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Publication Date	2003

Mulligan, D., Cormican, K and O'Sullivan, D. (2003) Requirements of SME's for effective innovation management, Proceedings of the 6th International Conference on Industrial Engineering and Production Management, 26th-28th May, Porto, Portugal.

Requirements of SME's for effective Innovation Management

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Keywords

Performance Indicators; Innovation Management; Small to Medium Enterprises; Large Enterprises; Collaborative Management

Abstract

Innovation has become one of the most important and effective ways of obtaining and sustaining competitive dominance in the market place over the past number of years. No longer can organisation depend the traditional performance metrics such as quality and efficiency in order to gain advantage over their competitors. This is true not only for large enterprises but also for small to medium enterprises. Innovation has traditionally been seen as key for those large enterprises that have money to invest and can afford to take risky investments. However, innovation plays an important role for the small to medium enterprises as the large companies often outsource many of their sub processes to them such as manufacturing. The main contribution of this paper offers a discussion of innovation management and collaboration; the paper will present the key differences between large enterprises and small to medium enterprises in relation to the innovation process; finally the paper will aim to identify areas of future research around this area that will contribute to the future competitive advantage of Irish SME's in the national and international market place.

1. Introduction

With increased competition in the market place and increased consumer pressures organisations are continuously changing their environment in order to sustain their market share. Competition in the market place is becoming more dense and there are many organisations competing for the same customer base. Various authors such as D'Aveni (1994) and Savage (1990) continually speak of a hyper competitive environment where the key competitive success factor is the ability to constantly develop new products, processes or services, providing the customer with increased functionality and performance. D'Aveni (1994) states that in a hyper-competitive environment, firms cannot count on a sustainable competitive advantage, but must continuously develop themselves in new directions. In order for companies to embark on this journey of continuous self-development they must ensure the entire co-operation of their actors within its network. This will include a highly successful innovation process not only from within the large organisation but also from each of its suppliers. In order to better utilise competence and resources held by suppliers, auto manufacturers have involved suppliers to an increasing extent in the development of new products (Clark and Fujimoto 1991; Lamming 1993). However this does not just apply to the automotive sector but to many other sectors such as electronics. Much of the

electronics industry are continually outsourcing their internal processes to SME's in order to focus on their core competencies.

A highly successful and innovative network demands a high degree of collaboration between manufacturers and suppliers. It also requires the transfer of knowledge between these two entities. As concluded by Wasti and Liker (1997), supplier involvement is positively associated with design for manufacturability considerations and product design improvements. However research by Littler, Leverick et al. (1995) showed that over 40% of the respondents expressed the view that collaboration makes product development more costly, more complicated, less efficient, more time consuming and more difficult to control and manage. This may be due to the fact that suppliers are often small to medium enterprises and hence often do not have sufficient technological infrastructure for the effective collaboration with larger enterprises. Often concepts such as the new economy, new technologies, hyper-competition and clock speed are used to explain that the dynamics of competition. In order to cope with this Savage (1990) introduces the possibility of a "fifth generation organisation" based on ideas of networking and new information technology. Therefore the need for firms to become more innovative and the need for successful collaboration have probably never been greater.

In light of the need for innovation, knowledge sharing, and the evolving "fifth generation organisation" this paper aims to provide a review of current literature on the area of innovation management, review the concept of small to medium enterprises (SME's), and outline the importance of innovation management to SME's in the Irish context. Based on this review requirements for SME's to become more innovative will be identified for future development.

2. Innovation – What and Why?

Many authors are regarding innovation and creativity as one of the most beneficial strategies that a company must have in order to survive in the future (Porter 1980)(Druker 1998). In an analysis of the strategies of the top 100 UK companies of the future, the Corporate Research Foundation found that structural flexibility and innovative power were listed among the top six drivers of future success. In the Irish scenario, Arthur Griffith set out a provocative and innovative vision of industrial development in an independent Ireland in 1905 as a mechanism for competition in a political economy (Kane 1999).

