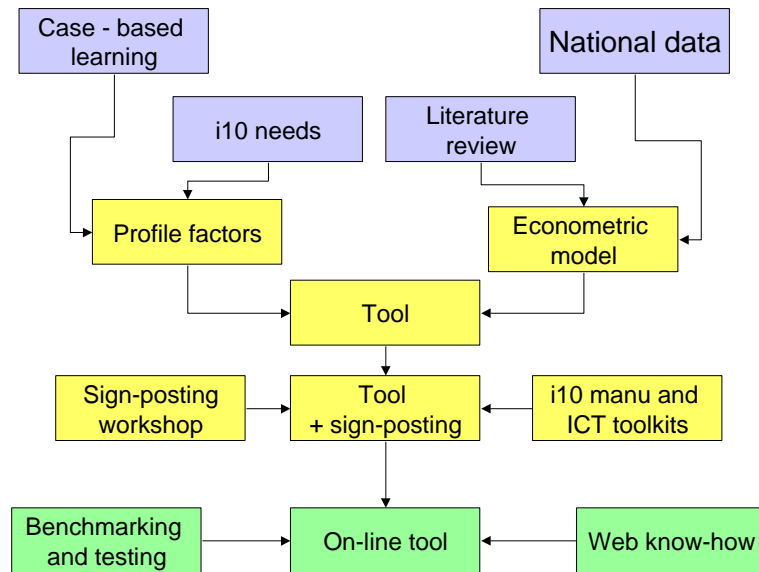


Figure 2 - illustrating the methodology used to develop the online innovation tool

Our approach has been to identify regional SMEs, contact them, invite them to use a free online innovation benchmarking tool which allows us to identify innovation opportunity; offer free company tailored sign-posting and to follow this up with a company visit by a translator where the company's innovation profile and skills needs indicate that there is a possibility that the universities can provide a service.

The anticipated SME experience

Within a day:

- Innovation benchmark against other companies
- Signpost to universities' services

Within 1-3 months (resource permitting):

- Hand held through initial university contact
- Successful engagement

RESULTS

Within a 6-month pilot period, 7000 companies were contacted by mail and invited to use the tool. 37 manufacturing companies used the tool and submitted Innovation profiles over a 6-month period. 24 companies were approached by translators. Of these companies, 7 were not interested in engaging with the universities directly; however, 17 continued through the process.

The knowledge transfer opportunities identified range from attendance at university - hosted events; consultancy opportunities; student placement, facilities use, Knowledge Transfer Partnerships (KTPs)²⁴ and a reduced form of KTP known as KEEP.

Formal evaluation of the new engagement process is being conducted in 2 stages. Stage 1 - an exit questionnaire for companies visited. To date, the exit questionnaires indicate the following:

- That the i10 translator visit was of use
- Contacts would be followed up
- Companies visited by translators would consider using i10 services in the future
- Companies who had not previously worked with a university, would now

Due to the time period involved for collaboration to come to fruition, it is impossible at this stage to judge the outcomes of innovation opportunities generated and hence make a business case for continued investment. An evaluation of outcomes will however take place after 1 year January 2005 - October 2005. This will involve contacting MAPSME companies to understand whether the each company has in fact followed up on its intent to work with i10 and contacting the universities to solicit feedback on the processes developed. Stage 2 evaluation will take the form of an evaluation of outcomes after 1 year in line i10 policy that is under development. This will be reported in subsequent papers.

Having piloted the online innovation tool and engagement process with manufacturing SMEs, the online innovation tool and engagement process is now being developed to accommodate service companies. The generic tool that results from this work will be completed by December 2005 and pilot testing will be completed by June 2006.

The econometric development of the generic tool and action-research based development of the existing process will be reported in related papers.

