# Resources and Entrepreneurial Capability within Boards of Directors in Established Smaller Independent Firms: Sources of Innovation and Firm Growth in the UK Plastic Processing Industry

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**Doctor of Philosophy**

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**THESIS SUMMARY**

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In the context of a significantly increased UK small firm population since 1997, the organizational growth capability of a neglected firm size sector, the established independent small enterprises (EISME) was selected for examination, focusing on the critical resource of the early board team. A resource based theory was chosen as an appropriate theoretical perspective, with entrepreneurial management viewed as a characteristic pattern of resource picking and deployment to build organisational capability.

The EISME board team resource is seen as a critical element in establishing a firm's resource development path, ensuring economic renewal through innovation and consequent evolution and emergence. The UK plastics processing industry, dominated by SMEs was chosen as the industry context. Technological change in the industry gives rise to unrealised potential for value creation and firm growth through innovation at many levels. UK firms under perform compared to equivalent countries sectors.

Hypothesised relationships were empirically tested to determine a link between the human capital resources of the early board team and higher levels of innovation, using a process measure specifically designed to capture entrepreneurial management orientation within early board teams. Data analysis indicated that higher mean education levels of internal board resource were significantly related to both incremental innovation and board level entrepreneurial capability as measured by the new construct, regardless of age and tenure length. Higher levels of firm performance measured by increased sales and employment over three years were not associated with higher innovation levels will entrepreneurial capability scores.

The research concludes restricted access to higher education during the middle years of the last century has hindered early board team performance in EISMEs. On the basis of a single industry study, some intervention and support to encourage early board team development and innovation may be necessary to initiate the accumulation of firm size specific management know-how in the general community to substitute for formal education deficiencies in older EISME directors.

**Key Words:** Entrepreneurial capability, innovation, human capital, education, resource based theory, SME's, board team

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# CHAPTER 1: INTRODUCTION

## 1.1 Established Independent Small and Medium-Sized Enterprises In The UK Economy

Firms in the middle, established independent small and medium-sized enterprises, (EISMEs) are a neglected firm size sector for research purposes. Rapidly rising UK small firm numbers, 3.7m in 1997 to 4.2m in 2004, (Small Business Service, 2005) is causing a change of focus in both industrial and economic policy. Government small business policy know formally recognises the need to develop organizational growth capability in smaller firms (Small Business Service, 2004). Academic research has yet to catch up and investigate how some smaller firms may successfully evolve and emerge from amongst the greater hoard. Aldrich considers the "organisational scholars have done an excellent job in explaining how things work in organisations that have been around for a while, but not how they came to be that way" Aldrich, 1999) p1. Fast-growing entrepreneurial new ventures have been well studied, but it is unrealistic to expect every enterprise to demonstrate the same fast growth characteristics.

## 1.2 Plastics Processing Industry

Firms in the middle, EISMEs, defined here, as independent firms employing between 20 to 249 employees, established for more than five years are relatively numerically few on the ground, some 75,000 firms in 1997. Such firms are capable of further growth, creating value for their owners and the wider economy, contributing in a way not previously recognised (Doyle and Gallagher, 1987). A particularly needy industry sector dominated by SMEs: the plastics processing industry was identified where sector productivity was substantially lower than for sectors in equivalent developed nations. The industries they supply cannot be considered mutual as ample potential for innovation continues to exist as plastic materials are applied ever further products. The industry value chain is also reconfiguring providing other opportunities yet SME management appears to be unable to exploit the potential to innovation.

## 1.3 Group Level Entrepreneurship

Entrepreneurship is too often studied through the activities of an individual when it might be more appropriate to study the resources and capabilities of a group. Approaching the question of poor EISME performance and encouraging organizational growth capability from the perspective of resource base theory, a further neglected area of study was identified:, the early board team. The term early is used to denote its development stage, not yet a fully functioning board team but potentially capable of internal expansion and impacting firm evolution and eventual emergence. Unlike the elite ambitious fast-growing venture capital backed entrepreneurial ventures, EISMEs do not start with full board teams, representing every function but grow in their own time and season. Owner director's personal and business objectives are invariably intermingled, inevitable given the lack of separation between ownership and control (Beaver and Prince, 2004).

### 1.4 Innovation

Economic renewal can be achieved through innovation (Mezias and Glynn, 1993). Innovation is considered the tool of entrepreneurs (Drucker, 1985) Innovation is therefore an outcome of entrepreneurial management behaviour (Stevenson and Jarillo, 1990) and applies at individual, group and firm levels. Firm level entrepreneurship and the more sophisticated innovation outcomes of organisational and strategic innovation are extensively studied in the corporate entrepreneurship literature (Sharma and Chrisman, 1999). Entrepreneurial new ventures based on the individual also receive considerable attention but no one looks at entrepreneurial management for firms in the middle. An assumption is often made that an emerging firm must make a transition to professional management, a potentially fatal distinction according to Watson (Watson, 1995). Adoption of formal routines, systems and structures, perhaps developed elsewhere, are likely to result in as much organisational rigidity and inability to innovate as in larger firms (Barton, 1992)

### 1.6 Early Board Team

The early board team is considered a critical resource for establishing future firm growth capability, forming a critical part of a resource development path, the direction of which is extremely difficult to change once it is set, and path dependence sets in (Aspelund et al., 2005). Early, applied to a board team, is used to denote a team, limited in size, which still has potential development capability in EISMEs.

Consciously or unconsciously, early board team members adopt management practices and thereby set the organisational processes which prevail in the firm. No research has specifically considered the problems involved in expanding the board team resource to drive future growth. Penrose is one of the few authors to address the difficulty of expanding the senior management team. Consideration is given to the nature of the 'services' (capabilities) rendered by the management team, with Penrose observing that both entrepreneurial and administrative capabilities were required for further growth. Maintaining and creating a board team entrepreneurial orientation to management practice, continuing to exploit innovative opportunities while simultaneously developing administrative controls in the establishment of routines and systems must be a truly difficult task and one of the reasons why so few firms evolve and emerge.

The research develops a thesis within resource base theory, viewing entrepreneurship as a dynamic process of picking and deploying resources for innovation (Zahra et al., 1999).

An investigation of the process link, an entrepreneurial capability, between the early board team human capital resource inputs associated with innovation outputs is proposed for EISMEs: in so doing, attempting to determine the dimensions of an entrepreneurial management orientation for a neglected group level of entrepreneurship.

# CHAPTER 2: RESEARCH PHILOSOPHY

## 2.1 Introduction,

Chapter 2 makes explicit the researcher's ontology and epistemology through which problems and the research processes are addressed as a key task ensuring research coherence and findings significance in relation to received research. Research method choice in the social sciences is inescapably linked to the researcher's ontology; their previous experiences create their philosophical, ideological, and epistemological understandings acquired during life. Sayer argues the philosophical assumptions of the researcher with respect to the nature of reality and objects of study matter: how we know and interpret reality combined with the resources available to the researcher underpin the methods used (Sayer, 1992).

The researcher adopts a broadly positivist approach and research philosophy, where the observer is an objective analyst and interpreter of tangible social reality. Underlying assumptions of positivism are the independence of the researcher from the research, determinism (causes and effects exist, or at the very least associations), a criticality of evidence, parsimony and the ability to generalise from the findings in order to explain and predict (Remenyi, 1996).

Bryman states 'methods of social research are closely tied to different visions of how the social reality should be studied. Methods are not simply neutral tools: they are linked with the ways in which social sciences envision a connection between different viewpoints about the nature of social reality and how it should be examined" (Bryman, 2004) p4. Whyte similarly deems research a subjective matter in his seminal book on Street Corner Society, when discussing his social science research approach. He says' to some extent my approach must be unique to myself, to the particular situation and to the state of knowledge when I began the research' (Whyte, 1981). Denzin and Lincoln, say that "the gendered, multiculturally situated researcher approaches the world with a set of ideas, a framework that specifies a set of questions that are then examined in specific ways'. (Denzin and Lincoln, 1994).

Selecting particular paradigms, epistemology and research perspective does not exclude or deny the validity of others. Merely that the perspective chosen is considered to best to illuminate the problem addressed at the time (Barney, 2001). Barney, in his 10 year retrospective review of resource based theory, argues that although he could have chosen one of three different empirical resource based view literatures on which to base his influential 1991 paper, (Barney, 1991), he deliberately chose one position, although at other times he had used others equally legitimately. He argues that the positioning of an argument relative to received literature is critical to determining the structure of the argument, the issues it will and will not address. Several alternative positions can exist which illustrate or give rise to different insights. There is 'no one best way' of positioning a theoretical argument. The researcher has chosen a particular position as appropriate to the research question but does not deny the value of other approaches and perspectives.

Certain key experiences have influenced the researcher's practical interests, world view, and choice of knowledge theory and means of enquiry on which the research is based. These expenses are briefly outlined below as they contribute to the matching of ontology, epistemology with the research methods chosen (Flick, 2002) p48.

**2.2. Paradigm Chosen: Ontological and Epistemological Considerations**

In pursuit of knowledge within social science, a researcher must take on board the wider debate on the choice of paradigm used, its underlying philosophies on the nature of the social world. The term paradigm can be and is applied at several levels within academic research; the philosophical, social and technical (Morgan and Smircich, 1980) Broadly, the philosophical 'lens' through which the reality of the social world, determines the research problem and methods (the research process) chosen.

Choice of research methods is and subjective matter as discussed above. To understand better the researcher's perspective, influential previous experience is now acknowledged. Firstly, work as a production and factory manager in a large, vertically, organised clothing manufacturer in the East Midlands (Courtaulds Knitwear Ltd) composed of geographically dispersed factories, had a significant impact. Each factory unit possessed distinct stitching and cutting capabilities, which were never lost despite some quite high labour turnover levels. At the time, it seemed as if capabilities were transmitted direct from factory 'bricks and mortar' to employees since skills and capabilities persisted in a quite remarkable way within units over time, yet they were difficult to emulate successfully in other units. The resources and capabilities within productive units became of enormous interest from the perspective of a manager wishing to replicate them successfully elsewhere. Just what was the process involved in transmitting and repeating skills and capabilities across factory units? The parallel with business expansion is clear. Just how do small firms expand and copy early success?

Exposure to the 'corporate underbelly' of London's SMEs within a local authority funded venture capital organisation, the Greater London Enterprise Board, further contributed to an accumulation of experience. Smaller firms seemed unable to develop effective management teams to deal with the complexity of larger scale operation whilst at the same time successfully economically renewing themselves. Their start-up and early trading may have been successful but they progressed no further. Direct observation of many different enterprises revealed management competence and team formation was a substantial limiting factor within emerging enterprises.

The inductive, speculative but naïve 'bricks and mortar theory' was clearly an inadequate explanation of an important subject. Just how are resources and capabilities copied and transmitted across units or as a firm grows? What role does management have in repeating initial success? Subsequent experience and academic learning led the researcher to theories of evolutionary economics, the resource based view of the firm and the management approach to entrepreneurship. The seminal works of Edith Penrose, Nelson and Winter and Schumpeter, 'The Theory of the Growth of the Firm', 'An Evolutionary Theory of Economic Change' and 'Theory of Economic Development: An Inquiry into profits Capital, Credit Interest and the Business Cycle' respectively, have all been influential in identifying the paradigm and problems of the research study. (Penrose, 1959) (Nelson and Winter, 1982) (Schumpeter, 1934).

Greater knowledge of essential the human capital resources of early board teams and their associated management processes needed to help them develop organisational growth capability was perceived as a valuable task. A deductive research approach where "the researcher, on the basis of what is known about a particular domain or theoretical considerations in relation to that domain, deduces hypotheses that must then be subjected to empirical scrutiny" (Bryman, 2004) p8 was chosen as an initial approach. An analytical study to assess the relationships between EISME team human capital resources and capabilities during firm emergence, using existing theory and concepts was deemed appropriate. Verification of whether there were particular generalised patterns of association between the board team human capital resources, capabilities and innovation outcomes, using existing, acknowledged theoretical key variables, could potentially throw light on successful early development of management competence of EISME board teams of benefit to the entire EISME sector. Some valuable understanding might therefore be gained the emergence and evolution processes of EISMEs to the study of their resources and capabilities.

### 2.3 Positivist Approach to Research.

For the purposes of the current research a positivistic paradigm is adopted influenced by the experience described above and by a pragmatic desire to explore a dominant functionalist research paradigm as one of four possible paradigms put forward by Morgan (functionalist, interpretive, or radical humanist and radical structuralist) (Morgan, 1984). The Morgan paradigm framework is subsequently used by both Grant and Jennings to demonstrate the need for a clear understanding of the alternative research paradigms for entrepreneurship research (Grant and Perren, 2002, Jennings et al., 2005). Grant and Perren argue that the "health and future development of research in this area (entrepreneurship and small business) requires a broadening of perspectives to enable debate, friction, creativity and ultimately new theories and understandings' (Grant and Perren, 2002). Jennings et al. also suggest "the power of alternative paradigms to contribute to knowledge and understanding of entrepreneurship" is insufficiently explored in a guest edition of Entrepreneurship Theory and Practice (Jennings et al., 2005). The research paradigm employed is therefore positioned in relation to their matrix.

The researcher's position falls along a continuum of core ontological assumptions, which range from positivist, (where reality is objectively verifiable), to phenomenological, (where reality is subjective, a projection of human imagination) through to one where reality is derived from transmission of information and their interpretation. Periodic scrutiny of the ever changing forms and interactions within our society is needed to determine the changing patterns and paradigms shifts (Morgan and Smircich, 1980).

The researcher chooses to occupy the dominant functionalist quadrant of Morgan's paradigmatic framework, where the social world is viewed as real, reality that can be objectively determined. The adopted position does not fall at the extreme end of sociological positivism, where the world is treated as totally objective and singular and separate from an independent researcher with value free and unbiased analysis. It moves towards the interpretivist side of Morgan's framework, influenced by the views of Popper, Kuhn, Daft and Weick to identify the board team human capital resource characteristics with the management and organisational processes used to deploy resources and build capabilities for continued innovation and growth (Daft and Weick, 1984, Kuhn, 1962, Weick, 1979). The subjective views or interpretations of EISME board teams on their firm managerial practices and organisational processes have been incorporated into the research by the research instruments used as will be demonstrated later.

Organisations (and their board teams) continually seek and interpret information for a wide range of questions according to Daft and Weick in their 1984 paper "Toward a Model of Organisations as Interpretation Systems." "People are trying to interpret what they have done, define what they have learnt, and solve the problem of what they should do next. Building up interpretations about the environment is a basic requirement of individuals and organisations. The process of building the interpretation may be influenced by such things as the nature of the answers sought, the characteristics of the environment, the previous experience, and experience of the questioner and the method used to acquire it." (Daft and Weick, 1984) Daft and Weick argue that incorporation of interpretive techniques is necessary to understand complex and dynamic processes organisations to complement the analysis of static frameworks and mechanical systems.

Two neo positivists, Popper and Kuhn, writing in the 1940s, (loosely dubbed post positivism have influenced personal ontology and epistemology. Firstly, Karl Popper undermines logical positivism with his critical rationalism in pointing out that universal truths cannot be conclusively verified in his famous swan example. That only white swans have been seen does not mean that there are no black ones. Everything cannot be known. Scientific knowledge therefore is no longer an objectively verifiable truth but a tentative set of assumptions subject to modification. Instead of proving a model to a high degree of probability where, after all, evidence to support a model is easily found by a subjective observer, a model will only survive after rigorous attempts to disprove, in a survival of the fittest routine. Popper preserves unity of the sciences but introduces a critique of the methodology. Yet Popper's approach is unsatisfactory, implying a degree of longevity or static nature to observable facts. The world around us undeniably changes, both societal structures and behaviour, and their relationships are modified. It is not static, it is dynamic. Contingency theorists and population ecologists argue the case with different views on the direction of cause and effect.

Is it then possible to apply a positivist approach to perpetually changing firms and entrepreneurial behaviour? Smaller firms and entrepreneurs inhabit an uncertain world, with conditions of ambiguity, uncertainty, lack of clear structures in sometimes turbulent and high velocity environments, (especially at the start of a Kondratieff wave). They are more volatile and transient than their larger brethren. Small firms are experiments in their own right, responding to the contingent factors in their environment under the conscious or unconscious direction of their management and employees. A need to ascertain and recognise broad relationship patterns between firm specific resources and capabilities for all stages of firm development exists, whilst recognising the dynamic and complex world smaller firms inhabit.

Explanatory theories of association without direction implied, clear cause and effect, and may well be different for the next generation of firms, following Popper. Their study would require longitudinal research designs beyond the scope of the research resources and a series of snapshots to spot the changes in patterns formed. As Grant and Jennings point out, the functionalist paradigm is still the most favoured for entrepreneurship research and takes no account of other research paradigms that may expand our understanding of the entrepreneurship phenomena in society (Grant and Perren, 2002).

Schumpeter argues that entrepreneurs create tidal waves of destruction, disrupting existing knowledge paradigms. Selecting a research paradigm capable of bridging such disruptions is a fraught issue, so it is perhaps not surprising in a field which has long suffered from a perceived lack of legitimacy, that the dominant research paradigm has been favoured to the detriment of exploring other perspectives.

If Popper's argument has been fundamental in undermining classical positivism in the natural sciences and the development of a post empiricist science within a positivist methodology and by implication social science, then T.S. Kuhn's contribution is also helpful. Kuhn's approach helps the researcher escape from the domination of an existing paradigm and is more fitted to research of organisations, small and large at times of change.(Kuhn, 1985, Kuhn, 1962), and better grasps the nature of a changing world.

Kuhn's argument was that new knowledge does not easily come from existing scientific paradigms. Scientists concentrate on finding bits of the puzzle that fit. New knowledge is consensual and does not challenge the accepted order of science. It is only when a 'revolutionary science', or a challenge to social order, appears that paradigms shift and eventually reform after a period of uncertainty, testing accepted theories which were dependant on the parameters and conditions of the previous paradigm. Paradigms are explained by Kuhn as: "universally recognised scientific achievements that, for a time, provide model problems and solutions to a community of practitioners" (Kuhn, 1962) p. viii.

For a time has been underlined above, as implicit in Kuhn's belief, is the likelihood that paradigms will shift over time. Sometimes the change will be dramatic but at others, more incremental, evolutionary and adaptive (Kuhn, 1962). A research lens not only needs to be used for repeated 'snapshots' but needs to be periodically reviewed and renewed as a paradigm shift its basis and interpretation produces modifications to what is 'known'. Major 'revolutionary technologies' (the applied manifestations of physical and social science) have been encountered by our society in the last decades and, it could be argued, have precipitated major shifts in paradigms in both natural and social sciences, apparent in the chaos of post -modernity.(Morgan, 1997)

Penrose in her introduction to her second edition of Theory of the Growth of the Firm considers that by the mid-20th century, the neoclassical theory of the firm (the theory of perfectly competitive markets, relative prices and Pareto optimal resource allocation) could reasonably be looked on as a mature science in the Kuhnian sense of a set of received propositions. It is one with which she basically disagreed in her analysis of the limitations to small firm growth. Even though paradigms are shifting, evolving and what is 'known' is changing continuously, adaptation and evolution occur, it does not render measurement in terms of numbers irrelevant. Quantitative research design and methods take "snapshots" of patterns of coherence / association within society which are of value in better understanding and organising human activity (Levy, 1994). These patterns are not immutable and change over time, necessitating periodic "snapshots" in order to assess change.

The polarisation between endogenous and exogenous theory: evolutionary/resource-based view versus the strategic positioning school ( and derivatives) is modified by an emerging third school of theory using an organic perspective to strategy, moving away from "traditional mechanistic perspectives based on disciplinary based theories, design models and a view of strategy as a planned posture" (Farjoun, 2002).

These organic approaches challenge, according to Farjoun, the unified, relatively narrow view and increasingly less pertinent traditional mechanistic perspectives. Such movement at a general theory level can only help with the creation of applicable strategy theory for SMEs, so currently lacking. The advent of organic developments, including "strategy process research, evolutionary and process models, and interactive and integrative views, has provided richness and pertinence (to strategy), but not a unified perspective". If, as Farjoun argues "an epistemological shift from mechanistic to organic assumptions from discreet to incessant time, from directional to interactive flow and from differentiated to integrated constructs and models" is in progression, then there are implications for future research briefly discussed in Chapter 10. The research, nonetheless, for practical reasons, remains located in the dominant functional paradigm with nomothetic research methods, in an attempt to define patterns of association between resources and capabilities for EISMEs as a marker in time.