Majaro (1998) defines innovation as a four-stage process involving idea generation, compatibility analysis, feasibility study, and commercialisation. This is similar to the definition taken by Drew (1990) when developing a study regarding the development of information technology in Ireland. In this report the four stage process was invention, development, diffusion and adoption. The terms used in Drews (1994) definition however are more implementation focused as it is related to IT implementation. These innovation processes are not however isolated to just the invention of new products or processes. Innovation can be either: (a) an invention which may be considered completely new; (b) an improvement of an existing product or system; or (c) a diffusion of an existing innovation into a new application (Zhuang, Williamson et al. 1999). Cormican (2003) cites the Wheelright and Clark (1992) model for continuous development in the area of next generation products and processes and further states that this is where the majority of innovation should occur.

Each innovation requires a level of creativity. According to McAdam and McGlelland (2002) creativity is a resource that has the potential to provide a competitive advantage and innovation is the management process that enables this competitive advantage to materialise. This is similar to Majaro's definition of innovation i.e. it is a holistic process in which creativity or invention is a subset of the innovation process. Creativity of the organisation must be in line with the company's goals and if successful can increase the financial benefits of the organisation. Collins and Porras (1994) identified that financially successful companies shared some common qualities which included a focus on ideas generation, "a focus which on continuous self-improvement" and "a recognition of learning from failures". This idea generation however is a form of knowledge – both tacit and implicit. Harnessing this knowledge however is critical to the success of the innovation process.

Innovation is becoming a requirement of all organisations in order to sustain competitive advantage and market share. However in a study conducted by Cottam et al. (2001) in an attempt to establish a roadmap of the level of innovation that UK companies were establishing innovation as a major strategy found that 71% of companies did not have dedicated personnel responsible for innovation within their organisation. This is not a clear metric of companies commitment to innovation as many authors have stated that they do not view innovation as a single strategy or department but as a philosophy that needs to be adopted throughout the organisation. Cottam et al. (2001) states that this philosophy should guide the company forward and is one that is managed outside the traditional functional structure of the organisation – perhaps on a cross functional basis. Cottam's findings indicated that the main areas of responsibility for innovation were with the R&D, Technical or Marketing functions, or that each strategic business unit or division had a responsibility for their own innovative practices. Innovation structures such as these however can often stifle the real benefits of knowledge sharing and collaboration, which is required in order for innovation to work successfully. Creativity or invention which is a critical part of the innovation process often comes from the cross fertilization of thoughts and ideas. Normalising the innovation process into the functional roles of the organisation can only be described as rigid and old hat in relation to the evolution of organisational development. Organisations are moving from structures that are defined by tasks to those that are defined by goals or objectives (Hertog 2000). They are continually setting up cross-functional teams in order to problem solve and innovate.

There is a high percentage of innovation that fails every year in industry (Dooley 1999), but this is not only due to innovation structures. Many authors have attributed this to poor goal definition and poor activity alignment. However Khurana and Rosental (cited in Zhang and Doll (2001)) contend that unresolved technical uncertainties and inadequate customer needs assessment are responsible for the failure of many new product development projects. Market, technological and competitive uncertainty can make it difficult for a project team to launch a product concept with internal as well as external integrity. Gupta and Wilemon (1990) list four factors of new product development failures: (1) the poor definition of product requirements; (2) technological uncertainty; (3) lack of senior management support; and; (4) poor project management. Other sources of uncertainty are from lack of knowledge and information. Gupta and Wilemon (1990) argue that uncertainties and ambiguity come from the following factors: (1) increased domestic and global competition; (2) continuous development of new technologies that quickly obsolete existing products; (3) changing customer needs and requirements which truncate product life cycles; and (4) increased need for involvement of external organisations in the new product development process, e.g. customers, vendors, and strategic partners. However these "sources of uncertainty" could be

viewed as drivers for innovation and collaboration, rather than sources of uncertainty. In fact these sources of uncertainty are considered as characteristics of the networked environment that Savage (1990) speaks about in his fifth generation framework.