DISCUSSION AND CONCLUSION

The project team recognise the role of the SMEs as a growth engine (Busquin, 2002) and their need, as expressed by Lambert, to be persuaded of the benefits of engagement with universities. Amongst UK universities there is currently a growing emphasis on what has been labelled 'third stream funding' or commercial income, which can sit alongside research and teaching. In this research we have identified two distinct barriers to accessing businesses. The first is the decreasing amount of publicly available information about local businesses and the second the reticence that many small businesses have for approaching universities.

The project has set out to address the issue of "easier access to knowledge". An innovation survey tool has been designed to provide an initial step to encourage companies in the region to consider communicating with their local universities. The tool provides the participating universities with an understanding of a client company's innovation profile. From this starting point it has been possible for universities to engage knowledgeably with the client company, to capture specific business needs and to offer appropriate responses.

The innovation survey tool itself has been designed as an easy to use on-line questionnaire. Care has been taken to make the tool "user-friendly". The size of the response to the pilot of the service, 37 companies, in so short a time has demonstrated that the survey tool is accessible. Behind the tool lies a robust development methodology. The econometric part of the tool is based on a thorough

analysis of available national data. The workshop method has ensured that every profiling feature built into the model has been reviewed.

The project continues to test the role of intermediaries - translators. Evidence to date suggests that SMEs who chose to engage following use of the online tool welcomed this approach. 37 companies used the tool. 24 of these companies were approached directly by translators. 17 out of 24 companies approached chose to meet with a translator. Evaluation of project outcomes will decide whether this role has an ongoing place in third stream activities.

We have shown that the innovation profiling has been informed by the most up to date management and economic theory backed up by continuing national and longitudinal studies and that these criteria can be updated as theory is further validated over time. The infrastructure for innovation support created is therefore sustainable with the continuing support of the partners for tool marketing, tool maintenance and translation services.

A key element in this theoretical basis is the concept of innovative potential. The statistical analysis within the research "supports the hypothesis that high innovative capacity leads to high innovation performance. However there needs to be a minimum level of innovative capacity (potential) for firms to generate positive innovation performance." This particular feature allows the intermediaries to focus their efforts on the most promising leads.

As the profiling reflects both the needs of the client companies and the strengths of the universities, this particular model for engaging in innovation opportunities sidesteps the weaknesses identified in the university sector of patchy and inconsistent services (DTI, 2002). Even companies who only use the survey tool on-line gain the added value of innovation benchmarking. They gain an indication of their own innovation potential and are signposted to other sources of support.

The experience in the East of England has been that voluntary engagement by businesses with the survey tool is producing a valuable dataset of information about the regional SME community, from skills needs to specific innovation opportunities. Being able to measure a need is enabling the universities and the regional advisory agencies to better plan their provision of services for manufacturers.

Early indications are that the project has been successful in engaging with companies in the SME community and hence the project has been enlarged to include the service sector. However, the real impact of engagement cannot be determined until there has been time for any collaborative activities to become established. A further evaluation of the outcomes after one year will be reported in subsequent papers. These will describe the companies served with this process in terms of the types of knowledge exchange achieved.

Three universities in the East of England and the UK Government's Manufacturing Advisory Service have contributed to this initial development. The innovation profiling and engagement processes developed will now be extended outside of manufacturing to service companies. The broadening of the tool and processes to include the service sector will introduce a further two East of England universities into the group together with pertinent trade bodies.

The innovation profiling developed can be applied to any region where regional economic priorities are known and where local universities have explicit expertise. Use of a similar process would allow universities in other regions to provide "easier access to knowledge", to identify innovation opportunities and to focus finite translation resources on these opportunities. We believe that this process of engagement with companies is sufficiently robust to be replicated across other universities, and in other geographical areas. We invite other universities to help us develop and evaluate this tool for other European regions.

ACKNOWLEDGEMENTS

The authors would like to thank their individual institutions for supporting this activity and the i10 project (See www.i10.org.uk) and the Higher Education Funding Council of England (HEFCE) for funding the work.