Repeated snapshots in a longitudinal design would clearly produce a better overall picture, but time and resources constrain research design. Numbers are interpreted subjectively and according to the adopted perspective and should be supplemented and complemented by other forms of analysis (Bryman, 1988) in a triangulation process to ensure validity, reliability and generalisability. Quantitative and qualitative researches are considered to be different sides of the same coin. Qualitative and phenomenological paradigms serve to expand and acknowledge significant changes in the way the actors see and construct the world, which influence our interpretation of reality, individually and as culturally. Both are legitimate approaches where dialectic may develop which advances knowledge more rigorously than following a single approach. The research does not adopt a trial and error process in attempting to disprove or falsify previous theories but aims to identify gaps in received literature to determine previously unknown matters in a changing and dynamic environment. Existing resource based theory and concepts are applied to smaller firms to explore the relationships during the firm emergence process between the early board team human capital resource and development of necessary management capabilities for innovation and organisational growth.

# CHAPTER 3: RATIONALE FOR FIRM SIZE AND INDUSTRY CHOICE

## 3. Introduction

Chapter 3 introduces, defines, and initially explores the important terms used, which are more fully explored later in the text. Secondly, it explains the choice of established independent small and medium-sized enterprises (EISME) as the research focus within the plastic processing industry sector as an appropriate context in which to study critical resources in the early board team necessary for innovation and continued organisational growth capability. The EISME focus is justified through an examination of the UK small and medium sized enterprise stock and current trends along with their role and contribution of SMEs to the UK economy overall. Major trends are highlighted, in particular the vast increase in numbers and change in nature of smaller firms over the last five years.

The consequences and potential future issues of the enormous increase in small firm numbers and the overall economic prosperity of UK SMEs are also examined. The chapter concludes that it would be wise to take action to study just how these numerous small firms may survive and develop organisational growth capability for overall economic prosperity. Government policy in permitting a high degree of competitive churning in the SME population may be mistaken, as attention to the development of organisational growth capability in established independent small and medium-sized enterprises will ensure that valuable resources and capabilities generated are accumulated and made available to the wider population of SMEs.

## 3.1 Definitions of Terms Used

### 3.1.1 Small and Medium-sized Enterprises (SME)

**Table1: UK Government Department of Trade and Industry (DTI) and European Commission Employment Size Categories 2002**

| Size category | Number of employees |
|---|---|
| Micro | 0 - 9 |
| Small | 10 – 49 |
| Medium | 50 - 249 |

Source: Small and Medium-Sized Enterprise (SME) Statistics for the UK 2002 Small Business Service

Small and Medium enterprises ('SME') are defined by employee size category, as commonly used by the UK Government Department of Trade and Industry for statistical purposes for reasons of practicality and simplicity. SME's are defined as an enterprise employing less than 250 employees, further subdivided as shown below in table xyz. Differences between the UK DTI and European Commission size definitions existed at the time the data was collected in 1999 but are not significant for the research so have been ignored. A more detailed UK SME definition is shown in the Appendix 1.

### 3.1. 2 Established Independent Small and Medium-sized Enterprises (EISME)

Established firms are defined as independent firms, which have been actively trading for more than five years and possess more than 20 employees at which level an internal delegation threshold is reached according to Storey (Storey, 1994). The explanation and justification for this choice is examined in more detail in the later section.

### 3.1. 3 Team capital / Board Team

Team capital refers both to the human capital resources vested in the early board team and the capabilities and competences built on these resources. The term does include the potentially wider management team, (supervisors, and other managers). The wider management team may legitimately have an impact on the way the firm's resources and capabilities are developed but are excluded in order to focus on the clearly identifiable board team. Team human capital in EISMEs, is argued to play a key role in establishing the direction of an emerging firm as it the board team's management practices and the organisational processes established, consciously or unconsciously, which determines the firm's growth.

### 3.1. 4 Early Board Team

Since the board team's internal collection of resources are the ones on which capabilities and the firm's resource path are built, the resource profile involved in team development is of interest. The early board team is the term used to describe the development stage of a firm's board team, the focus of the current study. It is important to note that 'early" does not necessarily mean early in time, only early in the sense of board team development as a necessary part of a firm's emergence. It may be a team either on the threshold or in the throes of developing into an effective board team. Alternatively, it might refer to a simple board of one or two people, possibly in an arrested state of development for a variety of reasons. A first tier of supervisory management may exist but there are no other senior managers within the firm. A fully functioning board may never develop in some firms, remaining under the control of the two minimum directors for a limited company. The second statutory board member is frequently inactive in many firms, the classic 'Mom and Pop' operations.

Many high-level, venture capital backed, new enterprises start with a full management team representing all the management functions with an MD/CEO, but it is not this type of firm with which we are concerned here. Smaller firms, less glamorous firms, do not start with a full team due to lack of financial resources. They are faced with the prospect of developing one at a later stage if the firm is to successfully emerge from caterpillar to butterfly using Penrose's analogy of the necessary metamorphosis (Penrose, 1959).

Penrose refers to the managerial team, in her seminal work - A Theory of Growth of the Firm, (Penrose, 1959) as a critical limiting resource to firm emergence. Penrose's managerial team is interpreted as the firm board team members acting as directors, executive or non executive. They may or may not own equity. If the board team is considered a barrier to successful firm evolution and emergence, then it follows that its internal resource endowment, expansion, and accumulation is of critical interest. Storey and Doyle and Gallagher note that firms can begin to grow at any time after establishment, contributing to employment growth throughout their lives, yet later growth in EISME's is not well studied (Storey, 1994) (Doyle and Gallagher, 1987).

Board team capability to respond to rapid changes in the external environment, ( called a dynamic management capability by Teece et al(Teece et al., 1997)) may require specific human capital resources within EISME's, not necessarily the same as those required in large established company management teams. Successful honing (to use the specific word used by Teece) of EISME board teams management practices and organisational processes may result in continued firm evolution and emergence. Yet EISME board teams have only recently begun to receive research attention (Huse, 2000). Clearly they are importance to the firm emergence process.

To sum up: team capital, board team, early board team, and top management team may periodically be used synonymously and refers to the same group of people: the collective human capital resource within the early board team of EISME's, responsible for the organisation of the firm's activities and its future direction.

### 3.1. 5 Resources capabilities and competences

The senses of these terms used within the resource-based view literature have been used variously, have evolved over time, and can produce confusion. For greater clarity the term resources are used within the thesis to apply to tangible and intangible resources used to create capabilities. These capabilities in turn combine to produce competences and strategic assets as outlined by Brush and Greene resource pyramid (add reference). Board team directors are those that configure and reconfigure resources to achieve desired capabilities and competences within EISME's.

### 3.1. 6 Management Practices and Organisational Processes

For the purposes of the research the term organisational process is used to signify the stage of a firm's behaviour before it becomes an established organisational routine. Processes are deemed to be more flexible and experiential, subject to rapid change then routines as described by Nelson and Winter (Nelson and Winter, 1982). Management practices are the higher order mechanisms, in the early board team in this case, which set and control organisational processes and routines. The management direction of the early board team, the management practices they adopt consciously or unconsciously create organisational processes and routines by which the whole organisation is controlled. Managerial processes are considered an important part of a firm's dynamic management capability according to Teece .(Teece, 1987). From the managerial processes or practices as they are called here organizational processes flow. Management practice refers to the patterns of management behaviour, which may or may not be characteristic of entrepreneurial management, adopted by the board team. Organisational processes, referring to the tacit as opposed to explicit organisational routines are deemed to be set by the board team's management practices.

The board team management practices determine the nature of the organisational processes through which the organisation is controlled and run. Organisational processes are 'the way things are done' in the firm, described by Nelson and Winter, are set consciously or unconsciously by those directing the firm (Dierckx and Cool, 1989, Nelson and Winter, 1982). Organisational processes are a key to understanding firm growth and emergence from an evolutionary perspective (Aldrich, 1999) as established later and further developed in the appropriate literature review chapter, their presence and nature. The early development process of board team resource development, particularly within EISME's has long been a neglected subject of research. More attention to board team resources, management practices and organisational processes associated with innovation may result in continued EISME economic renewal and growth. These relationships are explored in greater detail in Chapter 4 under the heading of entrepreneurial capability where the evolution of management practices and organisational processes appropriate for growth are discussed further.

### 3.1. 7 Entrepreneurship

Entrepreneurship has been studied from many different academic perspectives, complicating life at the unwary researcher. Kilby writing in 1971 describes the multiplicity of approaches as akin to describing a 'Heffalump'(Kilby, 1971). The picture is no less complicated today, with arguments for and against a separate academic field for entrepreneurship (Shane and Venkataraman, 2000). Stevenson and Jarillo lucidly explain and illustrate the various academic perspectives in their paper 'A new paradigm of entrepreneurship: entrepreneurial management' (Stevenson and Jarillo, 1990). A useful diagram from their paper is reproduced below as a simple means of outlining the academic contributions to entrepreneurship study and identifying the route followed within the research. The management approach involves study of *how* entrepreneurial management and outcomes are achieved following a Schumpeterian approach, where new combinations of resources and capabilities are made to achieve innovation discussed later.

Entrepreneurship is seen as an interacting set of management behaviour patterns, which achieves successful innovation outputs. The management approach has a natural corollary; it can be disseminated, taught and learnt to some degree by those wishing to practise or advise on entrepreneurial management at all levels- individual, group or firm (Dess et al., 1999)and forms a key reason for its adoption. Individual characteristics or personality traits cannot be dismissed however, and may still play a role in the learning process.

**Figure 1 Academic Contributions to entrepreneurship** Source: Stevenson & Jarillo 1990

Aston University

Illustration removed for copyright restrictions

Entrepreneurship, considered as a pattern of management behaviour, is geared to identifying and exploiting opportunities to achieve Schumpterian innovation but not necessarily entrepreneurial rent in EISMEs. Entrepreneurship generates new business streams through innovation for economic renewal in established firms as well as assisting in new venture creation. For EISME's, economic renewal, and survival must be the objective of innovation activity rather than superior competitive advantage and ensuing rents., Entrepreneurship is considered to evolve over time, and is dependent on context and firm growth stage (Hall, 1993, Kazanjian and Rao, 1999). Its management locus moves as the firm evolves according to the type of innovation required, discussed further in relation to innovation. Concepts explored later.

**3.1. 8 Entrepreneurship within RBT**

The entrepreneurial management process is given further context and focus by studying it within the context of the resource based view of the firm, dealt with in detail in Chapter 3. Entrepreneurship is viewed through the resource-based perspective as a pattern management behaviour in the picking and deployment of resources to achieve unique combinations to produce an inimitable identity for the business, determining firm size, scope and competitive advantage (Aldrich and Martinez, 2001, Alvarez and Busenitz, 2001, Greene and Brown, 1997). The approach adopted is further elaborated and justified in Chapter 3.

The psychological approach is not, however, neglected. A substantial literature on individual entrepreneurship and associated individual resources and characteristics exists (Storey, 1994) (Davidsson and Wiklund, 2001). Nature and nurture are both clearly involved in determining resources of the early board team and their performance but are as yet little studied.

### 3.1. 9: Group Level of Entrepreneurship

An early part of the firm's resource development path is determined by the composition and resource characteristics of the early board team and the specific management capabilities engendered. A gap in the study of entrepreneurial management behaviour, the group level of the early board team, begins to become apparent. The thesis argues that a neglected level of entrepreneurship, the group level represented within the board team, is critical to successful firm evolution and emergence. Its presence may explain why some EISMEs experience continued growth.

Entrepreneurship has been studied extensively at two levels: the individual and the firm. Although innovation on the part of teams of middle managers has been well explored in the literature, there is nothing on group entrepreneurship for board teams: a remarkable omission given the attention given to group behaviour in traditional large company management teaching. In order to remedy the gap, existing literatures on the resources and capabilities necessary for individual new venture entrepreneurship and corporate entrepreneurship are scrutinised to determine critical transition factors. Which resources and capabilities need to change most in the transition from small to large, if innovation is to continue? The early board team is the group responsible for achieving continued innovation, if the Schumpeterian definition of innovation is accepted. The propensity of the early board team to behave 'entrepreneurially' is a critical part of the early resource path development which will control the firm's future resource path and the future options open to it.

In order to justify the selection of EISME as a research focus and the SME enterprise profile and current dynamics are now examined initially.

### 3.2 Increased Significance of SMEs in the UK Economy

Small and medium-sized enterprises form an increasing proportion of the UK enterprise stock according to the DTI's Small Business Service's Small Business Survey, reaching the figure of 99.8% of the 4 million estimated enterprise stock in 2003 (Small Business Service, 2003 July).

Enterprise stock profile within the UK, has changed substantially since the 1960s and the important watershed of the Bolton Report in 1971(Bolton, 1971). As a percentage of the total population, small firms now show a substantial increase from an all-time low of 19% of business stock in the late sixties, when the Bolton Committee first examined the role of small firms in the economy (Bolton, 1971). The shift in firm size distribution towards smaller firms continues. The thesis argues for a reorientation of research effort towards the managerial processes in smaller established firms: the EISME due to the increase in numbers and shift to a knowledge economy.

The resources and capabilities associated with innovation and successful firm emergence in EISME's become of interest and, it is argued, justify more research attention than has been previously the case, where a distinct bias towards large company research has dominated. Stability and structure have been pre eminent in many large company based research agendas. The process of achieving equilibrium rather than living with disequilibrium and continuous evolution must be studied if firms, large and small, are to survive in a knowledge economy with changing competitive conditions (Kor and Mahoney, 2000). The processes used to cope with uncertainty and complexity may be different from large and small firms.

The figure 2 and below based solely on the self employed and manufacturing firms employing less than 200 illustrates the estimated trend in the enterprise stock since 1910. (Storey, 1994) p 28.

**Figure 2: The Importance of Small Firms in the United Kingdom:** Small manufacturing enterprises as percentage of total manufacturing enterprises in UK



**Source:** Storey, D. Understanding the Small Business Sector 2002 p 26

No single source for estimating the UK enterprise stock existed at the time the research commenced, although a regular estimate is now coordinated by a dedicated sub organisation of the DTI: the Small Business Service. Published UK Government SME population statistics are estimated from several different sources: the official register of businesses, the Inter Departmental Business Register (IDBR) as well as unregistered businesses based on their employment and turnover from other sources: the Business Register Survey (BRS): ONS surveys; Inland Revenue PAYE records and VAT statistics from Custom and Excise since there is no obligation to register the start of a trading activity.

**3.3 Shifts in Policy and Research Focus:**

Considerable government effort has been expended in fostering the birth of new enterprise creation once the role of SME's within the economy was recognised and accepted (Curran, 1999). Less research attention on the subsequent stages to start-up exists, examining development on organisational growth capability and , innovation for economic renewal. Scrutiny of the change in emphasis between resource picking and deployment processes for firms in the middle has been neglected.

Understanding the associated evolution of management practices and organisational processes in smaller established firms is the key to understanding there are the evolution according to Brush and Chaganti (Brush and Chaganti, 1996). It is only by understanding the key differences in the way smaller firm owner /directors manage their organisations, that we can understand the true nature of the transition or evolution within a firm that must take place if a firm is to grow in any significant manner.

Aldrich states that although scholars may have done an excellent job in explaining how things work in organisations that have been around for a while but not how they came to be that way in the first place (Aldrich, 1999). He argues that since large organisations started small, (usually), the absolute miracle of their creation and the emergence should be of interest. Most researchers, he argues, centre on structure and stability rather than emergence and change. Since smaller firms form an increasing part of UK stock, understanding the process of emergence in terms of how the resources and capabilities are configured within them as they emerge is a becoming an increasingly strong justification for focussed EISME research attention, regardless of firm age and apparent prospects.

There is a need to understand how organisational growth capability is developed slowly and surely within EISMEs, by identifying key resources and capabilities. So far attempts to understand small firm growth processes have endeavoured to identify individual characteristics capable of predicting fast growth firms. Firm growth has also been viewed from the outside through life stage models, discussed later (Hisrich and Drnovsek, 2002).

Such research has produced little usable knowledge for practitioners; the owners/directors of EISMEs, in the way resources can be uniquely combined and built into appropriate capabilities within an emerging firm. In particular, there is the missing focus on how board team resources might be assembled and used (Huse, 2000)

The UK government, in its 2003 national strategy document: The Strategy: Prosperity for All (2003) sets out plans for increasing national productivity and Gross Domestic Product (GDP) per head to levels across all firm sizes. The strategy finally presents one of the first integrated strategies across all sizes of firm. It recognises the importance and significant role of SME's within the economy through the identification and use of common key productivity drivers for both SMEs and large enterprises (Small Business Service, 2004b). UK Entrepreneurial activity generally has increased according to the Global Entrepreneurship Monitor (GEM). The Global Entrepreneurship Monitor (GEM) Report of 2004 shows the UK achieved an encouraging increase in total entrepreneurial activity score (TEA) from 5.4% in 2002 to 6.4% against a backdrop of decreasing TEA levels in the other G8 countries (apart from the USA).

With the widespread acceptance and establishment of the legitimacy of entrepreneurship and the smaller enterprise within the UK community, Government policy focus has now moved on towards supporting organisational growth capability, improving productivity and added value in established businesses as documented in their Small Business Action Plan: the evidence base (Small Business Service, 2004b). The GEM UK report even states that the terms entrepreneurship and innovation have become synonymous with the UK government's second term policies towards productivity, regeneration and growth (London Business School, 2003) p 8 signalling a major shift in policy.

Productivity growth, and consequently economic growth, are considered to be influenced by the competition inherent in the birth and death, entry and exit of small firms (Acs et al., 1999, Oecd., 1996). High 'death' rates of new enterprises within the first five years are deemed to be part of a necessary economic process (Dunne and Hughes, 1994) especially at a time when the nature of the UK economy is undergoing a transition from an industrial to a knowledge economy. Providing, of course, net job generation through a continuous surplus of births over death continues (Doyle and Gallagher, 1987). Policy considerations now take on board more sophisticated objectives than simply achieving a net gain in enterprise births or jobs; it considers firm survival rates and their ability to achieve economic renewal through innovation too. (Dti, 1996)

Continuing to accept the so called productive high churn rates on the basis of competitive efficiency may be a mistake, as it overlooks the progressive accumulation of resources and capability within the increasing numbers employed in smaller firms. Such an accumulated resource within the firm size sector has significance for the overall performance of the economy. The acceptance of high productive churn rates within the enterprise stock, without examining the process of resource and capability evolution, may lead to unnecessary waste of accumulated resources and capabilities. "A balance between successful firm evolution and emergence and small firm 'failures' as McGrath says, "can add to the resources and capability pool within SME stock as well". (Mcgrath, 1999)

The lack of sufficient examination of the resources and capabilities within EISME's essential for their emergence and development of organisational growth capability in the major reason of the research. In particular, the role and influence of critical team human capital resources on EISME management practices at board level and organisational processes used to establish control as the firm becomes more complex, has barely been recognised. The churn rate within the enterprise stock may well be, and continue to be, a way of increasing competition, productivity and efficiency, but it is also a potential waste of resources and capabilities if it results from ignorance of how firms evolve and emerge. Knowledge likely to further innovation and increased survival for EISMEs at a time of industrial restructuring, accelerating pace of change, globalisation of markets and development of knowledge economies must become a priority.

**3.4 SME Statistics- UK SME Enterprise Profile:**

The UK business stock, estimated to be 3.7 million in 1997 grew to almost 3 .9 million in 2002, 4 million in the 2003 and 4.3 million in 2004 according to the latest figures published in 2005 by the Small Business Service (SBS, 2003). SME's as a percentage of the total business stock dominate the UK enterprise stock at 99.8%, according to the DTI's national statistics for 2003 (Small Business Service, 2003 July). The majority, almost 70%, the self-employed, have no employees at all and of the balance, 25.3% have fewer than 10 employees. The size distribution of business firms is log-normally distributed, with one tail of the distribution composed of a large number of small firms. The other tail consists of a few very large firms. The profile is similar to many European countries of equivalent size. A summary of the split of UK enterprise stock for 2002 is shown below.

The medium sized firm sector is very small representing a mere 0.7% of stock and 11.9% of sales turnover. Their number is rising however, as might be expected from the growth of SME's generally since 1997. As time passes, some will survive but the research intention is to identify factors within the EISME resource and capability profiles which will support continued organisational growth capability for overall economic prosperity of the SME sector.

**Figure 3: Share of Enterprises, Employment, and Turnover by size of Enterprise, UK, start 2002**

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**Source: DTI Small Business Service Annual Small Business Survey 2003 Executive Summary**

The comparative figures for 1997 and 2002 medium sized firms are shown below.