In order to reduce the amount of innovation failure Cormican and O'Sullivan however offer a structure for product development. Using a funnel as a metaphor it forces the creativity and projects to align itself with the overall goals and objectives of the organisation. Each of these projects or activities are supported by a set of resources and results of these projects are fed back into the system providing a lessons learned approach to future endeavours and an increased knowledge bank for future work (Cormican and O'Sullivan 1999).

3. Small and Medium Enterprises.

Small to Medium Enterprises play a vital role in today's economy. This is especially the case in relation to the Irish industry. In the study by Drew (1994) there was over 90 percent of Irish industry in the electronic sector was provided by SME's. However, Drews (1994) study looked at the number of employees as the only metric. The EU has since provided a method of classification of industry size based on three metrics (see table 1). These are number of employees, turnover and balance sheet total. Following the EU definition of SMEs, the relevant population is defined as all independent firms with less than 250 employees and less than €40 million annual turnover (Europa 2003), see table 1. In recent years there has been an increased attention in the development of the SME's as their role in society has seen as given greater benefit to society than the large enterprises. Likewise SME's are more dependant on their local surroundings and the level of education and skill available than large enterprises (Kelly 2000). Capital investment is also of a far more personal risk to the stakeholders and it is these human factors that hinder the development of SME's.

There is often a perception that SME's are simply a smaller scale enterprise. However their role has often been quite different to those of a large enterprise. SME's have usually played the role of the supplier to many of the large enterprises. With the increased use of technology in the large enterprise and the importance of information and standardisations, there are increased pressures on SME's to apply these large bulky systems in order to compete, integrate and communicate effectively with large enterprises. Many of the large enterprises are placing pressure on SME's to integrate with their systems. This can be of major cost to the SME's however the benefits that these systems have for large enterprises often do not yield the same return for SME's as they cannot avail of economies of scale. Data for analysis is often readily available and relevant improvements are more obvious in small-scale enterprises.

SME's however have one major competitive advantage. One of the key characteristics of an SME is lack of internal structures and hence they are agile as they are extremely low on automation. However they are not without their problems. With the introduction of much legislation in the work place in terms of health and safety, quality (ISO9000), environmental management systems (ISO14000) etc., SME's have found it hard to cope with the skill base required to implement these systems. Employees in an SME tend to be multi skilled but not specialised in any particular area where in large enterprises there is a multitude of specialised labour in-house. If SME's are to compete and meet the requirements of their large enterprise they will have to innovate and governments will have to provide stronger incentives for small to medium organisation to do this. In order for SME's to evolve in the future they will need a flexible workforce and have the

infrastructure to work effectively with the other large enterprises. Much of this will involve a highly innovative process and the effective use of their knowledge.

	Medium	Small	Micro
Max. number of employees	Max 250	Max 50	Max. 10
Max. turnover (in million ECU)	40	7	-
Max. balance-sheet total (in million ECU)	27	5	-

Table 1 Classification of Enterprise size (Europa 2003)

4. Innovation and SME's

Innovation is important for SME's, especially in the current climate where SME's like large enterprises have a broad range of standards that they must adhere to, where the market is becoming hyper-competitive, where consumer demands are constantly changing and where the market is moving from competition to collaboration. The continued success of any industry is also attributed to a thorough investigation of customers' needs and end with the development of new products that offer superior value to them. SME's are particularly subject to this as most of the original design phase takes place with the SME's as a prerequisite for the Large Enterprises (Kumar et al. 2000). Salavou (2002) drawing from a full literature review suggests that market orientation may not be that crucial for business profitability unless product-related innovative attitude is taken into account. Hence Salavou (2002) proposes that market orientation will have a greater influence on business profitability for firms with more radical product innovations rather than for firms with less radical (i.e. incremental) product innovations. This research, which is based on the Greek food companies, also found that more innovative firms seem to achieve higher profitability if they do not follow a market-driven pricing policy. However this may not be the case for the SME's as the majority of their market is specified by the large enterprises that they supply. The innovation process of the product may be restricted by the specifications of the LE. Hence it is conceivable that innovation process plays an important role in order to reduce the price of the product part and compete with rival suppliers.