ENDNOTES

- ¹ FAME CDs, A and B only
- ² The location quotient is a standard measure of concentration. It measures the relative concentration of a given industry or sector in a region or area. It is defined as: $LQ = (E_{ij}/E_j) / (E_{in}/E_n)$ or $LQ = (E_{ij}/E_{in}) / (E_j/E_n)$ where E_{ij} is employment in industry i in region j , E_j is employment in region j , E_{in} is national employment in industry, and E_n is total national employment. The LQ measures a region's share of total national employment. It is a measure of relative concentration. An LQ > than 1.0 indicates that there is an above average proportion of employment in a given industry in a given region. Conversely for a LQ of less than 1.0
- ³ SPRU definition - those activities concerned with the generation, use, application and exploitation of knowledge and other university capabilities outside academic environments. Source Christopher Padfield, HEROBC/HEIF Conference, Surrey, January 2003
- ⁴ See www.i10.org.uk
- ⁵ See <http://www.ltnetwork.org/>
- ⁶ See <http://www.businessaccess.ac.uk/>
- ⁷ Based on IDBR custom search for MAPSME 2002 (IDBR, 2003)
- ⁸ See www.dev.i10.org.uk/mapsme
- ⁹ Model based on Community Innovation Survey, UK, 2001 (6784 firms) and Centre for Business Research Survey of UK SMEs, 2002 (2130 firms)
- ¹⁰ Informs us of industry clockspeed and the types of expertise required of the HEIs
- ¹¹ Informs us of industry clockspeed and the types of expertise required of the HEIs
- ¹² Companies are asked if they need to achieve higher productivity
- ¹³ See notes entry on staff qualification in Table 5
- ¹⁴ Indicates eligibility for further public support - an aptitude for working with others perhaps
- ¹⁵ Only in as much as the company is able to quantify funds and a need for R&D
- ¹⁶ Evident from tool use
- ¹⁷ Skills requirements obtained from tool
- ¹⁸ Not included in first development tool due to significance for smaller companies
- ¹⁹ Possibly evident from using the tool
- ²⁰ Tool targeted at specific growth industries and supply chains therein
- ²¹ Tool targeted at regional companies; however, company is often unaware of regional help available, specifically from local HEIs.
- ²² Firms from each SME band targeted for pilot study purposes
- ²³ Used as an indicator of overall Innovativeness
- ²⁴ UK Government subsidised knowledge transfer initiative

LIST OF REFERENCES

- Acha, V. and A. Salter, (2003), *Exploring innovation in CoPs. Community Innovation Survey users' group, SPRU and CENTRIM, The Falmer Centre, Brighton, London.*
- Aiginger, K., (2001), *European Competitiveness Report 2001: Chapter IV The Impact of Innovation on manufacturing performance.*
- Anon, (2003), *SMEs to get tax and accounting relief, London.*
- Ashford, R. W., R. G. Dyson, et al., (1992), "The Capital-Investment Appraisal of New Technology: Problems, Misconceptions and Research Directions". R. G. Dyson, *Strategic Planning: Models and Analytical Techniques*, Wiley and Sons Ltd, Chichester.
- Athreye, S. and D. Keeble, (2000), *Sources of Increasing Returns and Regional Innovation in the UK*, Cambridge Working Paper No. 158, ESRC Centre for Business Research, University of Cambridge.
- Brouwer, E. and A. Kleinknecht, (1996), *Innovative output and a Firm's Propensity to Patent*, Tinbergen Institute Rotterdam.
- Bullock, A. and I. Milner, (2003), *Data Scoping*, ESRC Centre for Business Research, Cambridge.
- Busquin, P., (2002), *Commission to invest EUR 2.2 billion in research projects for SMEs, CORDIS.*
- Ciborra C., (1991), "Alliances as learning Experiences: Cooperation, Competition and Change in High-tech Industries". L. Mytelka, *Strategic partnerships and the World Economy*, Frances Pinter, London.
- Cooke, P., (2004) "The role of research in regional innovation systems: new models meeting knowledge economy demands", *International Journal of Technology Management*, 28 (3/4/5/6): 507-533.
- Cordis, D., *Definitions of sme.*

Cosh, A. and A. Hughes, Eds. (2002), Innovation Activity and Performance in UK SMEs, **British Enterprise in Transition: growth, Innovation and Public Policy in the Small and medium Sized Enterprise sector 1994 - 1999.** Centre for Business Research, Cambridge.