**Table 2: Total UK Comparison 1997/2002 Firms employing 50 – 249**

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**Source: DTI Small Business Service Annual Small Business Survey 2003 Executive Summary**

These statistics are those shown for 1997 and 2002. At the point in time when the sample data was collected in 1998/9 the UK EISME population was as shown for 1997. According to a different set of figures produced by the European SME Observatory, which are not completely comparable with those of the UK, the UK has experienced a greater rise in the numbers of SMEs than any other country except Germany, with its well-known 'Mittelstand' of a previous era.

Table 4 , below shows the expanded population of EISMEs taking 20 employees as the appropriate start point within an organisation where delegation and supervision starts to develop from which the research sample will be drawn.

**Table 3: European Comparisons of Similar Economies 2000 Structure by Country and Size Class - Source: SME European Observatory (2003)**

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**Table 4: UK 1997 Selected Small - Medium Enterprises (20 -249 Employees) '000's**

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Source: DTI Statistical Bulletin SME's 1997

### 3.5 Firm Size Distribution in the UK: a shift to smaller firms

The tables above show a small shift in the firm size distribution over the years. The UK has experienced a substantial shift in the firm size distribution towards smaller firms in common with most equivalent modern industrialised countries. The reasons for this are many and various and depend on the perspective taken. The continued development of the EEC as a major trading global block within the world economy will have an impact on SMEs as competitiveness increases and creates potential for up scaling of activity within expanded markets, permits adoption of new technology and different ways of creating value within industry value chains.

Traditional industries, such as manufacturing, construction and mining have declined substantially in the last three decades as the cost of operating has become expensive relative to other parts of the world. Low-cost locations provide a better setting for the routinised tasks of high production volumes (Thurik and Wennekers, 2004). Growth in the services sector (financial, commercial, personal and social) has substituted for much of the previous traditional industry base resulting in significant changes to industrial structure, the nature of production and organisation of work (Birley and Westhead, 1994). In the UK, the privatisation of public sector utilities and deregulation has also contributed to this trend. It seems unlikely, as David Storey points out, that a shift in demand for manufactured goods to services has been the sole influence in the changing size structure of enterprises (Storey, 1994) p36.

Industry restructuring and the trend towards global markets has shifted comparative advantage in high cost locations, such as the UK, to knowledge-based activities, which cannot be routinised or easily transferred across enterprises. Knowledge-based service firms tend to be smaller than their manufacturing counterparts (Thurik and Wennekers, 2004). How tacit knowledge and learning generated within these enterprises is retained for future use in the growing number of service and knowledge-based firms becomes an issue when trying to sustain a knowledge economy composed of smaller firms.

A knowledge based economy is vested in a large number of smaller firms, where each firm possesses unique resources and capabilities. They accumulate knowledge capital, not easily replicated or transferable, likely to be beneficial to new industry sectors and national economies.

The introduction of new technology also plays a role in increasing the proportion of smaller enterprises during the introductory, experimental stages. Technology introduction in particular, has had a profound effect on former industrialized countries, helping them to develop new knowledge economies where smaller firms dominate (Acs and Audretsch, 1987). Some technology changes produce revolutionary, totally new products, creating new demand and new markets. Other technology introduces process change such as flexible automation producing diseconomies of scale making large-scale firms unnecessary and even undesirable (Kanter, 1984, Nonaka and Takeuchi, 1995). Traditionally, it has been argued that as technologies mature, the number of firms will reduce and increase in size as standardisation and competition develops, bringing into play economies of scale, scope and experience (Covin and Slevin, 1990, Freeman and Soete, 1997). If such economies no longer exist due to new technological processes then the dynamics of firm, market and industry life cycles may become different, refocusing attention on firm resources and capabilities in smaller firms without easily repeated routines.

Minimisation of risk, accessing innovation, and seeking a means of levelling variability of demand are all reasons for downsizing an organisation through outsourcing and vertical disintegration or de-layering. Whether it is industry or firm restructuring, such fragmentation strategies have served to drive up numbers of self-employed and small enterprises (Acs, 1993, Loveman and Sengenberger, 1991). Many of which will be dependent on large organisations in a subcontract relationship (Atkinson and Meager, 1986). Others point to the increased speed of communication and new patterns of consumer behaviour creating new markets and industries on a global but fragmented scale. Market fragmentation favours smaller firms even in global markets. Some researchers argue that the increase of the small firm base is the result of large firm pursuit of 'flexibility' strategies rather than the 'flexible specialisation' of smaller firms in which a new technological paradigm supersedes the previously dominant Fordist mass production system (Piore and Sabel, 1984).

Storey neatly categorises the reasons for the emergence of small-scale enterprises under the two headings of demand and supply side (Storey, 1994) p35. Many of these factors, as Storey points out, are potentially temporary, part of a fifth Kondratieff Wave, where small firms may play an important industry development role (Storey, 1994).p36.

### 3.6 The Economic Contribution of SMEs:

The UK Government SME approach adopted in the early eighties represented a marked change in public policy towards smaller enterprises from an earlier era as their role in the economy became better understood, (Reynolds et al., 2002). An enterprise culture was re-established (Curran, 1996, Menkveld and Thurik, 1999). Initially seen as a panacea to Britain's social and economic ills, (Burrows, 1991, Burrows and Curran, 1989) self employment and enterprise creation are now considered an intrinsic part of national industrial policy, with particular relevance for the regeneration agenda in both urban and rural contexts(Small Business Service, 2004a)

#### 3.6.1: Link between Level of Entrepreneurship and Economic Growth- Leveraging Economy Growth with Small Firms

Economists have only relatively recently started to re-examine the role of small firms in industrial organisation (Acs et al., 1999, Thurik and Wennekers, 2004). Economists, such as Hughes of the Cambridge Small Business Centre and Thurik and Wennekers are now putting forward the argument that the proportion of SMEs in the national economy has a significant leveraging effect on the national economy as a whole. They posit an equilibrium level between the proportion of SMEs and large firms for a particular stage of our country's economic development which creates a link between entrepreneurship and economic growth. (Wennekers and Thurik, 1999). Wennekers and Thurik say "many economists and politicians now have an intuition that there is a positive impact of entrepreneurship on the growth of GDP and employment'. Comprehensive evidence to support this view is not yet available despite the assertions and findings for country total entrepreneurial activity (TEA) reported by the Global Entrepreneurship Monitor (GEM, 1999 #2103}.

Does national economic growth cause an increase in the number of small firms or is it the other way round? Audretsch and Thurik in the paper Linking Entrepreneurship to Growth (Audretsch and Thurik, 2001) suggest there may be a U-shaped relationship between a country's stage of development and the level of entrepreneurial activity. In the effect, the level of SMEs within a country is related to its state of development. A countries enterprise profile will shift quite legitimately over time. The fact that the percentage of SME's and share of the economy vary by country and change over time for a number of reasons would seem to support this view (Acs, 1992, Hughes, Thurik, 1996, Thurik and Wennekers, 2004).

Every country has a different enterprise stock profile reflecting the country's history, political, economic and industrial development (Carree et al., 2002) If a link between the shift in the industrial structure and subsequent economic growth exists, it may favour, Acs argues, the innovation processes, industry and firm rejuvenation, apparent in many of the modern industrialised countries (Acs, 1990). It is clear, however, firm size distribution is dynamic, with evidence suggesting that the forces shaping the size distribution of firms may be evolving in such a way as to bring about an increased role for small firms in some industries but a decreased role in others, (Acs and Audretsch, 1990). An industry sector approach is therefore highly justified in the research.

For the research purposes the longer term dynamics of industrial organisation in the UK are beyond the scope of the thesis but leave a series of important questions unanswered. Will the increase in smaller firm numbers lead to a lesser export orientation or an increase in 'co-opetition'? (De Propris, 2002). What are the consequences if too many new enterprises remain in the self employed / micro category? Will there be sufficient job generation or will it result in a dwindling of overall national resources and capabilities? The economic process is deemed not to function if there are too few firms progressing through to large firm status either by organic growth, slow or fast, or by merger and acquisition. It follows that the combination of resources and capabilities in SME's that facilitate firm emergence is of intense interest to researchers.

As interesting as the economists macro level approach might be, obtaining an insight into the micro level of management practice and organisational process and the reasons why smaller firms evolve, continue innovating and manage their growth processes is also a significant task. Arguably, the micro level is potentially considerably more interesting since studies may produce practical and applicable findings for either potentially large high-performance firms with the prospective ability to drive industrial innovation and performance. Alternatively it can be viewed simply as a means of strengthening the organisational growth capabilities of EISME stock. The latter, in particular aims to ensure firm survival, longevity and the capacity for economic renewal through innovation by better understanding the evolution of resources and capabilities associated with successful firm emergence – a long neglected area of study.

Research study therefore needs to shift from the conditions and processes of enterprise creation to research on emergence processes and their component parts for the increasing number of surviving enterprises. It does not matter that they do not all grow into the large firms of the future but that they should survive comfortably, accumulating knowledge resources and capabilities of value to the whole economy without wasting the human resource and capabilities they generate. It is only by this slow incremental accretion of knowledge capital that the overall national position can be changed.

Efforts directed to determining key factors in development of a firm's resource path will ensure continued survival of a greater percentage of the increased SME numbers, encouraging modest growth and increased productivity through a clearer understanding of the management processes of firm transition and emergence.

### 3.6.2 Job Generation

UK governments, not surprisingly, became preoccupied with job creation in the late seventies and early eighties as a means of replacing jobs lost from traditional manufacturing as the economy restructured. Early research from David Birch in the USA (Birch, 1979), showed small firms as net job creators. The USA findings are broadly supported by other later UK studies (Storey and Johnson, 1987) (Doyle and Gallagher, 1987), in which small firms are shown to be responsible for a large share of new jobs. As net job generators, new small firms are very valuable within the economic process during industrial restructuring (Birley, 1986, Cosh and Hughes, 2000, Dunne and Hughes, 1989, Storey, 1994)

Earlier claims for new small firms as the *most* significant net job generators in national economies have been the subject of controversy. Greater understanding of the contribution of other firm sizes has been gained from the work of Parker et al and Doyle and Gallagher showing that established firms in the middle also generate significant amounts of employment. (Doyle and Gallagher, 1987, Parker, 2001). Whilst new starts are undoubtedly a powerful means of absorbing surplus labour fast, it is not necessarily the only way of providing overall economic growth. Against the current backdrop of year on year increase in self employed and micro firms, government policy and research effort is moving its emphasis from easing employment difficulties due to industrial restructuring to the process of supporting and fostering entrepreneurial management for economic renewal in those that have survived beyond the critical five-year time span (Small Business Service, 2004a).

Recent research shows SME's generally, not just new enterprises, are the greatest single source of new jobs at all points of the economic cycle (Small Business Service, 2003 July).The Dale and Morgan study 2001, commissioned by the Small Business Service (Dale and Morgan, 2001), shows an extra 2.3 million jobs were created in new businesses between 1995 and 1999, of which 85% were in small businesses. The study also reveals a significant 50% of new jobs came from existing SME's. A clear justification for focusing on the existing SME sector is thus established from the job creation point of view. Job losses were high, 66% for the period, but, of the net job gain achieved, 70% was accounted for by smaller businesses. The job creation potential of differing sizes of firms for the 1995 /99 period is shown in the SBS chart below:-

**Figure 5: Source of Job Creation and Loss, 1995-1999**

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**Source: Small Business Service: A government action plan - The evidence base Section 1 Small businesses and their role in the economy:**
**http://www.sbs.gov.uk/SBS_Gov_files/researchandstats/evbasestatistics.pdf**

Growth, from firms in the middle, 'the trundlers' in David Storey's terms, may come relatively slowly but there is a danger of overlooking their valuable economic contribution with an overemphasis on new starts and fast growers (Storey et al., 1987). Whatever the overall reasons for the shift within the UK stock to smaller enterprises over time, the processes of productive churn within the SME population are argued by government economists to increase business efficiency through competition leading to increased productivity in the economy as a whole (Small Business Service, 2004b). Such a free market approach ignores the long duration and impact on existing management resources and capabilities, which may persist within the SME sector management and bring benefit to other firms.

A policy of laissez-faire fails to recognise some fundamental differences between small and large firms. Small enterprises are not just a little big firms. Legitimate differences exist in the way the unmanaged by their owners. Firstly, owner's objectives may not be the 'rational' ones of their large established organisation counterparts. Personal and business objectives are inextricably mixed. Secondly, resource constraints in terms of access to human and financial resources play a role in determining which management techniques the management team are able to adopt and effectively use. Entrepreneurial marketing based on the bottom up rather than the top-down strategy of traditional marketing is a classic example (Carson and Gilmore, 2000, Chaston, 1997, Stokes, 2000). Theories of organic strategy, bottom up micro too macro, as opposed to top-down , macro to micro are beginning to emerge from within the strategic management literature (Farjoun, 2002), picking up on the former approaches of Mintzberg and Quinn (Mintzberg and Waters, 1985). The liability of newness may also have an impact on the way new enterprises emerge (Stinchcombe, 1965).

Edith Penrose argues large firms are very different from their smaller brethren "their organisation will become so different that we must look on them differently; we cannot define a caterpillar and then use the same definition for a butterfly." (Penrose, 1959) p19. If we are to understand how caterpillars turn into butterflies, we need to look at the transition processes, the chrysalis stage, examining the internal changes in greater detail through research studies. If Penrose had been a biologist and not an economist, the omission of the chrysalis stage necessary for the metamorphosis would have been odd. From the perspective of evolutionary economics and the resource based view of the firm, its omission is remarkable. For a management researcher, it provides an interesting locus of study since it seems critical that we understand something of the transition phase if we are to understand the processes of firm emergence from small to large.

**3.6. 3: Value Added:**

The country not only benefits from new enterprise job creation of new enterprises and existing smaller businesses but they contribute very similar amounts of gross value added, to large firms +250 employees, when the size sectors are added together as can be seen from the chart below. Given these two factors, it seems quite extraordinary UK research and management teaching continues to be preoccupied by the very small percentage of large established enterprises, despite the recognition of the important role smaller firms have in the economy. Firms 'in the middle', neither start-ups nor fast growers, those that have survived the first five years, are a neglected sector of research, where some interesting changes are now apparent in the UK. Medium sized firms achieve sales per employee of £100,845 over all UK sectors for 1997, which improved to £116.03 in 2002, consistent with the overall achievements in the small firm sector (Small Business Service, 2003 July) 2002)

The productivity growth gap in terms of gross value added (GVA) between small and large firms has narrowed substantially indicating some fundamental changes in the overall development and growth of UK EISMEs. More enterprises are surviving longer and growing in size and sales per employee (Small Business Service, 2003) indicating an increased success or 'emergence 'rate. Governments, with this lesson learnt, are naturally interested in early identification of the few firms that will constitute the new large firms of the future, estimated to be four in every hundred by Storey (Storey, 1994) p 27. Only a very few successful firms will grow and be responsible for a large proportion of the total increase in employment in SMEs (Loveman and Sengenberger, 1991)

**Figure 6: Share of Gross Value Added (GVA) by Business Size and Percentage UK 1999 -2001**

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**Source: Small Business Service: A government action plan - The evidence base Section 1 Small businesses and their role in the economy:**
http://www.sbs.gov.uk/SBS_Gov_files/researchandstats/evbasestatistics.pdf

The preceding section justifies the general selection of "firms in the middle"-the EISME. The specific justifications is for the precise EISME characteristics are now discussed, including firm size and number of employees, length of previous trading activity and independent status.

### 3.7 Firm Size Chosen:

The choice of firms employing over 20 is influenced by the likelihood of a firm having passed a delegation threshold where additional supervisory and management input is required. According to Atkinson and Storey, the threshold level for delegation begins as the micro business stage, once the 1- 9 employee level is passed (Atkinson and Storey, 1996). Storey says "in practice, once firms exceed between ten and twenty workers, they begin to employ individuals as managers or supervisors of the work of others but who are not owners of the business" (Storey, 1994) p 150. The nature of the delegation and form of direction becomes important at this stage. It is the point at which the development of board team resource should be studied. Few new ventures except those high level elite new ventures funded by venture capitalists have a full board present on start up. Edith Penrose, as we shall see later, has quite a lot to say on the limitations to firm growth resulting in the management team expansion within an emerging firm. The influence of self-employed lifestyle businesses which constitute a significant percentage of the SME population is thereby avoided by choosing firms employing over 20 people.

Directors are there to influence and set the firm's future direction by definition. Firms and their board teams must begin to make critical transitions in their management techniques, practices, and organisational processes necessary for the next stage in their life cycle, which have not received the study they deserve (Aldrich, 1999).p 50. If firm development is recognised as a path dependent process, then these first steps in resource picking and deploying, in developing the board team to build organisational capability are likely to be critical to the further evolution and emergence of the firm.(Atkinson and Storey, 1996, Daily and Dalton, 1992).

**3.8 Firm Age**

Size and age can have effects on the patterns of growth and survival according to Dunne and Hughes so the impact on the research sample must be considered (Dunne and Hughes, 1994). Skewing the data on which to base a statistical analysis of the early management practices and organisational processes and organisational of emerging board teams should be avoided. Successful small firms grow faster than their larger equivalents and maybe a necessary characteristic for firm survival if they are to avoid initial problems of resource constraints (Dunne and Hughes, 1994). The choice of firms older than five years also avoids any hypothesized liability of newness outlined by Stinchcombe where higher risks of failure are expected for young organisations compared with old ones (Stinchcombe, 1965).

Gibrat's Law, the law of proportionate effect, does not hold for small firms as shown in many studies (Cheshar, 1979, Mansfield, 1962, Santarelli and Vivarelli). Gibrat's Law is a descriptive relationship between size and growth, where the size of units and their growth percentage statistics are statistically independent. It has been argued that faster firm growth rates may be found in the smaller firm population due to a concentration of surviving firms, which reflect the higher firm death rates in the first five years of life. Firms of less than five years are therefore excluded in order to avoid these affecting the aggregate growth rates of the sample for the analysis.

**3.9 Independence:**

The Bolton Report defined independent small firms as follows: - they possess a relatively small share of their markets, do not form part of a larger enterprise and the owner-managers are free from outside control in taking their principal decisions (Bolton, 1971). Choice of an independent status for the firms studied ensures the actions of the board team are influenced purely by their own business and personal objectives and not those of a parent company.

Parenting style, of firm owning subsidiaries, to use Goold and Campbell's term, potentially influences the subsidiaries objectives, management practices and organisational processes and ultimately firm performance. Choice of independent firm status eliminates such effects and are therefore excluded from the study (Goold and Campbell, 1987). Independence was considered to be an essential criterion for firm selection because of the impact the combined ownership and control in EISME's on management objectives, strategies and style. Limited liability companies were selected, excluding partnerships and sole proprietorships, following Hakim (Hakim, 1989), who demonstrated that limited liability companies were more likely to grow than partnerships or sole proprietorships. More importantly, no outside influence on the way in which management decisions were taken

Of critical importance to understanding EISME growth process, is the acceptance that for a large majority, there is no separation of ownership and control (Fama and Jensen, 1983). The businesses are managed to achieve the owner's objectives, which are not necessarily the same as 'blue chip' company shareholders. The management processes adopted will reflect these (Jennings and Beaver, 1997). Owner manager objectives do not necessarily include achieving sustainable competitive advantage or optimizing growth and profit. These are rational management concepts and thoughts exported from within traditional management theory developed in relation to and applied to large established enterprises.

Large publicly quoted organisations are managed by the top management team on behalf of the shareholders and stakeholders, with demands for a degree of objectivity, not present in smaller firms (Gray, 2002). The impact of a wider range of objectives on the part of owner managers and the resources within EISME's are discussed in the following chapter in more detail.

As a means of studying firm emergence, the research, unlike the Bolton Report, begins to make a distinction between firms that are managed in a personalized way by their owners and those that are beginning to delegate and adopt consistent management practices and organisational processes towards a set of objectives, as part of the firm's evolutionary process. Organic processes rather than mechanical management structures are the centre of research attention. As previous research has shown, the presence of informal strategic management processes, rather than a formal business planning process is a better indicator for firm performance (Robinson and Pearson, 1984).

### 3.10 The Plastics Processing Industry

The UK has been long considered less successful than its European counterparts in 'growing on' new businesses for economic renewal of its business stock whilst simultaneously preserving firm innovative capabilities, according to Evangelista et al. (Evangelista et al., 1998). In particular, the SMEs within the UK plastics processing industry have failed to keep up the potential for innovation as industry technology, and markets change. The plastics processing industry sector, predominantly composed of SMEs, has not enjoyed the increase in productivity shown earlier for the overall UK SME figure, which gives rise for additional concern.