For most of the product innovation of SME's it should align with the overall goal of the LE. This calls for close collaboration between the SME and LE. For SME's the creation of a robust product definition typically requires information and feedback from outside environments and a number of corporate functions, including engineering, R&D, marketing and manufacturing. Such shared information helps companies to come up with the clear and realistic target and good strategic fit of projects. A successful SME therefore depends not only on the sharing of information but also on the transition of data to knowledge, product to innovation and competition to collaboration. This has been summarised by (Amidon 2003) in figure 1.

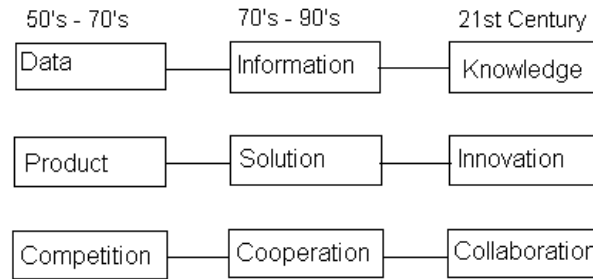


Figure 1 Evolution of thought

Collaboration and Innovation

As can be seen in Amidons' evolutionary model collaboration is becoming more important in today's industrial environment. This collaboration is not between competitions necessarily but between universities (knowledge hubs) and businesses, between customers and manufacturers, between suppliers and manufacturers etc. Collaboration between suppliers and large enterprises often fails due to a high level of uncertainty when dealing with large enterprises. Uncertainty is defined as lack of information on goals, alternatives and consequences (Zhang and Doll 2001). Geut and Wilemon (1990) describe how uncertainty concerning customer requirements may result in a poor product definition. However this may be of less concern to SME's that are suppliers for large enterprises as there is more formalised methods of information flow between the LE's and SME's in communicating the product specifications and requirements of the product parts. Therefore the front-end fuzziness of the innovation process is clearer for SME's than LE's. However they are influenced by the LE's level of front-end fuzziness, as they will have a lot of rework in their design if the LE does not have clear customer requirements. This is especially the case where the supplier takes full responsibility for the design and is involved at an early stage of the innovation process. Littler, Leverick et al. (1995) found that factors of considerable importance were establishment of ground rules, objectives and responsibilities, frequent communication, the relationship being perceived as important and having a product or collaboration champion.

The critical success factors identified by Corswant and Tunalv (2002) when involving suppliers in product development Technological competence, suppliers co-operation with other auto manufacturers and own suppliers, openness and matching of expectations, timing of involvement of suppliers, long-term strategy for involvement, coupling between production and product development, project management, pro-active supplier and co-ordinating auto manufacturer. In Corswant and Tunalv's study they explored a number of these success factors in detail by conducting a series of studies and interviews. The results showed that a limited amount of knowledge transfer between manufacturers and suppliers was regarded positive and that supplier collaboration in the development process does not guarantee access to the supplier's production competence and resources. Traditionally, suppliers have manufactured simpler components or sub-systems according to specification from the manufacturer. However, as outsourced modules are becoming increasingly complex and functionally interrelated, the importance of close communication between production and design increase.

It is becoming increasingly important for organisations to collaborate with their surroundings environment. There are three sources of environmental uncertainty that contribute to the failure of collaborative initiatives, these are: (1) lack of clarity of information; (2) general uncertainty of casual relationships between decisions and the

corresponding results; and (3) time span of feedback about the results of the decision (Lawrence and Lorsch 1976). Zhang and Doll (2001) also offer three more specific sources of sources of uncertainties: (1) the customer's requirements; (2) the nature of competition; and (3) the changing technology. In the comparison of these sources of uncertainty there appears to be three sources in terms of information; business relationships and feedback delay. As the environmental uncertainty increases, suppliers get involved early during the development process (Doll and Vonderembse 1991) and it is not uncommon for suppliers to be responsible for the development of whole subassemblies for their customers. Collaborative supplier relations are seen as the way to reduce uncertainty, speed the pace of new product introduction and sustainable long-term performance.