Cosh, A., A. Hughes, et al., (2003), Innovatibility of Manufacturing SMEs in the East of England: Econometric Analysis of Survey Data, Centre for Business Research, Cambridge.

Cosh, A., A. Hughes, et al., (1998), Innovation Surveys and Very Small Enterprises, Working Paper No. 89, ESRC Centre for Business Research, Cambridge.

Cosh, A. D. and A. Hughes, Eds. (1998), Enterprise Britain: Growth, Innovation and Public Policy in the Small and Medium Sized Enterprise Sector 1994-97, . ESRC Centre for Business Research, Cambridge.

Criscuolo, C. and J. Haskel, (2002), Innovations and Productivity Growth in the UK, UCL, CeRiBA, University of London, London.

Dodgson, M. and J. Bessant, (1996), Effective Innovation Policy: A New Approach, International Thomson Business Press, London.

DTI, (2002), DTI input to the Lambert Report. HMSO, UK.

DTI, (2002), Enterprise for All. HMSO, UK.

Eckhardt, B., (2001), Is Regional Innovative Activity path-dependent? An Empirical Analysis for Germany, Kiel Institute of World Economics Working paper 1058.

Ford, D. and V. McNiven, (2001), Manufacturing Industry in the Eastern Region: an analysis of support, needs and provision : A report for the East of England Development Agency, Institute for Manufacture.

Geroski, P., (1994), Market Structure, Corporate Performance and Innovative Activity, Clarendon Press, Oxford.

Goffin, K. and M. Szejczewski, (2000) "Product innovation in UK manufacturing companies", International Journal Manufacturing Technology and Management, 2 (1-7): 620-632.

Griffith, R., S. Redding, et al., (1998), Productivity Growth in OECD Industries: Identifying the Role of R&D, Skills and Trade, Institute of Fiscal Studies, London.

Gu, W. and J. Tang, (2001), A New Perspective on the Canadian Manufacturing Innovation-Productivity Linkage, Micro economic Analysis Branch, Industry Canada.

Gundling, E., (2000), The 3M Way To Innovation, Kodansha Europe.

Hayes, R., S. C. Wheelwright, et al., (1988), Dynamic Manufacturing: creating the learning organisation, Simon and Schuster, New York.

Hill, T., (2000), "Manufacturing Infrastructure Development". Manufacturing Strategy: Text and Cases, Palgrave.

Hoffman, K., M. Parejo, et al., (1998) "Small firms, R&D, technology and innovation in the UK: a literature review", Technovation, 18 (1): 39-73.

Hollanders, H., (2002), 2002 European Innovation Scoreboard: Technical Paper No 4 Indicators and Definitions, European Commission.

Hull, R., R. Coombs, et al., (2000) "Knowledge management practices for innovation: an audit tool for improvement", International Journal of Technology Management, 20 (5/6/7/8): 633-656.

IDBR, (2003), Bespoke number 8311 - breakdown of East of England manufacturing data, Office of National Statistics, Sheffield.

Jones, O. and N. Tang, (2000) "Innovation in product and process: the implications for technology strategy", International Journal Manufacturing Technology and Management, 1 (4/5): 465-477.

Kalantaridis, C. and J. Pheby, (1999) "Process of innovation among manufacturing SMEs: the experience of Bedfordshire", Entrepreneurship and Regional Development, 11 : 57-78.

Keeble, D., (1996), Small Firms, Innovation and regional development in Britain in the 1990s, ESRC CBR Working paper wp42.