Using the government SME statistics breakdown into SIC categories, the industry sectors with the largest number of EISME's were identified. From these, a single industry sector was identified as suitable for further study, the plastics processing industry.

### 3.10.1 Industry Overview: Plastics Processing Industry

The plastic processing industry has been selected for study as the manufacturing sector with the largest number of established independent medium sized firms. The UK medium size firm sector is not strong on the ground overall with a relatively small number of enterprises out of the overall UK total of 25,130 (0.6%l) 1997 SME Statistical Bulletin (Department of Trade and Industry (Dti), 1997) (Small Business Service, 2002) out of a 3.7 m 1997.

The plastics process industry sector is struggling compared to other UK industry sectors and, in particular, to its industry counterparts in equivalent developed economies, France, Germany, and Japan (British Plastics Federation Industry Report 1999) and therefore deserves research attention. The EISME sector is large enough to provide a sufficiently sized data set for quantitative analysis, which cannot be said of other equivalent industry sectors. SMEs are noted for their poor response rates to surveys so larger the pool the better (Murphy et al., 1996).

The plastics process industry is an important sector of the UK national economy, representing a growing annual turnover of £18 billion, employing over 250,000 (British Plastics Federation 1999). The industry has the potential to contribute more to the economy in terms of increased employment and wealth creation. The British Plastics Federation's Industry Report 1999 shows that the UK plastic industry sales per employee are only $96k compared to Japan at $164k per employee and Germany at $155ki. Table 5 below shows the SIC 252 category from the UK statistics for 1997 and 2002.

**Table 5: Firm Size Profile: 1997 SIC 252 Manufacture of Plastic Products**



**Source: DTI Statistical Bulletin SME 1997**

Unlike the total overall UK medium sized enterprise figure shown earlier, the statistics for SIC 252, the plastics process industry, show a continued loss of SME enterprises, down from 5,860 to 5,390 1997 to 2002 with an accompanying loss in employment numbers. Turnover is only marginally down on 1997 indicating increased productivity. The 50 - 250 firm size categories are reduced by 20 firms

**Table 6: Firm Size Profile: 2002 SIC 252 Manufacture of Plastic Products**

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Illustration removed for copyright restrictions

**Source: Small and Medium Sized enterprise (SME) Statistics for the UK 2002 Small Business Service**

between 1997 and 2002 with a significant impact on turnover. The precise reasons for the decline are not known. Firms may have grown, been acquired, or closed. The overall picture does not present the processing element of the industry as one in good health given the opportunities in its environment. (Plastic Business Trends Survey 2003 British Plastics Federation)

The industry potential for innovation introduction from advances in material and information technologies is now examined as a necessary condition and context for studying the resources and capabilities required for successful board team action through their ability to gather and manage resources to build capabilities for continued innovation.

### 3.10.2 Industry Innovation:

The plastics processing industry is not a new one, it is old in years but certainly not declining and continues to have considerable potential for innovation from several sources. The innovation levels are not so rapid that the industry and markets can be described as hyper-competitive or as a high velocity environment in a way that Eisenhardt would recognise (Eisenhardt, 1989). The industry exhibits a modest level of innovation, in the blurring of industry boundaries and restructuring of the industry value chain, creating ambiguity and uncertainty, which management and board teams must learn to exploit to their advantage in their pursuit of value creation.

New industries are populated by firms which may carry out their tasks in radically different ways, adopting unique competences and routines. The plastics process industry is in a situation where existing resources and capabilities must be reconfigured with new ones to achieve innovation outcomes for firm economic renewal, which gives the researcher a better chance of identifying specific resources and capabilities configurations associated with organisational growth capability, management practices and organisational processes.

### 3.10.3 Environmental Pressure:

Increased environmental pressure on the industry for recycling and biodegradable products exists from both the government with considerable powers of sanction for non-compliance and consumers. A potential climate levy charge, estimated by the British Plastics Federation to cost the industry £60m, currently under discussion is also an incentive to replacement of offending processes and products through innovation. A plastic bag tax in Ireland has also sent shivers through much of the industry. There is evidence industry SME's are ill equipped to manage the process of innovation to achieve necessary product biodegradability and reduce processing energy consumption.

### 3.10.4 Industry Structure:

The UK plastics industry is made up of raw material suppliers, machinery and tool suppliers, and plastics processors, manufacturing a wide array of semi-finished and finished products. The industry is divided by the British Plastics Federation into business groups shown in the table below, supplying four principal market sectors: packaging, transport, construction, electrical and electronic sectors. There are three broad components of the industry value chain, the raw material suppliers, machinery and tool suppliers and plastics processors, New technology introduction is causing restructuring within the value chain through merger of plastic processors, machinery and tool suppliers presenting both challenges and opportunities for innovation in the sector. The processing sector of the value chain, the numerous EISME's forms the research focus.

The industry is subdivided by its industry body, the British Plastics Federation, into the categories shown below in Figure 7 below:-

**Figure 7: British Plastics Federation - Business Groups within the Plastics Industry**

Aston University

Illustration removed for copyright restrictions

**Source: British Plastics Federation - http://www.bpf.co.uk/bpfabout/Committees_and_Groups.cfm**

### 3.10.5 Suppliers / Raw Materials:

The industry value chain involves some very large chemical firms, the polymer producers, who produce the total raw material supply of plastic pellets for processing from 4% of the total crude oil consumption. The scale of raw material processing by the polymer suppliers (Bayer, BP, Dow Chemical, and Dupont) is such that the plastic product processors have little say in the type of new raw materials introduced. The large scale suppliers of polymers have however been active in promoting information and knowledge of their new materials and providing technical assistance to the many smaller firms in the industry since the technological and managerial resources of this size of firm are acknowledged as limited in many cases. Internet sources of advice are now very common in the industry particularly from the raw material suppliers in an effort to pull and push through new plastics materials and applications, reducing time taken to resolve problems encountered in using new materials or processes.

New plastic materials continue to be developed and introduced by the large firm raw material suppliers with large research and development departments to the industry's SMEs. The characteristics of the many types of plastic available, its versatility, light weight, toughness and durability, recyclabililty and low cost compared to other materials means that new applications for both new and old raw materials continue to occur.

### 3.10.6 Management:

The suppliers however have a continuing problem in fostering innovative applications of new materials in smaller firms. The suppliers, as well as the government expend time and money in attempting to encourage use of new materials by smaller firms as witnessed by the recent Partnership in Plastics Programme (PIP) and the Plastics Faraday run by the former industries research body in collaboration with Strathclyde University and the Rubber and Plastics Research Association (RAPRA). Smaller firms lack the necessary internal resources themselves making this type of activity important to successful innovation so far. The innovation onus is therefore one of development rather than of blue skies research. It is the ability of the management to use the resources available internally and externally that is the critical issue.

### 3.10.7 Technological Innovation

Combined with a revolution in materials technology and continued application of information technology to processing, future innovation prospects are bright. Schumpeterian innovation is made possible through the application of plastic materials to many areas of life replacing traditional materials improving strength, durability, weight, heat resistance.

The nature of the technological innovations in the plastics processing industry is not large-scale or very capital intensive. Changes in raw materials, and production and sampling processes also expand the potential number of applications in new markets by replacing existing materials. Recent examples of the applications of new materials in new situations replacing other materials include the following: plastic jug kettles, plastic corks, biodegradable garden twine, and nappies. The enabling technologies and new production processes are within the grasp of many smaller firms. Flexibility of response with smaller runs, higher quality, and performance achieved through a series of incremental, new to the industry, process innovations are much in demand in the various markets the industry supplies.

Development work carried out on the shop floor in parallel with day to day operations, is difficult to identify. Production disruption and loss of sales income are likely to be a considerable disincentive to board team persistent attempts to introduce innovative products and processes necessary for firm economic renewal, requiring a commitment to innovation. New integrated manufacturing techniques and new enabling process technology have been applied to many areas including sampling and prototype manufacture, which has meant that it is far easier to create innovative shapes and applications and engage in very short production runs with minimal cost and disturbance.

The industry is stimulated to restructure where new process technology incorporates the activities of firms that previously operated independently in their own right. A level of opportunity for the board team to behave entrepreneurially in exploiting opportunities upstream and downstream due to process innovation is thus provided. For example, tool making for plastic moulding is fast becoming an obsolete part of the manufacturing process as machines capable of creating sample moulds and prototypes by computer are introduced and adopted by moulding companies. These processes make initial design and sampling work easier and less costly, short runs become economically viable and permit greater accuracy in moulding difficult shapes at a lower cost. Control is maintained in-house, potentially increasing the flexibility and responsiveness to customer needs. New process and IT skills are therefore required within the processing industry which previously relied heavily on the machine tool suppliers. Up stream machinery / tool making firms, previously a necessity, are being eliminated.

Firm acquisition to obtain captive in house processing to ensure continuity of supply and quality is also occurring in an industry in the throes of reorganisation. Some tool and machine makers have become manufacturers, launching new processes and machinery in order to survive. The environment is therefore one of change and a degree of turbulence likely to encourage the emergence of specific organisational capability if the firm and top management team are able to actively respond to such changes (Barney and Zajac, 1994, Wernerfelt, 1984). Technological change makes existing sources of competitive advantage redundant by making existing competencies (Hagedoorn 93) and capabilities irrelevant (Sarkar et al., 2001).

**Summary**

The continued economic health and prosperity of EISMEs is rightly a matter of national and local policy (Small Business Service, 2004b). Their potential economic contribution in terms of jobs generated and value added justifies the research in very practical terms. Support to the small firms sector is no longer so focussed on a policy of 'picking winners', future large corporations, but aims to improve the overall sector productivity and competitiveness as a major contribution to the economy.

A neglected and needy firm size, the established independent small and medium-sized enterprise in the plastic's processing industry, has been selected as the research focus to study the critical resources of the early board team as critical tour the development a of innovation and firm growth capability, to ensure continued innovation and economic renewal. The UK plastics processing industry has particular problems of International competitiveness. In essence a group level of entrepreneurship for EISME's, not previously studied has been identified. The importance of the EISME, it is argued, has been enhanced by the continued increase in the number of small firms as a percentage of the UK total enterprise stock, as the UK changes from an industrial to knowledge economy.

The processes of competitive churn may have value for competition and efficiency generally. If, however, the firm size sector is to be encouraged to develop organisational growth capability, a greater understanding of the process of management resource accumulation and capability development underpinning the firm evolution and emergence should be cultivated. The value of the resources and capabilities of the increasingly large number of smaller enterprises cannot be overlooked without an attempt to understand how organisational growth capability might be strengthened within the sector for overall rate of economic prosperity.

# INTRODUCTION TO LITERATURE REVIEW CHAPTERS 4, 5 & 6

## Introduction

Chapters 5 and 6 constitute a review of a wide literature to position the research within the necessary theoretical perspectives, to identify relevant previous research and specific areas where there are knowledge deficiencies. Research hypotheses for testing based on these gaps are formulated at the end of the appropriate chapters. Chapter 4 examines the key frameworks of resource based theoretical and entrepreneurship, locating and justifying the precise paths pursued as the most appropriate for studying both the evolution and emergence of EISMEs from a complex set of literatures. The research gaps in the study on EISMEs identified in Chapter 3 are further explored and developed in Chapter 5. The critical role of the board team as a significant resource to encourage development of organisational growth capability is established by reference to Edith Penrose and other relevant literature. Potential human capital board team resources favouring entrepreneurial management are identified. Innovation as an outcome measure of entrepreneurship, following the Schumpeterian approach, is shown to be relatively unusual in both individual and firm entrepreneurship research and something to be rectified. In the context of smaller firms such an approach may prove to be a superior measure of a firm's ability to survive and economically renew themselves, than classic superior firm performance measures. Superior competitive advantage and profits are dubious concepts for EISME's where ownership and control are not separated.

Chapter 6 extends Penrose's initial approach, in which Penrose considers the management processes within small and large firms as significantly different, and proposes an examination of the neglected "chrysalis" emergence stage for the metamorphosis of a caterpillar to butterfly. Following recommendations by both Teece and Pettigrew, the Chapter identifies key aspects of management practice and organisational process characteristic of firms "in the middle," making the transition from caterpillar to butterfly. Existing entrepreneurial management practices are identified from the literature with the intention of assessing those where the most change is required to move from individual independent entrepreneurship to the firm level: corporate entrepreneurship. The literature review concludes by identifying the key hypotheses to be tested within the research.

# CHAPTER 4:
# THEORETICAL FRAMEWORKS AND PERSPECTIVES ADOPTED

## 4. 1 Theoretical Framework: Strategy

Entrepreneurship study within the research is pursued through the management approach within the resource based perspective derived from the economics and strategic management fields. A few comments on the location within the broader framework of the strategic management field are therefore required. Broadly speaking, top-down strategic approaches applicable to large established organisations, have dominated corporate strategies and management education in business schools. Strategy creation in new ventures and EISME's requires a different approach, depending more on an inside out, bottom up process than is generally recognised in the literature or textbooks.

Development of tools for analysing external environment opportunities and threats has proceeded far more rapidly than those for analyzing firm resources and capabilities, according to Barney (Barney, 2001b). Application of useful strategic theory for SME's has been impeded by the prescriptive strategic tool domination developed by the positioning school of strategic management. Such theory is located at a macro level of industries and markets where SME influence is minimal. They are therefore largely inapplicable to SME's for reasons which are further discussed by Beaver and Prince and Jennings and Beaver in their recent papers but not further elaborated upon here (Beaver and Prince, 2004, Jennings and Beaver, 1997).

Strategic theory, as suggested by Grant, would be a lot more useful for smaller firms if theory focused on internal resources and capabilities, matters well within their grasp at a micro level (Grant, 1991a). Value creation for customers in niche markets through creation and use of unique knowledge within the firm may be a better concept around which to develop relevant strategic theory for SMEs rather than the concept of competitive advantage and above average rents. The development of resources and capabilities in an emerging organisation are clearly shaped more immediately, consciously or unconsciously, (Dierckx and Cool, 1989) by the early board team, reflecting customer response and environmental change.

If the process of resource variation, adaptation, selection, and retention as described by Aldrich does not occur then the organisation will not successfully evolve (Aldrich, 1999). It therefore 'makes sense' to try and understand the key constituent factors within the evolution process as part of emergent, as opposed to deliberate, strategy creation(Mintzberg and Waters, 1985)from the inside out as part of a bottom up process. The resource allocation process can be seen as serendipitous rather than planned, in parallel with the emergent and deliberate strategies of Mintzberg.

The concept of value creation through picking and deploying resources to produce new, unique combinations of resources and capabilities, transforming inputs into added value outputs is an easy concept to embed within entrepreneurial strategies, easily understood by founders and their managers. The concept also helps overcomes the lack of separation of ownership and control in EISME's, which renders much of the dominant management theory based on such separation rather dubious for EISME application. Neither economic nor entrepreneurial rents can be considered the prime objective of owner directors. Other factors, which are discussed later, come into play.

Key themes in strategic management theory are briefly outlined to identify the theoretical perspective most likely to yield the greatest insight on the emergence and growth processes of smaller firms.

Frequent change and innovation blurs the boundaries of markets and industries, stimulating new demand for products and processes, creating a turbulent and hostile world: conditions that challenge existing prescriptive and normative strategy theory aimed at achieving stability and structure in larger enterprises rather than coping with dynamic change in a flexible and adaptive manner(Eisenhardt and Tabrizi, 1995).

The two major strategy theory approaches, concerned about the continuing search for economic rents, viewed as complimentary to each other (Bowman, 1974, Rouse and Daellenbach, 1999) can loosely be labelled, "outside in" and "inside out", can be seen as a development of Andrews's early influential 'strengths or weaknesses opportunities and threats' model (Andrews, 1971).

### 4.1.1 The Positioning School of Strategy Theory

**Outside In:**

The 'outside in' approach of the positioning school, based on neoclassical economics, aims to determine firm performance through a deliberate choice of firm position /strategy in a market and industry according to the structure and conduct to achieve competitive advantage in what is now known as the structure, conduct, performance paradigm (SCP), following Porter (Porter, 1985). Substantial criticisms of Porter's influential position based strategies exist for two principal reasons. It is assumes stasis (Pettigrew, 1992a) (Chakravarthy, 1982) and linearity, (Henderson and Mitchell, 1997). Not notably strong features of current economic conditions, where industry structures are in a state of flux, subject to revolutionary science, innovation, and globalisation, presenting ambiguous / uncertain structures, where small firm numbers are proliferating.

The criticisms become more acute when SCP / positioning school theories are applied to the small firms sector. Existing models of 'outside in' theory cannot be easily applied to smaller firms as Beaver and Prince, Jennings and Beaver, Hannon and Atherton, Gray all point out, suggesting that a variety of different approaches be adopted to investigate the strategic activities of smaller firms, (Beaver and Jennings, 2000) (Gray, 2002, Hannon and Atherton, 1998, Jennings and Beaver, 1997). As Cowling remarks "the three most fundamental political tenets of new classicism are perfect competition, perfect knowledge of technology and perfect foresight. Each of which leaves no role for the entrepreneur as a marketer, and innovator or as the bearer of uncertainty"(Cowling, 2003)

Others such as Jones and Tilley accept the goal of increasing small firm competitiveness as the overall goal of SMEs. Yet they simultaneously accept that the owners' objective may simply be survival. Such an approach is likely to produce potential conflict in constructing usable strategy theory as Jones remarks (Jones and Tilley, 2003) p. 2. The need for strategy theory applicable to smaller firms becomes pressing as their number as a percentage of the total enterprise stock increases, leaving an inherent conflict unresolved. Ownership and control is a closely held matter in EISME's, which in turn influences the firm objectives (Gray, 1998, Short, 1994)

Of the four generic strategies suggested by Porter, (Porter, 1985) only one has potential application to smaller firms according to Storey and Hall. A combined strategy of market niche and differentiation is seen by them as suitable for small firms, making use of the sectors inherent flexibility and informal organisational structures to respond to customer needs more quickly than their larger counterparts. Market leadership and cost advantage are not strategic options available to smaller firms for obvious reasons. Expensive strategies based on branding and differentiation must also be excluded. (Hall, 1992, Storey, 1994).

A predatory pike in a pond is bad news for an angler and other forms of pond life. It eliminates others of the same species, eats other fish and life forms, and reduces the population and biodiversity of pond and surrounding area in the process. If, applied as a metaphor to the process of merger and acquisition between small firms and large, there is a link between the level of entrepreneurship within a country and economic growth as discussed in Chapter 2, then such predatory and aggressive strategies implicit in equilibrium theories, detrimentally influence the health and diversity of the SME stock.

A different less aggressive and ultimately destructive concept, (implicit in equilibrium theory) as a strategy outcome is required where mutual benefit between firms and a reliance on emergent strategy and more organic forms of growth can be taken into account (Hannon and Atherton, 1998) (Farjoun, 2002). Strategy theory promoted and intended to strengthen organisational growth capability, must make sense to owner directors if they are to be expected to use it. Owner directors are not solely motivated by a desire to outperform competitors in terms of superior profitability or market share. Valued 'amenity potential' may be gained from their businesses, according to Gimeno et al. (Gimeno et al., 1997). Gimeno et al. develop a model which attempts to explain why some firms survive while other firms with equal or better do not. They argue that some owners may deliberately accept lower performance thresholds and choose to continue trading. Importantly, they argue that the human capital attributes of owners of new ventures (and by inference EISMEs) determines the acceptability of performance thresholds. Firm survival is not simply a function of maximum economic performance but may include other factors such as education and experience.

In major corporations, separation of ownership and control exists. An assumption of rational and logical management on the part of the management team on behalf of shareholders is present through the application and exercise of traditional management concepts (Fama and Jensen, 1983).(Short, 1994) The shareholders are assumed to have more or less standardised objectives in the desire for share dividend streams and capital growth. They are able to redeploy their assets to a more profitable area if they so wish by selling their shares. Yet as Gray shows, few owner directors and entrepreneurs make financial gain their primary goal. (Gray, 2002).

As Penrose remarks "it is not reasonable to expect all businessmen to devote their last ounce of energy to making money" (Penrose, 1959) p36. She goes on to say that very good businessmen may well possess a personal scale of values in which an income greater than that necessary to provide a comfortable position in the community has a relatively low claim on time and effort" (Penrose, 1959) p 39. If the positioning school of strategic management theory with its prescriptive, linear, static and normative approach fails to assist understanding, evolution and emergence of management processes during dynamic firm growth, then can the resource based theory of the firm stemming from evolutionary economics be of greater assistance? Resources in new and emerging firms are scarce and constrain strategy. Yet looked at from the other direction, the firm resource profile, including the human capital resources of the early board team will determines strategy and future direction (Penrose, 1959) p.32.