In relation to SME's in Ireland there are a number of factors that appear to further hinder the progress of collaboration with their surroundings. These issues reside mainly in the use of information technology. This study showed that while there was nearly 100% use of computers in industry and over 75% of them use the internet, the high level of technology uptake have not translated into equally high levels of e-commerce activity. Also security was an issue with over a quarter of them. This security issues was not noted as the main barrier to an e-commerce initiative. The main barrier was mainly due to staff knowledge and training and implementation cost.

Firm Size and Innovation

It is without question that innovation provides a competitive advantage to any company that is willing to endeavour in it. However there have been a number of arguments as to how the firm size affects the ability of a firm to innovate and there is substantial amount of conflicting evidence on this topic. Firm size influences positively in R&D projects financing possibilities because of internal funds availability and stability for larger firms. The success of larger organisations is also as a result of trade-offs between R&D and other non-manufacturing areas such as marketing and financing, which are usually more efficient in larger firms. However there is a large consensus among various authors such as Acs and Audretsch (1990; 1991), Pavitt et al. (1987) and Scherer (1965) that argues that R&D is not impeded by company size. Acs and Audretsch (1990) proved that small firms tend to achieve high innovation rates in relation to size. Although the hypotheses that firm size promotes the level of innovation is still the dominant one (Arias-Aranda et al. 2001).

In the analysis there was a distinction made between the level of R&D and the productivity of R&D. This is similar to Mc Adam and McGlelland (2002) distinction between creativity and innovation. Creativity in this case corresponds to the level of R&D however it is the innovation process that ensures the productivity of this R&D. According to Aranda et Al. there are appropriate conditions, which force firms to benefit from R&D activities by applying innovations in a firm's outputs and limit growth conditions due to innovation investments.

5. Understanding innovation for Irish SME's

In order to understand the innovation process for Irish SME's the authors have differentiated small to medium enterprises from large enterprises. This endeavour may provide some insight to why previous innovation research may not be directly mapped to the innovation of SME's. Drawing from this literature review a number of key areas have been identified and are summarised in Table 2.

Category	Small and Medium Enterprises	Large Enterprises
Source of Uncertainty	Collaboration / Integration between LE's	Fuzzy Front End
Innovation style	Pull process	Push Process
Cost	Resources are scarce	Resources are plentiful
Innovation type	High level of incremental innovation	High level of new and innovative
Inspiration base	High level of collaboration from large enterprises	Customer requirements
Dependency	High social dependency	High technology dependency
Risk	Personal	Corporate
Level of Uncertainty	Low	High
Technology	Adaptable	Rigid and Complex
Influence	Local education	Global education
Impact of SME	Local	International

Table 2 Comparison of innovation between SME's and LE's

Coupled with these differences this review has investigated characteristics of the Irish scenario that may influence the level of innovation. Innovation has not been the hub of Irish industry. In the past tax concessions were offered in order to encourage the setup of industry in Ireland. Ireland contrary to initial expectations, became a manufacturing outlet and fostered little innovation in the workplace. This has changed over the past number of years and there is a firm commitment by the state to promote innovation. There has been a 932 million investment to science and technology in 1999. The state has also made a firm commitment to education and training and in recent years has set up a number of initiatives to insure that SME's in particular benefit from research that is undertaken. However it has been highlighted in the literature review that there is a lack of implementation of technology that would strongly benefit the innovation process in the Irish scenario. The primary reason given is due to lack of training and knowledge. Although with this continuous investment coupled with the high level of familiarity of basic information technology in the workforce, Irish SME's have a good basis for innovation.