Kleinknecht, A., (1987) "Measuring R&D in small firms: How much are we missing", Journal of Industrial Economics, 36 : 253-256.

Lambert, (2003), Lambert Review of Business-University collaboration: Final Report, HM Treasury.

Lawson, C. and E. Lorenz, (1998) "Collective learning, Tacit Knowledge and Regional Innovative Capacity", *Regional Studies*, 33 (4): 305-317.

Lefebvre, E. and L. A. Lefebvre, (2002), "Innovative Capabilities as determinants of Export Performance and Behaviour: A longitudinal Study of Manufacturing SMEs". A. Kleinknecht and P. Mohnen, *Innovation and Firm Performance: Econometric Explorations of Survey Data*, London and Basingstoke.

Love, J. and S. Roper, (1999), *Location and network effects on Innovation Success: Evidence for UK, German and Irish Manufacturing plants*, Northern Ireland economic Research Centre Working paper 44.

Miller, P., R. Botham, et al., (2001), *Business clusters in the UK - A first assessment (volumes 1,2 and 3)*, Trends Business Research, University of Glasgow, Cogent Strategies, University of Cambridge.

Mosey, S., J. N. Clare, et al., (2002) "Innovation decision making in british manufacturing", *Integrated Manufacturing Systems*, 13 (3): 176-184.

National Statistics Office (1999), *Bespoke analysis on behalf of MAS-east*, personal communication

Neely, A. and R. Filippini, (2001) "A Framework for analysing business performance, firm innovation and related contextual factors: perceptions of managers and policy makers in two European regions", *Integrated manufacturing Systems*, 12 (2): 114-124.

Neely, A. and J. Hii, (1998), *Innovation and Business Performance: A literature review*, Judge institute of Management, Cambridge..

Neely, A. and J. Hii, (1999), *Innovative Capacity of Firms in East of England: Actions and Performance : Research Commissioned by the East of England Development Agency*, Cranfield School of Management.

Oakes, I. K. and G. L. Lee, (1996) "Approaches to innovation amongst component suppliers: some smaller firm perspectives", *Int Jnl Technology Management, Special Issue on Access to Technological and Financial Resources for SME Innovation*, 12 (7/8): 808-819.

Probert, D., (1997), *Developing a Make or Buy strategy for manufacturing business*, IEE, London.

Probert, D., C. Farruckh, et al., (1999) "Linking technology to business planning: theory and practice", *International Journal of Technology Management*, 18 (1/2).

Probert, D. and N. Shehabuddeen, (1999) "Technology road mapping: the issues of managing technology change", *Int. J. Technology Management*, 17 (6): 646-661.

SBS, (2002), *SME Statistics 2001*.

Schroeder, R. G., K. A. Bates, et al., (2002) "A resource-based view of manufacturing strategy and the relationship to manufacturing performance", *Strategic Management*, 23 (2): 105-117.

Stockdale, B., (2001), *UK Innovation Survey 2001*, Department of Trade and Industry, HMSO. UK.

Weerawardena, J., (2003), *Small Firm Competitive Strategy: A Conceptual Model and Research Proposition*.

Wood, E., (1997), *SME Innovator Types and their Determinants*, Working Paper No. 72, ESRC Centre for Business Research, University of Cambridge.

Yoguel, G. and F. Boscherini, (2003), *The environment in the development of firm's innovative capacities: Argentine industrial SMEs from different local systems*, DRUID Copenhagen Business School.

YTKO, The Cambridge-MIT Institute, et al., (2003), *Report on the findings of a Programme of Dissemination to and Engagement with SMEs Concerning the Research into Enterprise Performance Undertaken by the Center for Business Research & Cambridge MIT Institute*, YTKO, The Cambridge-MIT Institute, CBR, EEDA, Cambridge.

Zairi, M., (1995) "Benchmarking innovation for best practice", *World Class Design to Manufacture*, 2 (3): 33-40.