#### 4.1.2 Resource Based Theory: 'Inside Out'

A firm's management according to traditional theory must strive to match internal resources and capabilities with the external market and industry conditions in order to achieve advantage over competitors, endlessly maximising profits on behalf of the shareholder without over stretching their resources and capabilities (Andrews, 1971, Chandler, 1962). (Baden-Fuller, 1995). The 'inside out' /endogenous approach, the

**Figure 8: SME Main Personal Career Motivation -1990 – 1999**

| | 1990 | 1996 | 1999 |
|---|---|---|---|
| Independence / Be own Boss | 50% | 52% | 46% |
| Make money | 19% | 16% | 17% |
| Security for future | 9% | 10% | 14% |
| No alternative/avoid unemployment | 6% | 11% | 8% |
| Family tradition | 5% | 5% | 5% |
| Other | 11% | 8% | 10% |
| Sample size | 1, 349 | 753 | 1121 |

Gray 2002 Small Business Research Trust

second major approach, views firm performance as determined in large part by the organisation's resources and capabilities and, by implication, the role of management.

Resource based theory argues that resources and capabilities are a source of superior firm performance giving rise to rents. Rent, defined as a return in excess of a resource owners opportunity costs, can be achieved in different ways (Mahoney and Pandian, 1992) (Peteraf, 1993). Broadly, the logic of generating and sustaining rents suggest that rents are derived from the services of durable resources which are scarce and valuable resource (Ricardo, 1817); relatively important to customers and are simultaneously superior, imperfectly mobile, imperfectly imitable, specialised, imperfectly substitutable and are not entirely appropriable by others (Aharoni, 1993, Teece, 1998, Wernerfelt, 1989). They are non tradable or untradable in imperfect factor markets (Barney, 1991).

Management, it is argued can deliberately pick and deploy resources to create capabilities, deliberately creating isolating mechanisms and barriers to entry to create competitive advantage.

But which of these two strategy approaches is most appropriate for studying small firm emergence processes? Both are aimed at helping firms, and their managers improve internal functions and firm performance in a prescriptive, normative manner. Competition is seen as eroding value in the SCP, whereas Schumpeterian innovation, a feature of today's changing environments, is seen as an essential driver to the value creation process, through creation of disequilibrium. The SME community functions principally on the basis of co-operation and vital networking, leveraging resources and generating knowledge (Collinson, 2000); although competition has a useful function in improving productivity of routine tasks (see Chapter 2).

A mechanistic and prescriptive approach to strategy, which suggests that all competitors are progressively eliminated, fails to recognise the knowledge, resource, and capability generating functions (value) of the SME community (Collinson, 2000). The national SME reservoir contains a substantial set of resources and capabilities where a balanced focus on the accumulation of management learning and knowledge in the picking and deploying of resources must be maintained with the overall productivity benefits of competitive churning. Failure to find conclusive evidence of a direct relationship between small business strategy, formal strategic planning in and firm growth would seem to add support to this argument (Lyles et al., 1993) and - a matter discussed in more detail in Chapter 5.

Resource based theory is now considered to be a significant and dominant paradigm in strategic management research by many (Mahoney and Pandian, 1992) but is still not a unified field. It is fragmented and fraught with definitional problems (Priem and Butler, 2001b). A veritable 'terminological soup' exists with no clear consensus on meaning and application with the terms resources, capabilities and competences used differently across the field (Foss, 1997).

Contributors to the resource based view dislike the neo classical economic approach to strategic theory where a representative firm level of analysis prevails (Bygrave, 1993). The resource based view of the firm involves getting inside 'the black box' of the firm (Nelson and Winter, 1982, Rumelt, 1974, Rumelt, 1984) , considering the actions of managers in making decisions on the way resources are acquired, allocated and combined for expansion. The search for higher rents remains fundamental to strategy within RBT and continues to drive research applicable to large established firms. Firms generally seek to improve their economic performance (Foss, 1997) p. 4. through use of their resources but their management teams, dependent on their incentivisation packages(Hambrick and Mason, 1984, Veliyath et al., 1994), may choose to adopt short term rewards at the expense of long-term economic renewal through innovation.

RBT is a more fruitful and fitting theoretical framework for examining emerging organisations since it crosses many research fields - economics, organisational, entrepreneurship, and strategy. It also provides a more tangible closer to hand perspective to strategy creation likely to focus attention where it's needed, inside the firm, which should render it more useful to those directing SMEs. If it is not, then it fails an important test of utility. Evolutionary theory unites different economic behaviours into a single coherent framework using the basics concepts of resource variation, adaptation, selection, and retention according to Aldrich (Aldrich, 1999). Entrepreneurship is a particular capability to innovate built on specific firm resources which are selected, varied, adapted, retained, or discarded according to the demands of the environment and managerial decision.

The exploration of the different types of resource needs for different types of firms, small and large in different contexts then becomes a subject for research (Bygrave and Hofer, 1991). The roots of resource based theory and some of the less explored or neglected observations in the work of Edith Penrose on domestic firms provide the research with

- An alternative approach to strategy as a value creation exercise for SME owners. Value creation as a concept is not new to strategy theory but has been eclipsed by Porter and followers until revived by Prahalad, Grant and Kay (Prahalad and Hamel, 1990) (Kay, 1993) (Grant, 1991b).

- A fresh means of exploring the limitations to EISME growth through resources and capabilities. Strategy in many firms, not just small firms, is an emergent process that develops on a piecemeal basis without the precise advance knowledge of the outcomes of according to Mintzberg and Waters (Mintzberg and Waters, 1985). (Dollinger, 1995).

No visible formal strategic planning does not mean there is no strategic orientation to an EISME's activities, merely that strategy, embedded in the human capital, is oriented towards achieving different management practices and organisational processes specifically generated to achieve personal objectives (Gibb, 2002) (Barkham et al., 1996). Direction setting occurs 'on the hoof' made against the objectives held by the founders or owner directors without formal planning processes ever being evident.

Resource based theory, in which the value of the human resources, the capabilities they generate and accumulate within the firm over time, is a more appropriate way to study firm emergence growth and expansion. Stable structures and systems are characteristic of larger organisations, (Cyert and March, 1963) and therefore amenable to the application of SCP paradigm application. Formal strategic planning has been commonly used as a proxy in achieving and measuring various organisational outcomes but assumes stability not present in many smaller firms. A failure to link conclusively the existence of formal planning, strategy type and firm growth and performance, discussed later, would seem to support the inappropriateness of such a measure.

Effective strategy theory for SMEs, if it is to make progress, must address the impact of human capital resources on strategic orientation by examining the processes of value creation used by those concerned – in this case the early board team. The resources required for continued innovation may be different compares to other firms were innovation is not sought. Comparative study of the management processes in both small and large firms is facilitated within RBT. It can also distinguish different levels of analysis to give important insight into management process changes occurring as a firm emerges from small to large.

Which management practices and organisational processes characterise either successful growth and/or innovation firms in the very early stages of firm emergence? Are these the same for larger firms? What human capital resource is influential in determining the management practices and organisational processes supporting innovation? Which are the most important for successful firm emergence and transition? Can an intermediate stage of resource and capability transition be identified? How and why do they change as the firm grows in size? These questions that lie at the heart of research into the perennial questions of why some firms grow and others do not.

Strategies based on resources and capabilities are part of an internal process of value creation, through picking and deploying activities to create new resource and capability combinations. Processes geared to such an end are more likely to have meaning and relevance to EISME owners than outside in, top down strategies, which challenge the available resources. If value creation is the objective of strategy and is simply defined as an outcome mutually desired by customers, founders, investors or stakeholders then the concept of value creation holds greater promise as a credible outcome on which to base strategy theory development applicable and of genuine use to SME owner directors.

### 4.1.3 Resource Definitions

The term resources, as they are commonly used in the RBT literature, are now defined to identify the broad categories from which the resources appropriate to EISMEs can be identified. The broad categorisations of resources follow more or less the same pattern in most of the literature according to researcher but some confusion starts to rise when considering the terms capability, competence and distinctive competence.

Resources are held internally within the firm and can be categorised as tangible and intangible. Tangible resources can be considered simple resources if they are discrete: plant, equipment, raw material, property and land (Penrose, 1959). They can also be valuable in their own right, scarce, rare and difficult to copy (Barney, 1991). Smaller firms, though, rarely have major tangible physical resources at their disposal. They rely more on the more complex systemic and knowledge-based intangible resources and capabilities, which can be generated internally.(Gray, 2002). These resources are the result of combinations of simple or complex resources, path dependent, difficult to repeat and to measure (Amit and Schoemaker, 1993, Penrose, 1959, Venkatraman and Grant, 1986).

Firm resource profiles consist financial, physical, human, organisational, and technological capabilities for Hofer and Schendel (Hofer and Schendel, 1978). Grant adds a sixth broad category of intangible resource represented by reputation, brand recognition, goodwill and knowledge with the emphasis on knowledge, a particularly important intangible resource for emerging small firms (Grant, 1996, Grant, 1991b, Penrose, 1959). Aldrich et al. views entrepreneurial organisations as consisting of social human and financial capital as the key resource areas.(Aldrich and Martinez, 2001). Brush Greene and Hart use six types of resource: human, social, financial, physical, technological and organisational (Brush et al., 2001)

The human capital resource within emerging firms is chosen as the resource to investigate, arguing that the firm's strategic orientation is embedded in the human capital, a tacitly held vision, shared amongst the early board team, rather than tried and tested structures and routines evident in larger companies. Tried and tested structures and routines do not have time to form in such fast moving environments but are more fragile and experiential in nature according to eisenhardt.(Covin and Slevin, 1990b, Eisenhardt, 1989). If as Edith Penrose argues, the management team, is a critical area for successful firm growth, than it deserves to be treated as an essential resource and locus for entrepreneurial management likely to support the company over the long-term; a point which Penrose makes and is returned to later.

The resource pyramid (shown below) proposed by Brush et al in their paper, 'From Initial Idea to Unique Advantage: The Entrepreneurial Challenge of Constructing a Resource Base' is adopted as a particularly useful model, following Penrose's view of resources.(Brush et al., 2001). The pyramid is probably derived from Flamholtz's work, which is discussed in a later Chapter. For EISMEs, the early board team human capital constitutes a critical key intangible resource and yet its formation, internal resources, and capability development are widely neglected. The sequencing and balancing of resources may change during firm emergence with varying proportions of picking and deploying of resources required, which may contribute to the difficulties of size transtion.

### 4.1.4 Resource Based Theory Strands – Path Pursued

There are many useful summaries resource based theory development (Barney, 2001b) (Foss, 1997) but thesis attention is focused on one particular area, the contribution of Edith Penrose and her special relevance to emerging smaller firms and their growth limitations. Rugman and Verbeke in their analysis of Edith Penrose's contribution to the resource based view of strategic management produce a helpful analysis of the approaches within RBT (Rugman and Verbeke, 2002), shown below to

**Figure 9: Value Creation Resource Pyramid**

**Value Creation Resource Pyramid: Brush, Greene and Hart 2001**

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assist in outlining the major trends within RBT before focusing specifically on Penrose's contributions.

Using the matrix below , approaches to resource based theory can be described as falling into two categories based on their managerial goals and the conditions needed to achieve them. A major flaw immediately arises with the matrix as applied to EISMEs. An assumption is made that both growth and superior economic rents are sought. As previously discussed the managerial goals of smaller owner directed firms and publicly quoted corporations are very different.

Many modern resource based theories assume that the management team is either a) seeking superior profitability and above average rents in acquisition of valuable resources or the way resources are combined or developed over time to generate unique capabilities and increase competitive advantage, quadrant 1 (Amit and Schoemaker, 1993) or b) seeking an optimal growth pattern through deployment of resources including acquisitions, mergers and international diversification (quadrant 3). Modern Resource based theory focuses on identifying critical resources and isolating mechanisms, which will produce a long term sustainable position for competitive advantage. Alternatively, RBT aims to identify the balance and sequence of resource acquisition/absorption within the firm to create superior profitability and thence competitive advantage (Kor and Mahoney, 2000). Resource based theory which focuses on identifying isolating mechanisms is an uncomfortable theoretical fit for EISMEs, since sustained competitive advantage is not the predominant goal and invariably the environments are too turbulent and uncertain to sustain long-term positions.

**Figure 10: Rugman and Verbeke: Prescriptive Foundations of Resource Based Theory Approaches to Strategy**

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**Source: Rugman and Verbeke , 2002, SMJ Edith Penrose's Contribution to the resource based view of Strategic Management**

The newer disequilibrium approaches of quadrant 2, dynamic capabilities, show a better fit in terms of understanding firm emergence processes. The dynamic capabilities approach of Teece et al. is a significant contribution to resource based theory, rooted in earlier contributions from a number of economics and strategic management researchers such as Penrose, Nelson and Winter, Selznick, Chandler, Quinn, Andrews and Schendel and Hofer.(Andrews, 1971, Chandler, 1962, Nelson and Winter, 1982, Penrose, 1959, Schendel and Hofer, 1979, Selznik, 1957) (Quinn, 1980, Quinn, 1985). Teece et al argue that managers must integrate, build and reconfigure internal and external competencies by honing their technological organisational and managerial processes to address rapidly changing environments, identify new opportunities and effectively organise resources to meet customer need.(Teece and Pisano, 1994, Teece et al., 1997); precisely the process expected of an entrepreneur or entrepreneurial team so vital at the point of early board team formation. Dynamic capabilites emphasize the managerial processes, the way things are done within the firm, in picking and deploying, allocating and reconfiguring resources as a firm responds to both internal and external environmental changes. In smaller ventures, changing fast in order to survive, these processes are rarely explicit.

Eisenhardt et al. argue dynamic capabilities vary in different market conditions, with a different balance between picking and deploying resources for either moderate markets or high velocity ones(Eisenhardt and Martin, 2000). The implication is that the balance between picking and deploying resources will vary during the life cycle of the firm according to the degree of turbulence in the market.(Lichenstein and Brush, 2001)

(Miller and Shamsie, 2001). Arguing in the context of larger firms, the authors state that dynamic capabilities are a set of specific and identifiable processes such as product development, strategic decision making and alliancing, that are idiosyncratic and path dependent in their emergence with significant commonalties across firms (Eisenhardt and Martin, 2000). In stable moderate markets they resemble organisational routines but in more turbulent markets or high velocity markets they are simple, more fragile and experiential, vested in the human capital rather than the routines and structures. The intangible, experiential management practices and organisational processes are those in which the research is interested but within the context of EISME's. Heterogeneous resources are created during a Schumpterian process of innovation and competition due to the efforts of the individuals and teams involved. The resource combinations are unique but highly dependent on the nature of the human resource, knowledge and skills they possess (Penrose, 1959) and major contributors to value creationas (Mahoney, 1995, Penrose, 1959, Schumpeter, 1934) (Baumol, 1990).

Identification, acquisition and deployment of tangible and intangible resources combine and result in a unique identity for the business, which become the determinants of firm size and scope according to Greene and Brown (Greene and Brown, 1997) But the process is dynamic, shifts in the types and combinations of resources are characteristic of firm development and growth according to Penrose and Mosakowski. (Mosakowski, 1993, Penrose, 1959). As Aldrich indicates, far too little research effort has been made to examine these shifts (Aldrich, 1999).

Numerous studies have attempted to measure the value particular firm strategies with combinations of resources and capabilities to find correlations with measures of firm performance. Their objectives vary but are aimed at achieving prescriptive models at the corporate entrepreneurship level. Studies include: relationship of resource base to choice of competitive strategy (Borch et al., 1999); marketing capabilities and firm performance (Hooley et al., 1999); organisational flexibility and market orientation (Barrett and Weinstein, 1998); leveraging interfirm relationships through networking to achieve a distinctive organizational capability (Lorenzoni and Lipparini, 1999). Few specifically explore established less glamorous firms, except for Brush and Chaganti.(Brush and Chaganti, 1996), fewer still expect the configurations examined to change in application in smaller and large firms.

Existing research in the context of larger firms agrees that all sizes of firm must, of course, have the managerial capacity to renew their resource positions to achieve congruence with the rapidly changing environmental conditions.(Chandler and Hanks, 1998) A firm's resources and capabilities must be dynamically managed to cater for changing conditions in market and industry environments, particularly so for smaller emerging firms. An adaptive capability becomes all important especially at time of accelerating change, requiring rather different management skills to those of stable environments(Brown and Eisenhardt, 1995, Eisenhardt and Tabrizi, 1995). Resources and capabilities must continually 'morph' if they are not to become impediments to strategic reorientation in response to environmental changes (Rindova and Kotha, 2001). How much more so this must be in the context of smaller firms, having to grow at a much faster rate in order to survive. A firm's management practices and organisational processes must be considered crucial to achieving the morphing process.

EISME owner directors have already established a resource base from which to operate. They are required to economically renew their firms and resource positions according to the external environmental conditions for firm survival. The task is one, not only of recognising the potential opportunities presented by technological change, but the type of innovation required by the market and industry life cycle stages. Variation of firm resource 'bundles' through selection, acquisition, combination and reconfiguration in a conscious rather than unconscious manner, as argued by Aldrich, is required (Aldrich, 1999). Stopford and Baden-Fuller in an important early paper on corporate entrepreneurship make the same point in the context of large organisations(Stopford and Baden-Fuller, 1994)

Entrepreneurship viewed through the management approach, where dynamic capabilities are essential, has particular relevance to advancing the study of entrepreneurial management in different sizes of firm in different market/industry contexts. It also makes possible the examination of how resources or bundles of resources change over the time for the different levels (individual group or firm level) and moving locus of entrepreneurial management. Resource and capability profiles evolve as the firm evolves, making important shifts over time in conjunction with market positioning (Lengnick-Hall, 1992) The 'filling in' of developmental gaps using RBT in relation to smaller firm emergence has the potential to be very valuable in practical terms, and helpful in adding to a systematic body of information called for by Shane and Venkataraman (Shane and Venkataraman, 2000) but within an existing framework!

#### 4.1.5 Picking versus Deploying

Returning to the RBT matrix above, quadrant 2, the balance and sequence of resources is explored further. Makadok argues RBT is split into two further streams between work firstly examining picking resources and secondly those focusing on deployment (Makadok, 2001), which begins to make eminent sense in the context of emerging firms. There two two sets of managerial activities, picking and deploying of resources,which will vary over the firm's life for a wide variety of reasons, according to the nature of the resources and capabilities required (Brush et al., 2001, Galunic and Rodan, 1997).

New venture formation, in the first instance deals almost exclusively with identifying, selecting and acquiring the appropriate resources at minimum cost (Brush, 1996, Katz and Gartner, 1988). A new venture concentrates initially on the assembly of the necessary resources through their identification and acquisition. An established firms needs to have a greater emphasis and skill in the deployment of resources, varying the resource and capability combinations by adding and reconfiguring old resources with new to achieve the desired outcomes. The process becomes of increasing complexity as the firm increases in size, well beyond the scope of one or two founder/director. A rapidly expanding firm needs to continue picking as well is deploying resources to build unique capabilities so that the early board team team human capital resources and capabilities derived from them become uniquely critical for success.

### 4.1.6 Resource Based Theory Critique and Penrose's Contribution

The fourth quadrant in Rugman and Verbeke's diagram, as earlier indicated is the strand of most interest when viewing the resources of the early board team within EISME's. In order to truly appreciate Penrose's contribution, it is examined or alongside the most commonly heard criticisms of RBT.

Much recent resource based theory work suffers from similar criticisms as that of the positioning school but none that seriously prevent its further development and application to EISME's especially if Penrose's approach is followed. Stasis, an inability to cope with dynamic situations and uncertain structures, especially when applied to strategies aimed at creating resource positions as isolating the mechanisms, is a common criticism.

Priem and Butler make specific criticisms of RBT. It is tautological; that different configurations of resources may produce the same value and therefore not be sources of competitive advantage; the roles of product markets are insufficiently taken into account and that the theory has limited prescriptive implications are the principal themes (Priem and Butler, 2001a). These are firmly rebutted by Barney in his counter argument paper and do not undermine potential extension of theory to emerging EISME's although he does not explicitly refer to EISME's. (Barney, 2001a). Barney makes an invaluable point, indirectly in his rebuttal of Priem and Butler's points when he points out that there "critique acts as a timely reminder of the logical limits of prescriptions derived from the theories of sustained firm advantage" Theories often have important managerial implications, but those implications are limited by the "rules for riches" paradox (Ropo and Hunt, 1996). Efforts to develop theories that, when applied, "will always generate sustained strategic advantages clearly are foolish" (Barney, 2001a). The 'amenity value' sought by owner directors cannot be recognised.