6. Framework

In order to identify future areas of research for the effective innovation and integration of SME's in Ireland it is necessary to identify the environment in which innovation will occur. As stated in the literature review collaboration is important for SME's in order to innovate. This is necessary in order to capture the requirements of the local surroundings and also to access the knowledge hubs that are available to it such as the training and consultancy of research that is provided by the state. Key to a successful innovation is a framework that will effectively monitor progress of any innovation. These indicators are primarily lead times, quality, and cost. Innovation within SME's is need driven and comes directly from the large enterprises; therefore product creativity is not as important for securing the market share. Sources of the knowledge and information that contribute to the innovation process of an Irish SME are shown in Figure 2.

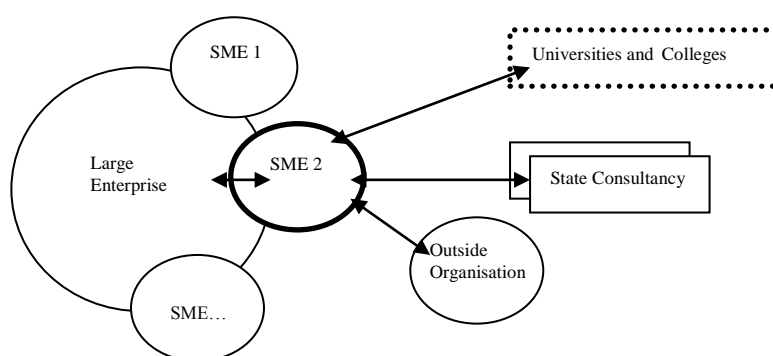


Figure 2 Knowledge and Information sources for Irish SME's

Considering these distributed information and knowledge hubs and the nature of SME's in the Irish context three key areas of research that will enable the innovation process of SME's in Ireland are identified and discussed. These areas are eBusiness, collaborative innovation management, and finally human resources. Each of these facets of research is described below.

eBusiness for SME's - In order to effectively integrate the information sources and flow of information and knowledge between the large enterprise communications need to be business to business and business to customer compliant. This would help to reduce some of the environmental uncertainties that were identified by Zhang and Doll (2001). Streamlining the order fulfilment process of the SME would also help with the integration and improve the responsiveness to the changing and dynamic nature of the large enterprise.

Collaborative Innovation Management for SME's - Another important area of focus is the development of a distributed innovation management system that will manage and support the innovation process of SME's. This system should allow the storage and access of knowledge from the different sources identified above. This management tool reflecting the architecture of Cormican and O'Sullivan outlined earlier should also help develop the SME efficiently as well as provide key customers with 'development plans'. As SME's do not have high levels of money to investment in comparison to LE's, these tools need to be low cost, practical and effective.

Human Resources for SME's - The final interaction we will draw attention to here is the interaction between development and operation in any organisation. Development typically means changes to systems both technical and social. While changes to technical systems are addressed change to the social subsystem are more elusive and less easily defined. This is a very important area of research that warrants attention in order to effectively implement these technologies and foster a culture of innovation that will ensure the future sustainment of Irish SME's.

7. Conclusions

The objective of this paper is to investigate and understand the environment of SME's with special attention to those operating in Ireland. The review was distilled and analysed and finally synthesised in order to understand the needs for SME's to become more innovative in Ireland. This review showed that Ireland provides a good platform and infrastructure for innovation with continuous investment from the state and state supported consultancy for the transfer of this innovative technology. Investment in education will support the continued implementation and development of technology.

The body of this paper however has identified areas of immediate future research that coupled with the infrastructure provided by the Irish state would enable SME's operating in Ireland to innovate more effectively. The areas of research identified were (a) e-business, (b) collaborative innovation, and (c) human resources. The areas of work should aim to: (a) develop online systems located within the SME for each of the major levels of information exchange between an SME or cluster of SME's and their customers, (b) develop low cost

solutions to facilitate the change management process within SME's and (c) analyse, understand and develop tools and techniques for the development of the social subsystem within SME's.

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