Barney rounds off his rebuttal paper saying that he wished he had "spent more time on the question of value and how to parameterize it". He effectively goes to the heart of creating usable strategy theory for EISMEs. The manner in which resources way resources are picked and deployed by the management team to build capabilities in response to specific external conditions clearly, must play a critical role in the early stages of firm growth, creating complex path dependencies and unique value. The driving force of management strategy does not always lie in the direction of achieving sustained strategic advantage but lie in other forms of value creation.

### 4.1.7 Penrose's Approach and Allied RBT contributions

Penrose's contributions to resource based theory, as expounded in her 'Theory of the Growth of the Firm', create a potentially useful base for extending the field and its application to EISME's in order to understand basic human capital resources of board teams, and its essential mediating role in the formation of capabilities essential for organisation growth. The management practices generated from the team human capital influence the nature of the organisational processes by which activity within the firm is controlled according to Nelson and winter. (Nelson and Winter, 1982).

The management practices present in the firm are therefore argued to be ascertainable through the presence of characteristic entrepreneurial or managerial organisational processes. Penrose argues that both are necessary in growing firms: entrepreneurial capabilities for innovation and managerial (administrative in Penrose's language) capabilities for routine maximum efficiency day-to-day management of the business. The locus of entrepreneurial management shifts within the management hierarchy during the stages of firm growth. As a consequence, the management practices and organisational processes adopted must also be modified essentially, the implication is that as the locus of entrepreneurial management shifts, so must the individual, team or firm patterns of management behaviour. At such time the organisation's processes will need to shift to meet the needs of the new form of entrepreneurial management, under the guidance of managers, if continued innovation is required.

Individual entrepreneurship for new ventures must be transformed to a group level of entrepreneurial management carried out by the early board team. As the organisation develops in complexity during further growth, the middle manager bears the brunt of initiating innovation and effectively behaving entrepreneurially on the half of the wider organisation (Kanter, 1984). By the time the firm has reached maturity in market and industry, other innovation strategies become necessary. Innovation and the introduction of radical new streams of business become increasingly difficult within the context of an established organisation (Kanter, 1991). Product and process innovation may be driven through by middle managers but organisational, strategic and domain transformational innovations are all strategies that need to be driven through from the top, by the main board or even the CEO alone.

#### 4.1.8 A Healthy Antidote to Traditional Large Company Management Concepts

What is it about Penrose's perspective that makes her approach to growth of the firm a good starting point? Firstly, reading Penrose on the subject of small firm emergence is a healthy antidote to the heavy dose of management theory which assumes a firm's sole objective is profit maximisation. Penrose views the world as one in disequilibrium, where innovation and change play a significant role. Her refreshing attitude to the goals of smaller enterprises means she is distinctly dismissive of claims that small firms should seek endless competitive advantage and above average rents as a primary goal. She focuses primarily on the purposes of the owners (whatever they may be) and the contribution of smaller firms to social welfare and benefit of an emerging firm population; a remarkably modern attitude for the time(Penrose, 1959) p. 56,. She was not particularly interested in shareholder profit, considering that multinational enterprises made excess profits in poorer countries and considering regulation necessary to curtail the alleged monopoly power of multinational enterprises. (Penrose, 1959) p 25. Growth of the firm was about value creation rather than value appropriation.

Secondly, she extends resource based theory by arguing that resource possession creates economic value only when they are effectively managed, effective management for value creation must include innovation. Edith Penrose is widely acknowledged to have played a central role in providing the intellectual underpinning of the resource based view with her seminal work 'Theory of the Growth of the Firm' (Best and Garnsey, 1999, Lockett and Thompson, 2004, Pitelis and Wahl, 1998) (Montgomery, 1995). Her work however as applied to smaller firms has not been pursued. Penrose sees emerging firms as inhabiting a Schumpeterian world of creative destruction and perennial gales, which incessantly revolutionise economic structures from within, incessantly destroying the old ones, incessantly creating a new ones. (Penrose, 1959) p. xiv. The process of creative destruction is seen as an essential fact of capitalism, one where disequilibrium prevails rather than equilibrium.

Penrose as an evolutionary economist approach did not believe in sustained rents, long run superior profitability, and long-run equilibrium as an approach applicable to the smaller domestic firm. Neoclassical economists as far as she was concerned, built their theories on models of market equilibrium, resource allocation price and welfare maximisation but very few thought it necessary to inquire what happened inside the firm, indeed that their firms had 'no insides to speak of' (Penrose, 1959); something with which she vehemently disagreed.

Her view of industrial activity is dynamic, not static, where opportunities can arise and be exploited without market movement eroding the opportunity to nothing. The concept of an industrial sector of homogenous firms producing homogenous products, a necessary assumption of equilibrium theory, denies a role for entrepreneurship, a very necessary feature of growing firms, because market theory would show that such opportunities would be competed away almost immediately. She considered, according to Best, that 'the firm strategically shapes the market, rather than reacting passively to it, but within a moving, historically contingent environment. As firms develop and respond to productive opportunities, they alter and further differentiate and, in the process re-characterise the parameters (technological, product, organisational) of the 'market' (Best and Garnsey, 1999).

An important third distinction made by Penrose, is between the resources and the services they yield. Productive resources yield productive services. An important feature of the work is the view that the managerial team, an intangible human resource, yields both entrepreneurial and managerial services (capabilities), Precisely how the managerial team deploys resources depends on the capabilities (services) and gives rise to unique value, according to Penrose thereby firmly focusing on the managerial team and its limitations (Penrose, 1959) p 34. Fourthly, as a consequence of the above, Penrose links human capital resource of the management team to the "generation of productive opportunities", innovation and firm growth. She establishes the managerial team as a significant limiter to firm growth and goes on to explore how the team develops.

Within the research on EISME's, the managerial team is considered to be synonymous with the board team. Penrose, herself, mentions a slightly broader team of six to ten people, but this is interpreted as applying to larger firms at a later stage of expansion, perhaps similar the Hercules Powder Company on which she originally based her research. A more realistic size of the type of firms under study would be the core, directorial team, excluding senior managers (if they were to exist)

A further Penrose contribution of significance to small firm emergence is the recognition that the managerial team, its inherited accumulated knowledge sets the direction of firm development, and determines the rate of growth, as the rate of growth cannot exceed the capability of the managerial team's ability to cope. The process of developing board team capability is distinctly 'lumpy' and acts as a break on expansion. Firm development is path dependent, based on the inherited board team resources and capabilities. Consideration of EISME organisational growth capability cannot therefore take place without including the team human capital resources and the nature of the capabilities derived from them.

The exact contribution of Penrose to RBT has recently been the subject of some debate between Kor and Mahoney, Rugman and Verbeke, Lockett and Thompson and Pitelis. (Kor and Mahoney, 2000) (Rugman and Verbeke, 2002, Rugman and Verbeke, 2004) (Lockett and Thompson, 2004) (Pitelis, 2004). Rugman and Verbeke considered Penrose had not made as significant a contribution to RBT as many suggest. Kor and Mahoney strongly rebut the suggestion, arguing, as Lockett and Thompson that Penrose contributes significantly to understanding the phenomenon of firm growth (Lockett and Thompson, 2004) but that Penrose also provides "a theory of effective management of firms resources, productive opportunities and diversification strategy" (Kor and Mahoney, 2004). She provides "an explanatory logic to unravel the causal links among resources capabilities and competitive advantage, which contributes to resource based theory of competitive advantage" (Kor and Mahoney, 2004). Yet everyone fails to recognise that by RBT has developed principally in relation to large established organisations.

The heart of the debate seems to lie in reconciling her approaches to the study of domestic (small firms) and multinational enterprises. Her work on multinational enterprises may have been subsequently extended not entirely in a way she would have originally approved of according to Pitelis (Pitelis, 2004) (Best and Garnsey, 1999). In later life, like the vast majority of researchers, Penrose seems to have adopted the prevailing attitude of the time that 'big was best', chose to study large enterprises as research objects, and focused on multinational enterprises in her later work to the exclusion of small domestic firms. She never returned to explore growth of small firms and their emergence from caterpillar to the butterfly, as she characterised the difference between small and large firms. Penrose's early contribution to the emergence and evolution of smaller firms has remained largely unexplored but her original contribution in her analysis of small firm growth and her insights into the limitations to firm growth of the managerial team are considered worth building on.

Her work recognises the reality of the interdependent community of smaller firms attempting to survive and grow modestly. Best and Garnsey describe her theory as a dynamic theory of enterprise growth (Best and Garnsey, 1999) , surely a good basis for generating dynamic, evolutionary approaches to the investigation of resources, capabilities in smaller firms; in particular , the human capital resources of the early board team and their management practices and organisational processes likely to foster continued firm evolution and emergence.

The research therefore attempts to build on Penrose's original insights but moves on in an attempt to understand some of the management processes associated with innovation inherent in the 'chrysalis' transition stage which any emerging and growing firm must ultimately undergo. As North and Smallbone indicate, established mature firms may start to grow rapidly at any time (North and Smallbone, 1995). Examining the resources, tangible and intangible of EISME's, is therefore as just as valuable as looking at those of new ventures or trying to pick winners (Beaver and Jennings, 1995).

**4.1.9 Limitations to Growth**

Penrose outlines three classes of explanation as to why there is a limit in the growth of firms: managerial ability, product, or factor markets and uncertainty and risks (Penrose, 1959) p.43. Only managerial ability deals entirely with conditions within the control of the firm. The other two, firstly, pertain to conditions outside the firm for the former and for the latter to a combination of internal attitudes and external conditions, where the risk and rewards of the managers become peculiarly important within EISME's.

If two assumptions are made: firstly, there is no limit to the level of expansion a firm can undertake and secondly, firms will be faced with different supply and demand conditions, Penrose chooses to concentrate on the internal factors restricting expansion. The first two assumptions are arguably fair. A further assumption made by Penrose, in positing no limitation in the supply of managerial talent in her analysis, is not. Penrose makes the assumption that all firms possess enterprising and competent management: her analysis proceeds on the basis these qualities are present in the firm and available within the environment.

Her assumption that the central management is not abnormally incompetent may have been faulty for the UK. (She was writing in the United States) as two underlying and interrelated factors were influencing the human capital of potential board team stock; in the early 70s, only 3% of the age cohort received higher level university education. Employment within the commercial environment was not perceived as a desirable career option to many graduates. Those that were interested in a commercial career were attracted to the greater benefits offered by larger enterprises. Few graduates entered smaller firms. (Belfield, 1999).

An acknowledged failure to provide an educational entry routes to management careers in the UK existed. U K businesses relied heavily on accountancy training as the principal route to a management career as a result: a factor considered to have influenced the management competence development in the UK generally according to the Constable and Handy reports (The Making of British Managers (John Constable and Roger McCormick) 1987, and The Making of Managers (Charles Handy) 1988). An over emphasis on management by numbers attributable to this fact was considered a UK management weakness.

The failure of graduates to undertake management careers and a lack of clear entry routes during a 30 year period may well have contributed to a particular weakness in the human capital resource of smaller firms. The older age groups, which suffered from lack of access to higher education or a clear entry route to management, are currently EISME directors. Penrose's assumption of an equal supply of managerial talent for firms cannot be made for UK SMEs compared larger firms.

Penrose views firms as a collection of resources bound together in a coherent administrative organisation, an administrative framework of boundaries, which are determined by "the area of administrative coordination" and "authoritative communication." Its general purpose is to organise the use of it's "own" resources together with other external resources to produce and sell goods and services at a profit. (Penrose, 1959) p. 31. The size of administrative area of coordination, argues Penrose, determines firm size, and is theoretically infinitely expandable.

Subsequent research has proved Penrose incorrect; there are optimum board sizes (Haleblian and Finkelstein, 1993). Board size and firm performance do not have a linear relationship. The administrative framework is created by the people who run it, albeit haphazardly in response to immediate needs of the recent past. Alternatively, as she wryly points out they may have been shaped by conscious attempts to achieve a 'rational' organisation, importing systems and structures from elsewhere. Penrose's argument runs that growth and expansion do not occur automatically, some planning and organisation of resources to achieve it, must take place. Very little effort has taken place to understand the resource and capability evolution in smaller firms

Penrose argues that specialised resources or managerial ability must be available for expansion plans; their availability is limited by the management team. A management team cannot take advantage of all opportunities available since by its very nature as an administrative and planning organisation, most of its time is occupied in knowing and approving of existing plans and operations. But notably, she recognises that no growth plans will take place if the board team "wishes to maintain its character as an organised unit." Ambition or a desire to expand is a prerequisite to further action.

Penrose recognises that existing operations of the firm consume management time and effort- 'there is a physical maximum to the number of things any individual or group of individuals can do there is clearly some sort of limit to the rate at which even the financial transactions of individuals or groups can be expanded." p 45. The capacities of the managerial personnel set a limit to the expansion of the firm in any given period. She argues that supervisory management cannot be hired in the marketplace, the team is something more than a collection of individuals; it has experience of working together as a unit, which gives rise to services uniquely valuable to the firm. (p 46) She argues that the team develops a working relationship, makes decisions and acts in a way that determines the efficiency and confidence of their decisions. Existing management limits the amount of new management that can be hired simply because of the time that it takes to embed them into the team and acquire the necessary experience. Over rapid expansion of the team means that individuals cannot obtain experience of each other (i.e. learn) and the firm, which undermines the confidence of decision making and firm efficiency.

Disorganisation can follow with a period of stagnation. Time and service length, experience, are critical to the way the central management / board team works according to Penrose, as a team is not something that forms immediately. The combined experience of a firm's managerial group plays a crucial role in the whole process of expansion, for the process by which experience is gained "is properly treated as the process creating new productive services available to the firm". In other words, the way in which the team forms, the length of time taken, and the experience acquired it is vital to board team capability if it is to yield the services necessary for expansion.

The 'inherited' managerial resources control the amount of new managerial resources that can be absorbed, they create a fundamental, and inescapable limit to the amount of expansion of firm can undertake at any time, argues Penrose. Internal path dependence within the board team therefore exists, limiting the potential capabilities it can offer. New team members take time to be absorbed and are a distraction to the existing managerial team, so that incremental growth within the board team is the only expansion possible. Dramatic or radical expansion of the board team is unlikely to be effective p.49. She remarks "In small firms where managerial services are supplied by from one to a half dozen men who are fully occupied in running the firm, expansion sometimes depends on overtime spurts of activity which can only occur periodically. Each stage of growth therefore must be consolidated before a new burst of expansion occurs to release the managerial resources required for the activity" p 50. The development of the board team is thus revealed as potentially erratic process with the success of the team formation playing a critical role in firm expansion: a process which has received scant attention in recent research.

Penrose's analysis of the emergence of small firms is considered incomplete. She recognises the managerial functions and the basic administrative structures in large firms undergo fundamental changes as part of expansion, which profoundly affects the nature of the organism itself. She makes no attempt to examine the nature of these changes: how and why small and large firms are so different. She states simply that the administrative structures of very small and very large firms are so great that in many ways it is hard to see that the two species are of the same genus. Small and large firms "become so different that we must look on them differently; we cannot define a caterpillar and then the use the same definition for a butterfly". (Penrose, 1959) p. 19.

#### 4.1.10 Convergence of Resource Based Theory Development

Penrose's approach, combined with the dynamic capabilities approach of Teece et al. within RBT, begins to create an interesting convergence with theories of entrepreneurship that extend the boundaries of the RBT domain, according to several authors; Alvarez and Busenitz and Zahra, Kuratko and Jennings (Zahra Kuratko et al., 1999). (Alvarez and Busenitz, 2001). Connor and Rumelt also consider entrepreneurship as an intrinsic part of the resource based theory framework. (Rumelt, 1987) (Conner, 1991). A focus on the resources involved in the entrepreneurial process, from recognising entrepreneurial opportunity to the ability to organise these resources into a firm, to create heterogeneous outputs and superior products, is now seen as a key part of resource based theory. Empirical application of resource based theory to entrepreneurship and smaller firms to determine some of the finer details involved is required. The thesis aims to contribute such detail by focusing on the human capital resources of the early board team and their management practices.

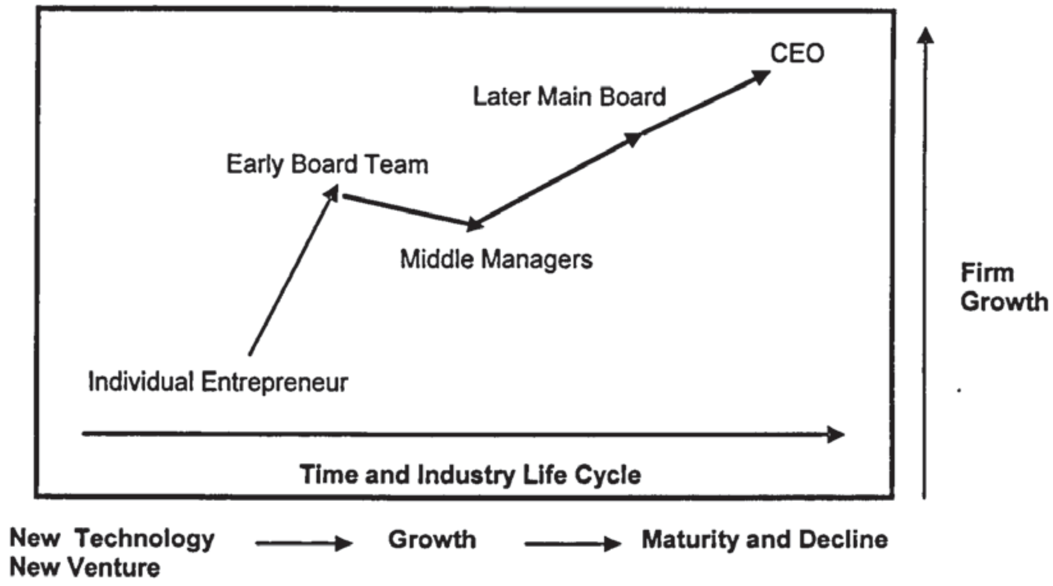
#### 4.1.11 Locus of Entrepreneurial Management

Researchers seem to have concentrated so much on the individual entrepreneur within new ventures that they have overlooked the necessary shift in locus of entrepreneurial management to an early board team as part of firm emergence. According to Penrose, further firm growth is unlikely if this does not occur.

As the firm grows and experiences maturing markets and industries, different types of innovation are required, driven by different sets of management within the organisation (Miller and Shamsie, 2001).. As the locus of entrepreneurial management shifts, it is argued, so must management practices and the associated organisational processes. . A graphic illustration is provided overleaf to better illustrate the point.

A firm is founded and driven by the innovative vision of original entrepreneurial individual. If the firm is successful and grows, there must be some transfer of innovation initiative to a wider group of people, the early board team. The early board team assumes the mantle of responsibility for both maintaining entrepreneurial and managerial services to produce both innovation and effective management of existing routine work. As the organisation increases in complexity, responsibility for innovation moves to the middle manager, well-documented by writers such as Kanter and Leonard

**Figure 11: Entrepreneurial Management Locus Transition**




Barton (Barton Leonard, 1995, Kanter, 1984). Market and industry maturity require more sophisticated levels of innovation response likely to be instigated by the main board or CEO; organisational, strategic and domain transforming innovation. (Baden-Fuller and Stopford, 1994) (Markides, 1998), requiring yet another shift in management practices and organisational processes under their direction.

Organisational adjustments to achieve the different types of innovation are acknowledged to be significant and not always to achieve easy to achieve in strategic innovation and innovation management literatures; substantial bodies of work in their own right (Nonaka and Takeuchi, 1995) (Burns and Stalker, 1961, Chandler et al., 2000, Damanpour, 1991, Ghoshal et al., 1995, Hamel, 1998).(Utterback, 1994) . Studies of innovation in smaller firms have taken place but none focus on how emerging firms retain the innovation capability amongst the management. The early board team, it is argued, its resources, the management practices based on them and organisational processes engendered are argued to be critical for successful firm development and emergence.

If, management functions in smaller firms are legitimately carried out differently (Gilmore and Carson, 1999, Greene and Brown, 1997), the management processes will also vary significantly from those in larger firms. Small and and large firms are intrinsically different but emerging frims must learn to vary their management proactices and organisational processes. The innovation outcomes sought by firms of different size are different and related to market maturity and industry development. The innovation field already acknowledges that innovation type and process is carried out differently in small firms (discussed in more detail below) (Acs and Audretsch, 1990, Rothwell and Dodgson, 1990).

It follows that the entrepreneurial management processes supporting the innovation introduction may also different in certain respects. Emerging smaller firms continue to experiment and hone the management practices and organisational processes to find what works best. As a firm grows, a part of its activity becomes increasingly routinised, requiring explicit and stable control systems. A firm must however continuously innovate to achieve further growth, requiring simultaneous entrepreneurial, dynamic management capabilities. Managing to maintain both routine administrative and entrepreneurial capabilities simultaneously must require an assessment of board size and internal resource. The dimensions of the chrysalis transition from caterpillar and butterfly are becoming more apparent.

An integral part of the chrysalis stage for an EISME, is argued to be the formation of an effective early board team capable of maintaining a good balance of administrative and entrepreneurial management. The complex metamorphosis between butterfly and caterpillar can easily falter if the balance is disturbed as Penrose discusses. The board team or entrepreneurial team formation, structure, composition, numbers, age, education and experience, barely studied in emerging firms, become of vital importance.

The inherited resources of the managerial team determine their capabilities and their future direction. Not all those who emerge from the chrysalis stage will be fast movers, the large companies of the future. In Storey's terms they will be ' trundlers', but they will nonetheless emerge as strong economic entities contributing in their own right to economic prosperity.

### 4.1.12 Entrepreneurial and Managerial Capabilities

So what is the difference between entrepreneurial and managerial capabilities as defined by Penrose? Many authors define entrepreneurship as being at one end of a spectrum of possible management behaviour patterns aimed at dynamically managing resources and capabilities to achieve innovation of differing kinds against a backdrop of rising global and domestic competition (Stevenson and Jarillo, 1986, Zahra et al., 2000). The type of management, style or structure, at each end of the spectrum is characterised in different ways by different writers: organic or mechanistic (Miles and Snow, 1978); proactive promoter or resource utilisation maximisation trustee (Stevenson and Jarillo, 1990) innovator or reproducer(Stevenson and Gumpert, 1985) and can be viewed as matching entrepreneurial and adminstative services described by Penrose.

An implication implict in the above models is that firm management style moves along the axis from one end of the spectrum to other as required, perhaps dependent on external forces the nature of the industry in which they are located (Chakravarthy, 1982. Penrose defines entrepreneurial services as:- "those contributions to the operations of the firm which relate to the introduction, or an acceptance on the behalf of the firm, of new ideas, particularly with respect to products, location and significant changes in technology, the acquisition of new managerial personnel, to fundamental changes in the administrative organisation of the firm, to the raising of capital and to the making of plans for expansion, including the choice of method of expansion." {Penrose, 1959 ) p 31/32 footnote.

In contrast, managerial services relate to the supervision of existing operations. A significant and valuable differentiation within the management task. They are management capabilities dedicated to good, competent management of routine day-to-day operations, whereas entrepreneurial services relate to the execution of entrepreneurial ideas and proposals (Penrose, 1959) p. 31. Penrose argues firms need both entrepreneurial and managerial capabilities simultaneously. The same individual (s) more often than not, provides both types of service to the firm in the early stages, according to Penrose. But what happens later?

How can a board team, limited in size and resources manage to balance entrepreneurial and managerial services as defined by Penrose? It is not just a matter of making a transition from one end of a scale, entrepreneurial to professional management, as so many argue (Flamholtz, 1986).(Stevenson and Gumpert, 1985) Simultaneous provision of entrepreneurial and managerial services is clearly a difficult task, resulting either in a seesaw effect between the two, or a failure to do one or the other at the required time. A balancing act must occur, difficult to manage and highly dependent on the human capital resources involved. An expanded human capital base within the early board represented by, increased numbers, age, experience, and education may make the balancing act or alternating sequence easier to achieve.

Penrose treats entrepreneurship as a common or garden management behaviour involved with the renewal of the firm, not just a feature of fast growth. The characterisation of entrepreneurship as solely related to fast growth firms undertaking significant innovation needs be reviewed in the context of EISMEs if development of modest organisational growth capability is truly desired. It needs to recognise that continuous incremental innovation on the part of smaller firms is an essential part of the emergent process. Many consider a transition from entrepreneurial to professional management to be a rite of passage for the smaller firm (Chell et al., 1991, Flamholtz, 1986). From Penrose's point of view a loss of innovation capability would occur and act as a limitation to the growth of the firm. Watson also considers the transition from entrepreneurial to professional as a potentially fatal distinction (Watson, 1995). Why must a firm lose its entrepreneurial capacities during growth? The implication is that they are inappropriate, but innovation for economic renewal must continue. An apparent paradoc that much literature accepts quite happily.

Researchers persist in trying to apply traditional managerial tools to ascertain 'rules for riches' for 'optimum' small firm performance. They make the assumption that entrepreneurship requires fast growth and superior profits. It doesn't, the outcome may simply be survival, economic renewal and increased firm longevity for most smaller firms.

### 4.2 Entrepreneurship Framework Adopted for Study

Although it is clear why the thesis has adopted the resource base view that the firm from the previous section, it is now necessary to plot the match of path chosen within the entrepreneurship literature to justify discarding other approaches.

#### 4.2.1 Entrepreneurship Framework

Entrepreneurship, a relatively young field of research, still struggles for recognition and legitimacy. It presents a multiplicity of academic study perspectives from which to chose. It is a field full of potentially competing and conflicting perspectives where there is some disagreement on what constitutes entrepreneurship.(Busenitz et al., 2003) (Gartner, 2001). Different entrepreneurship research traditions even exist between USA, Europe, and other parts of the world (Huse and Landstrom, 1997). Existing research is studied and approached from the economic, psychological, and socio-cultural and management perspectives, which makes it hard to progress as a coherent and integrated field of study and make clear advances.

The complexity of the research output has lead many writers to plead for a comprehensive analytic framework against which to map all entrepreneurship research contributions including Low and MacMillan, Brazeal and Martinez, Aldrich and Martinez, Shane and Venkataraman, d'Amboise, Wortman, Gartner, Davidsson and Wiklund, Van de Ven and Wortman (Low and Macmillan, 1988).: (Aldrich and Martinez, 2001, Brazeal and Herbert, 1999, Shane and Venkataraman, 2000) (Brazeal and Herbert, 1999, D'Amboise and Muldowney, 1988, Davidsson and Wiklund, 2001, Gartner, 1988, Low and Macmillan, 1988, Van De Ven, 1993, Wortman, 1987).

Shane and Venkataraman argue in 2000 that entrepreneurship should be considered a research domain in its own right and imply that it lacks legitimacy without an overarching theoretical framework of its own. (Shane and Venkataraman, 2000). It requires according to Shane and Venkataraman- 'A conceptual framework that explains and predicts empirical phenomena that are not explained or predicted by the conceptual frameworks already in existence in other fields' (Shane and Venkataraman, 2000). Markets are viewed as rarely, if ever, approaching equilibrium a place where entrepreneurs can seek and discover and successfully exploit opportunities.

Creating a separate theoretical framework for entrepreneurship study is considered a pointless exercise when greater academic legitimacy can be achieved through integration with other existing perspectives such as RBT and should be avoided at all costs. In the view of recent developments of organic strategy within the strategic management field, the creation of a separate framework is considered to be more likely to create an obstacle to greater understanding rather than to facilitate. A point made forcibly by a number of researchers including Zahra and Dess in their response to Shane and Venkataraman paper and less so by Low in his paper "The Adolescence of Entrepreneurship." Entrepreneurship is better treated, Zahra and Dess argue, as an integral part of the strategic management field, since it draws on "many social science disciplines and continues to derive its strength from its eclectic nature providing richer opportunities for empirical research as well as enhancing the development of both descriptive and normative theory" (Zahra and Dess, 2001). Low, despairs over the pot pourri of entrepreneurship research, which appears to be spreading ever wider, and concludes entrepreneurship legitimacy requires the involvement of other disciplines to create a true intellectual community. (Low, 2001).

Low and Macmillan's original paper on the future of entrepreneurship research in 1988 calls for some academic discipline in addressing entrepreneurship research, reconciling three elements necessary for entrepreneurial success: process, context, and outcomes for more rigorous research. Development of evolutionary theory within the strategic management field is currently helping to achieve somewhat belatedly Low and Macmillan's desired position first stated in 1988. Aldrich and Martinez follow, arguing strongly for the adoption of evolutionary theory as a unifying, single coherent framework for entrepreneurship as the way of reconciling entrepreneurial outcomes, processes and context, using the basic concepts of variation adaptation selection and retention (Aldrich and Martinez, 2001). Aldrich and Martinez propose a view of entrepreneurial management as a pattern of management behaviour where new organisations or business streams are created by resource variation, adaptation, and selection.

The current research adopts the views of Zahra, Dess and Aldrich and works within the management approach to the study of entrepreneurship, described earlier by Stevenson and Jarillo (Stevenson and Jarillo, 1990). How does entrepreneurial management take place? It is viewed as just one end of a spectrum of management behaviours ranging from entrepreneurial to administrative, (Stevenson and Jarillo, 1986) where the associated structures are organic or mechanistic (Miles and Snow, 1978.the other major research approaches to entrepreneurship are broadly defined as economics, psychology, sociology and management by Stevenson and Jarrillo {Stevenson, 1990 #1232) and are now briefly examined for their contributions.

### 4.2.2 Economists Approach

Economists examine the effects on the economy, psychologists and sociologist investigate just why people behave entrepreneurially (nature or nurture argument) and 'management scientists" are more interested in how entrepreneurial outcomes are achieved. The entrepreneur has long featured in the economics literature but as Baumol notes, the entrepreneur is a grey ghost that haunts the economics literature; a ghost rarely fully identified, never quite pinned down in terms of the precise managerial contribution to an economy but without which there is no firm foundation to study and entrepreneurship practice (Baumol, 1993).

Entrepreneurship is still considered a special factor of production which cannot be replicated in the way that machinery or normal labours can (Reid, 1995). The entrepreneur and the firm are indivisible. Yet curiously, within the Economist's perspective, a group function of entrepreneurship, between the individual and the firm are largely neglected. Entrepreneurship seems to be obsessed with value creation either by individuals or firms yet only the hi tec, hi growth entrepreneurship literature acknowledges the value of teams (Kamm and Shuman, 1990). Even Casson, an evolutionary economist who deems entrepreneurs to have superior decision-making capabilities in the allocation of resources, (very much at the micro level) argues "that the firm is essentially and institutionalised extension of the personality of the entrepreneur" (Casson, 1996).

Maybe initially, but if the firm is grow successfully then a failure to transfer some measure of direction to a wider managerial team is likely to cause a barrier to growth (Penrose, 1959). The innovation management literature, based on established large firms does not make this mistake, valuing the efforts of teams of middle managers as the powerhouse of product and service innovation as Nonaka and Takeuchi, Barton and Kanter all describe (Barton Leonard, 1995, Kanter, 1989, Nonaka and Takeuchi, 1995). Traditional management in any large company context concerns groups of people organising others, rarely does an individual have total control in effecting all decisions(Weick, 1979), yet entrepreneurship with the notable exception of research on high-technology high-growth ventures ignores this aspect.

Macro level studies are best left to the economists. The current study is restricted to one country and industry in attempt to minimise the contingent variables within the social and cultural contexts, recognising that entrepreneurial patterns of management behaviour are influenced by both factors (Birley and Macmillan, 1997), in particular whether the industry conditions are benign or hostile (Covin and Slevin, 1989).

### 4.2.3 Psychological Approaches:

Entrepreneurial typologies and personality traits have been well researched over the years. Typologies have limited usefulness except perhaps for potential investors (Chell and Haworth, 1992, Wortman, 1987). The personality trait approach is no longer considered particularly useful for predicting venture success. Considered by many researchers to have failed to make a real contribution to the understanding of the entrepreneurial process, it has languished of late (Baron, 2004b, Mitchell et al., 2002).(Cooper et al., 1994).

McCelland writing in 1961 describes entrepreneurship in socio psychological terms, where entrepreneurial behaviour is dependent on personal motivations which in turn are dependent on environment characteristics (Mccelland, 1961). Cooper at al (Cooper et al., 1988) challenge the existence of such a link, arguing that it is extremely difficult to link the environment, psychological and sociological traits causally to the complex patterns of entrepreneurial behaviour simply because humans learn and their motivations change continuously. Many researchers followed McCelland in an attempt to identify potential personality traits of entrepreneurs associated with strategy and/or firm performance but met with limited success according to writers such asChandler, Stuart and Abetti, Heunks and Roper (Chandler and Jansen, 1992)(Stuart and Abetti 1990) (Heunks, 1998, Roper, 1998).

Entrepreneurial characteristics which had been found to be associated with successful entrepreneurship in a variety of research studies are as follows: achievement need, (Mccelland and Winters, 1969) internal locus of control, (Miller and Toulouse, 1986), desire for autonomy, (Sexton and Bowman, 1985) tolerance of ambiguity and uncertainty ( add ref), risk taking (Brockhaus, 1980, Busenitz, 1999) and overoptimism (Cooper et al., 1991). Such characteristics or personality traits can be determined by the administration of personality tests such as the Kirton Adaptation-Innovation Inventory (KAII) and the Myers Briggs type Indicator- Creativity index.

Individual entrepreneurial personal characteristics are perhaps best viewed as basic human capital resources, which act on, mediate and influence other management behaviours, according to Storey (Storey, 1994)p.126. Storey is supported in studies from organisational theory. Individual behaviour can be substantially modified within a board team according to Pettigrew (Pettigrew, 1992b). Studying the impact of a lone individual on an organisation becomes potentially an exercise in futility. A group level of analysis, of entrepreneurial management behaviour within the board team, where the combination and interaction of the human resource capital, must play a significant part in firm emergence and economic renewal and has been ignored too long (Huse, 2000)

Other research work centred around the impact entrepreneurial personality include attempts to identify an individuals likelihood of becoming an entrepreneur (Chell et al., 1991, Gartner, 1988); link individual personality traits with strategy, the success of new venture formation and firm performance (Chandler and Hanks, 1998, Chandler and Jansen, 1992, Chell et al., 1991) (Herron and Robinson, 1993, Kamm et al., 1990); whether entrepreneurs with certain personality traits are more prone to take more risk than corporate managers for new ventures (Busenitz and Barney, 1997, Hoy and Carland, 1983, Miner, 1990, Stewart et al., 1998). Much of the research above is based on assumptions which do not take into account how EISMEs are likely to define success, recognise appropriate smaller firm strategies compared to a large firms or take into account different types of decision-making based on biases and heuristics common where innovation is involved.

A second factor which undermines the use of the personality trait approach, is that it ignores the fact that humans learn and that the profile will change over time. Analysis of a team's personality traits would become impossibly complex as the interactions between group members are continuously influenced by personal and business motivations over time as people learn through their experiences. The application of cognitive behavioural theory, to entrepreneurship may produce some promising approaches for the future as outlined by Mitchell et al , Baron , Russell and Simon et al. (Mitchell et al., 2002) (Baron, 2004a, Russell, 1999, Simon et al., 2000). For the research in hand, cognitive approaches are insufficiently developed and too complicated to be easily assimilated into the research. The personality trait findings present obstacles to the research in that they may also be too generalised to distinguish those individuals with growth ambitions according to Chell (Chell et al., 1991).

The locus of entrepreneurial management and its outcome innovation, is argued to shift during the life cycle of the firm. The managerial practices and organisational processes associated with innovation for each shift of locus are not necessarily the same. Indeed, the behaviours of individual entrepreneurs fostering innovations in new ventures are not the same as those managers or groups of managers in larger established firms or even those of the chief executive leading a mature firm through a rejuvenation process. Further exploration of these concepts occurs in Chapter 6.

In terms of the literature there is very little exploration of group entrepreneurship in smaller firms carried out by early board teams. Many smaller firms are faced with the necessity of starting with one or two directors and subsequently growing and effective board team. They do not have the resources of large organisations to draw upon. Creating or fostering entrepreneurial behaviour within an early board team, in the context of the enormous UK small firm population increase must be considered essential. Interactions within an early board team are clearly significant and undoubtedly come into play with synergy playing a role, creating another level of complexity, which has yet to be examined according to Francis and Sandberg (Francis and Sandberg, 2000).

The very same fact of human leaning and knowledge accumulation, (which upsets the utility of the personality trait approaches) make some of the simpler intangible human capital resources (has viewed from within RBT) potentially useful in determining the ingredients for effective board teams, their emergence and ultimately firm growth. Easily determined factors such as number of directors, aggregate age, experience and education may in combination be sufficient to contribute to continue entrepreneurial management by early board teams. Chapter 5 is dedicated to discussing these in more detail

**4.2.4 Resource Based View and Entrepreneurship**

An important watershed occurred within entrepreneurship study in the 1990s when emphasis was shifted to examining entrepreneurship within RBT. Researchers shifted their attention away from the what and the why to how entrepreneurial behaviour occurrs. Perhaps more importantly, it begins to examine the configurations of resources and capability associated with specific competencies and performance outcomes. Entrepreneurship is defined as a management process based on resources, which transforms resources creating new capabilities through the the picking or deployment of resources and is defined variously by a number of writers. Resource based theory views organisations as consisting of resource bundles {Stopford, 1994 #1097}(Wernerfelt, 1984) created by the firm over time, composed of tangible and intangible resources and capabilities, establishing a resource path dependence.

Resource bundles change over time and generate unique capabilities and in turn competitive advantage according to Amit and Shoemaker (Amit et al., 1993). Resource bundles change over time and are influenced by age and size of firm(Brush and Chaganti, 1996, Mosakowski, 1993) and management action in response to changes in the marketplace (Chandler and Hanks, 1994). Entrepreneurs, according to Casson, have superior decision-making capabilities when it comes to resource allocation (Casson, 1982). At firm formation, resource picking – identification and acquisition is the primary activity (Kazanjian and Rao, 1999).

Once the firm is established however resource deployment activities must take precedence to ensure the growth of a successful resource base (Brush and Chaganti, 1996, Brush et al., 2001, Stevenson and Gumpert, 1985, Stevenson and Jarillo, 1990). Stevenson and Jarillo state simply that it is a a process by which individuals or teams, either on their own or inside organisations, pursue opportunities without regard to the resources they currently control (Stevenson and Jarillo, 1990) The group level of entrepreneurship gets a mention here but innovation is not included as an outcome. A successful entrepreneuriall orientated team, in the fast-growing NTBF or an EISME must therefore be able to recognise the need for different resource variation behaviours – either picking or deploying according to circumstance

Identification of characteristic entrepreneurial patterns of management behaviouris increasingly pursued within an evolutionary resource based perspective to entrepreneurship notably by Katz, Aldrich and Zahra (Aldrich and Martinez, 2001, Katz and Gartner, 1988, ZahraKuratko et al., 1999). Aldrich's approach argues that resource selection, variation adaptation and retention contribute to firm emergence according to Aldrich (Aldrich and Martinez, 2001) and is particularly relevant to the research in hand: entrepreneurs (board teams) modify their organisations (variation) and use resources to survive in changing environments (adaptation), influenced by a variety of factors (including entrepreneurial human capital / personal and business objectives), which in turn lead to the success and survival of organisational processes (selection). The resource variation process is dynamic; combinations which do not produce the required results are quickly discarded.

Lichtenstein and Brush in a longitudinal study explore the configurations of resource bundles overtime in new ventures and produce a dynamic model of resource acquisition, development and their effects in new ventures in order to identify and analyse how resource bundle patterns change over time and how these might be linked to from performance. The model is shown below.

**Figure 12: Lichtenstein and Brush dynamic model of resource acquisition, development and effects in new venture.**



**Source Lichtenstein, B.B. and Brush C. (2001) Entrepreneurship Theory and Practice Vol 25:3 p37-58**

Firstly, the authors ask which resources are the most salient for new venture growth and secondly just how these change over time in a way to achieve competitive advantage (or perhaps more appropriately for more modest ambitions within EISMEs create value). If the model is applied to early board teams, more finely grained research questions can be asked such as which human capital resources are most salient for only four teams where innovation is present. Secondly, the configurations of resources and capabilities for the firm size and industry: EISMEs and the plastics processing industry. The early board team and its management practices are argued to control the developing organisation through directing and setting the organisational processes and routines. Only successful processors and routines are retained (retention). Patterns of management behaviour within the firm evolve during growth. If these patterns of behaviour are perceived as a variation in the balance of picking and deployment of resources to build capabilities then it can shown that these patterns vary according to the firm life cycle stage.

Low and Macmillan's 1988 plea to reconcile context, process and outcomes is met by the resource base theory of firm and goes some way to extending knowledge by tackling a number of outstanding omission / issues on the level of analysis, context and process (Low, 2001). These are respectively the failure to examine innovation and entrepreneurship by industry sector, the neglect of the group level of entrepreneurship study and a failure to link resources to capabilities. Working within a resource based view provides firstly, an all embracing integrating framework, and in the process integrating entrepreneurship research into mainstream research enhancing the legitimacy of both. (Aldrich and Martinez, 2001, Gartner, 1988) A satisfying apparent convergence of the newer approaches in resource based strategy and organisational theory encourage the adoption of such approaches to entrepreneurship generally (Farjoun, 2002).

Secondly, it provides a rich field of potential investigation as the framework is increasingly applied to the relationships of different resources to specific capabilities as discussed in the previous section. Increasingly resourced based approaches are applied to small as well as large contributing to understanding vital internal processes. Lee et al and Lechner and Dowling examine the relationship of external networks and internal capabilities in technological ventures (Lee et al., 2001),(Lechner and Dowling, 2003); Lechler examines whether social interaction within an entrepreneurial team influences success (Lechler, 2001) and allows the question of whether whether the characteristic patterns of management behaviour which encourage entrepreneurial management and innovation outcome are similar for all firm sizes and stages of development.

Such an assumption cannot be relied upon. Small firms are not little big firms, the way things are done in smaller firms can be different, quite legitimately, in significant respects to larger firms. The first step is to identify the necessary resource foundations on which capabilities can be built for each critical stage within a firms evolution. A single entrepreneur in setting up a new venture will spend a considerable portion of his time in identifying, assembling, acquiring and initially allocating resources to start the venture. Once the venture has commenced the balance of picking to deploying the resources changes in favour of deploying as the venture attempts to develop capabilities and competences.

So far there is a scant but increasing literature on the resources and capabilities required for new venture formation and for further growth of established SMEs. The majority however still use the language of traditional management based on large corporations, using terms such as competitive advantage based within the structure conduct, performance paradigm. The inappropriateness of such terminology and the implicit assumptions is further discussed in the Chapters 5 & 6 where the concept of evolving resources and capabilities are further discussed since it possible to conceptualise proportiional variation of picking and deploying behaviour by different management individuals or groups for different firm growth stages. The concept is further developed in Chapter 6 with reference to Flamholzt's work in combination with that of Brush and Green.(Flamholtz, 1986){Brush, 1996 #302

#### 4.2.5 Entrepreneurship and Innovation

Not every definition of entrepreneurship involves innovation. For some, it is merely the creation of a new enterprise {Gartner, 1988 #376}. The adoption of a Schumpterian economic, outcome based concept of entrepreneurship is considered the most useful study approach from an academic research, practical and policy making perspective following Bull (Bull and Willard, 1993). Simply creating a new enterprise where nothing new is introduced to the world, merely increases competitive pressures in existing markets. It does not create new ones through creative tides of destruction as described by Schumpeter. Without innovation there is no economic renewal either at firm or national level (Wennekers and Thurik, 1999).

Peter Drucker, like Schumpeter, indicates innovation is the tool of entrepreneurs, (Drucker, 1998). Determining the presence of entrepreneurship by association with certain resources and capabilities with innovation outcome makes sense. The balance of the entrepreneurial and administrative managerial capabilities can then begin to be assessed.The absence of innovation as an outcome of entrepreneurial behaviour is considered to be a flaw in much of the recent entrepreneurship research; a flaw which becomes a major problem if seeking to bridge the individual and corporate entrepreneurship literatures.

Successful entrepreneurial management then, produces innovation outcomes, using a micro level resource based view approach to study, which permits analysis of the patterns of management behaviour at different levels, individual, group or firm level; a pattern of behaviour which recognises and exploits opportunities for innovation (Stevenson and Gumpert, 1985, Stevenson and Jarillo, 1990). Entrepreneurship is a dynamic form of management geared to picking and deploying resources to build something of value, new to the world, from virtually nothing either in new enterprises or within existing ones. Resource acquisition and allocation continue to be used to achieve entrepreneurial management, a strategic orientation towards innovation, at all stages during a firm's life cycle producing novel and unique resource combinations and configurations, which create value for stakeholders and shareholders (Kazanjian and Rao, 1999).

An increasingly large literature for firm level entrepreneurship, broadly labelled corporate entrepreneurship has also emerged, dealing with firm level of organisational, strategic and transformational innovation(Covin and Slevin, 1991) but so far with the exception of a few Brush, Mullins and Cooper have examined the less glamorous firms in the middle.(Brush and Chaganti, 1996, Cooper et al., 1991) (Mullins, 1996), suggesting a need for such research. The complicated transitions that a chrysalis needs to make in transforming itself from Caterpillar to a butterfly deserve greater scrutiny. Examining the component parts of the transition involving the early board team human capital and their intangible management practices and organisational processesare associated with innovation and organisational growth capabilityform an important part of the process.

#### 4.2.6 Corporate Entrepreneurship

It is not sufficient to merely look at the individual entrepreneurship literature, if we are to understand its transition and evolution from individual to firm level. Established mature firms have become increasingly concerned with maintaining their competitiveness in a changing world and have increasingly looked at ways of achieving more successful innovation through more entrepreneurial patterns of management behaviour.

Study of firm level of entrepreneurship, corporate entrepreneurship has increased substantially in the last 10 years (Covin and Slevin, 1991, Zahra, Jennings et al., 1999). Unfortunately, the term corporate entrepreneurship, as for individual entrepreneurship, has come to have multiple and confusing meanings in the literature. Corporate entrepreneurship study is inspired by the desire of larger firms to maintain their capacity to grow at satisfactory rate to satisfy their shareholders and the financial markets. Pursuing innovative opportunities within their mainstream areas of business is one avenue open to them for achieving continued growth. Firms in maturing markets and industries experiencing a diminishing level of growth must find other routes to economic renewal and rejuvenation (Hamel, 1998).

Burgelman and early writers on entrepreneurship at firm level define corporate entrepreneurship as a new model of strategic behaviour in large established firms which identifies entrepreneurial activity as a natural and integral part of the strategic process (Burgelman, 1984). Innovation, the output of entrepreneurship occurs in many different ways within organisations and has led to a degree of confusion over the meaning of the term.

Earlier, entrepreneurial management processes are argued to be dynamic and change during the life of a firm according to the level at which they take place (individual group and organisation) and the context. The innovation outcomes of firm level entrepreneurship, corporate entrepreneurship are more sophisticated as one would expect from larger established firms in more mature markets, needing economic rejuvenation, and renewal. Innovation encompasses not only a product and process innovation but organizational and strategic innovation, transformational domain redefinition. (Markides, 1998). (Covin and Slevin, 1990a). Corporate entrepreneurship can be seen as firm level behaviour designed to achieve different types of innovation. In some cases, diversification strategies are adopted to achieve further growth. Incidentally diversification became the other main area of Edith Penrose's research interests, which came to dominate in her later academic life, rather than growth in smaller enterprises.

Sharma and Chrisman's paper "towards a reconciliation of definitional issues in the field of Corporate Entrepreneurship" goes a long way to clarifying the position on the meaning of corporate entrepreneurship (Sharma and Chrisman, 1999). The corporate entrepreneurship literature generally, is a body of work which attempts to understand how a firm creates and maintains an entrepreneurial orientation (and by implication innovation, according to the definition of entrepreneurship adopted by the thesis) by investigating the corporate environment. (Shepherd and Krueger, 2002).

The corporate entrepreneurship and diversification literatures are large and cannot be tackled here in detail, except to comment, perhaps, that the definitional confusion within corporate entrepreneurship is the result of a failure to recognise several critical factors; firstly, the role of innovation in entrepreneurial management; secondly, the change in locus of entrepreneurial management necessary during firm evolution and growth. Finally, as a consequence of the shift in locus, the managerial processes, and resources, necessary to produce successful innovation outcomes can change quite substantially in nature overtime.

Failure to define entrepreneurial management as an activity with innovative outcomes, which requires requiring different resources and capabilities as it changes locus during firm evolution, creates a fundamental barrier to understanding why some firms grow successfully and others do not. Something easily addressed by a greater level of academic study working within the resource base view of the firm. The thesis attempts to address part of the transition process by examining the necessary resources for the early board team and the necessary management practices and organisational processes associated with innovation.

Chapter 4 has explored the key frameworks of resource based theory within strategic management and entrepreneurship and the path which has been followed in identifying an interesting foundation in Penrose's work to extend further study on the limitations to growth of smaller firms by examining the managerial team; defined here as early board team, their human capital resources and ability to maintain simultaneous entrepreneurial and administrative management capabilities to ensure continued innovation for EISME renewal and survival.

Chapter 5 now proceeds to examine the existing literature on board teams in smaller firms in more detail. It concludes with an examination of research studies on innovation in small firms.

# CHAPTER 5: BOARD TEAMS AND INNOVATION

## 5.1 Introduction

Chapter 5 reviews the literature to determine the early board team human capital resources responsible for picking and deploying organisational resources to achieve innovation outcomes. Using the resource based view of the firm within strategic management and the management approach to studying entrepreneurship, Chapter 4 identified a path in which to study firm emergence. A particular strand of RBT work, as described by Rugman and Verbeke, using both Penrose's analysis of early management and Teece's dynamic capabilities approach, is embraced to scrutinize more closely the balance and sequence of firm resource development in EISMEs (Rugman and Verbeke, 2002). In the course of the chapter, an argument is made for the use of value creation as an alternative concept to that of competitive advantage in EISMEs to ensure greater relevance of strategic management for smaller firms, where ownership and control are not separated. The RBT and entrepreneurship perspectives adopted permit a micro level analysis of firm resources, notably those of the early board team, its capabilities, and outcomes achieved. Three particular gaps in firm evolution knowledge are identified; firstly, the neglected early board team board and their human capital resources, considered critical to maintaining an appropriate balance between entrepreneurial as opposed to traditional administrative managerial capability. Secondly, Schumpeterian innovation as an output is discovered to be rarely used as a measure for entrepreneurial firm performance; a surprising omission given the dominance of the Schumpeterian innovation concept in much of the literature.

Thirdly, although innovation management literature deals extensively with the activities of groups and innovation in the larger firm context, there is a remarkable absence of study of a group level of entrepreneurship related to the early board team level in emerging smaller firms. The call for a transition to so-called professional management during firm emergence is considered a fallacy, as it fails to recognise the value of continued innovation for EISME renewal and further growth. Entrepreneurial management does not just take place in the elite, high-growth, high-tech firms with full management teams as Beckman et al point out. It applies to all sizes and age of firm regardless of context. (Beckman et al., 2006). Entrepreneurial management, involving picking and deploying resources for innovation is considered one end of a spectrum of managerial orientation. Firms, in particular EISMEs, need to alter the balance between picking and deploying resources either simultaneously, or in sequence. Entrepreneurial management must continue, shifting its locus from the founding individual(s) to the early board team if an EISME is to evolve and emerge.

Chapter 5 continues the literature review by firstly, endeavouring to determine the essential critical human capital resources for successful early board teams by examining existing board team literature for both small and large firms. Path dependency is established through the accumulation of firm specific resources and capabilities, such resources include those of the early board team (Augsdorfer, 2005). The board resource characteristics required for successful EISME performance are not necessarily the same as those found in large established firms. A brief review of the innovation literature follows, defining innovation and its role in the firm and economy. The nature of innovation output for small and large firms is discussed with a view to identifying the innovation type to be used as an outcome measure for EISMEs. As a firm evolves and emerges, the locus of entrepreneurial management and the type of innovation undertaken shifts to match environmental and market needs (Low and Abrahamson, 1997), requiring a different pattern of resource picking and deploying the development of appropriate new capabilities and competences. The Chapter concludes with the selection of simple human capital resource categories for EISME early board teams and puts forward to hypotheses for testing by quantitative means.

### 5.1. 1 Critical Resources for EISME Early Board Teams:

A certain level of human capital resource is deemed necessary within the early board team to ensure continued innovation and further growth. As the complexity of the operation increases the depth and breadth of those early board team resources must increase, accompanied by increasingly sophisticated organisational capabilities. Penrose argues that the managerial team, a unique and specific firm resource, which combines individual resources and capabilities, plays an important role for small firm growth and can constitute a significant barrier to growth. Remarkably few researchers have attempted to extend Penrose's argument on board team size and composition in smaller enterprises as a means of exploring why some firms grow and not others. Recently a small but increasing volume of work focusing on small firm resources has appeared including work by Chaston, Cowling, Brush and Green, (Brush and Chaganti, 1996, Changanti and Mahajan, 1989, Chaston and Mangles, 1997, Cowling, 2003, Lichenstein and Brush, 2001) (Hadjimanolis, 2000). Work of specifically addressing board team in small firms is limited although Huse sets out a research agenda (Huse, 2000). Board teams and their influence on firm performance have not been often addressed except by Bennett and Hughes below. Their work examines the role of boards in small and medium-sized firms through three concepts taken from large company corporate governance literature: concepts of resource dependence, counselling, and control respectively to the smaller firm. Of these concepts, resource salience of Pfeiffer and Salancik (Pfeffer and G.R., 1978) certainly has relevance to smaller firms but the value of the other two is dubious. Mosakowski examines entrepreneurial resources organisational choices and competitive outcomes are both entrepreneurial individuals and entrepreneurial teams but the entrepreneurial team she refers is clearly within a larger established firm(Mosakowski, 1998).

Superior firm performance cannot be takeover granted as the objective for SMEs. As seen earlier, maximum profit cannot be taken for granted in the small firm context (Curran, 1986). Not surprisingly, their results show no evidence of a strong association between board size, educational qualifications, and board structure with firm performance, profit, or employment growth. The lack of separation between ownership and control undoubtedly has a bearing. Viewed through the resource based perspective, it is not just the individual owner manager, as Hadjimanolis argues, but the early board team which emerges as the principal orchestrator of resource accumulation and capability development (Hadjimanolis, 2000).

The research examines the solid majority of smaller firms which make a substantial economic contribution to the nation rather than following the obsession with picking winners to identify the few faster growing firms (Beaver and Jennings, 1995). If government policy wishes to encourage firm innovation and organisational growth capability, the issue of how firms, commencing with one or two individuals can successfully add to their early board team resources and capability must be accepted as a critical part of the smaller firm development process and general. Of specific interest are the human capital resources which compose the basic building blocks of the early board team. The early board team human capital resources influence the management practices and organisational processes and determine firm future direction and management orientation. As Hite and Hesterly indicate, the stage between emergence and early growth is a critical one, where tension exists between different types of management practices and processes. Obtaining the right mix of board team human capital will therefore make a difference to success or failure (Hite and Hesterly, 2001). For smaller firms, the intrinsic value of the human capital resource, individual or board team may substitute for more explicit firm structures and systems through the impact on the emerging tentative experiential organisational processes, in both the early stages of board team development.

Human capital can be defined as general or specific (Cooper et al., 1994). Cooper et al indicate that the founding entrepreneur provides the firm with general human capital and resources in the form of their life experiences and education. The more diverse is the level of human capital the more able the individual (and by implication, the team) to develop their capabilities. In particular balancing of entrepreneurial and "administrative" management capabilities, must be facilitated by greater human capital within the early board. The potential for vital small firm networking, necessary for leveraging resources, is increased with a larger number of board members but only if they possess the appropriate human capita , including firm size experience.

Successful innovation also requires a combination of resources and capabilities within the early board team to ensure learning and knowledge creation (Collinson, 2000) (Gray, 2002) (Zahra and George, 2002). The process of honing organisational capability is a task for the early board team must learn. (Teece et al., 1997). It can either develop managerial as opposed to entrepreneurial capability or can attempt to balance or sequence their management resource allocation behaviours: picking and acquiring new resources, deploying them to achieve new combinations and new capabilities for successful innovation. In other words, create a process of balancing routine administrative management with entrepreneurial management to achieve continued innovation outcomes. The board team may deliberately create new capabilities or they may evolve and emerge on their own. Causal ambiguity can therefore exist in the creation of valuable unique firm specific resources and capabilities, which can be as an effective barrier to duplication by the early board team as by potential competitors on the outside (Wilcox King and Zeithaml, 2001). A significant factor for firm failure to emerge, not yet studied.

Knowledge of the precise human capital resources which underpin learning and knowledge creation in an early board team are therefore of clear interest to researchers. The board team human capital acts as an intervening or moderating variable on many organisational processes and outcomes. Innovation outcomes are of particular significance to the study as the end product of entrepreneurial capability within the early board team. At the other end of the scale, in the corporate entrepreneurship literature, much research has been carried out to determine how a firm can achieve or sustain an entrepreneurial orientation (Brown and Eisenhardt, 1995). No research has been applied to specific board team composition and the factors known to be associated with entrepreneurial orientation (Shepherd and Krueger, 2002), which constitutes a research deficiency in understanding how firms evolve.

### 5.1.2 Life Stage Growth Models

A logical place to identify the essential human capital resource ingredients for early board teams might be the life stage growth models. Stage models have been produced by the new Greiner, Steinmetz, Scott and Bruce, Churchill and Lewis and Flamholtz (Greiner, 1972) (Steinmetz, 1969) (Scott and Bruce, 1987) (Churchill and Lewis, 1983, Flamholtz, 1986). Unfortunately the firm stage growth models shed very little light on just <u>how</u> firms grow. They have been reviewed and criticised by many including Storey and Gibbs as being overly descriptive and lacking in empirical grounding (Gibb and Davies, 1991, Storey, 1994). Most growth models provide 'common denominator' stages of growth, which might be useful to those attempting to categorise firms externally but aren't particularly useful for pragmatic managers and owners wanting to grow their enterprises.

Unwarranted assumptions abound: a firm must grow; a firm must pass through all stages for instance. Only the Churchill and Lewis model makes an important distinction in understanding smaller firm growth in differentiating between firms where the owners remain engaged or become disengaged. Those in the latter category preserve the status quo as they pursue other interests and can continue "as it is, be sold or merged at a profit, or subsequently be stimulated into growth" (Churchill and Lewis, 1983). Or are they disengaged? Is this just another unwarranted assumption? Anecdotally, many owner directors claim they are pursuing enterprise growth. Is as camouflage for disengagement, or does it represent a management competence gap? Further study of EISMEs will determine whether Contras recruitment of specific human capital to the early board will help the directors achieve modest levels of growth which are still of economic benefit to the nation without stretching the resources and capabilities to far.

For the EISME firm size sector, the growth ambitions of those who would like to profit from firm expansion (central and local government, banks and professional service providers) should be treated with caution if it leads to the imposition of inappropriate management concepts and tools, which do not recognise the reality of the owner directors objectives. The five stages outlined by Churchill and Lewis; existence, survival, success, takeoff and resource maturity, may be useful in conceptualising the emergence process but provide no more than a signpost to potentially different resources and capabilities for an emerging firm. A more finely grained examination of the resources and capabilities for each stage is required

Greiner, in describing a firm's progress as a series of crises – revolutions which precipitate evolution – misses an important point. Such revolutions may well be characteristic of the more poorly performing firms (as described by Mullins(Mullins, 1996) and not represent the successful incremental evolution undertaken by 'successful' board teams. But how is "success" defined here? If strategic management is to have relevance to owner directors, the term success must encompass value creation - value creation which is not published profit, increase in sales and employees. Declaring a profit which only benefits the taxman, not the principal shareholders who also happen to be the management is clearly not the name of the game. "Amenity value" to the founders, as described by Gimeno et al is a lot more to the point and means that the process by which resources are acquired and allocated to build capabilities can be approached in a way that owner directors understand. (Gimeno et al., 1997). As Churchill and Lewis identify, some firms may well be subsequently stimulated into growth. These authors identify both management and firm influences to the pattern of growth: managerial style, organisational structure, extent of formal systems, major strategic goals and the owner's involvement in the business. These measures of growth are viewed through the lens of a large firm growth and effectively cut off those firms where the managers are also owners. The other factors managerial style, structure, strategic goals and extent of formal systems also fail to recognise the need to retain innovation capability alongside the development of routine administrative management.

Scott and Bruce, as Steinmetz, consider firm growth in terms of the type of management control present, categorising control as direct supervision, supervised supervision, indirect control and divisional organisation(Scott and Bruce, 1987). The levels of control increase as the firm develops in complexity. Failure to evolve an appropriate management style limits growth – "the Penrose effect" in essence. Steinmetz identifies the management structure of the organisation as an identifier for the growth stage. How to get from one type of management control to another is left unaddressed in this model. Curiously, the point at which a firm develops its first functioning board team is not recognised as a critical stage. Churchill and Lewis do indeed suggest the models take insufficient account of very early stages of firm emergence but size is solely conceptualised in terms of annual sales or sometimes employees, not always helpful in examining sometimes lumpy firm evolution. Important factors to firm growth are ignored; value-added, number of locations, degree of complexity, and the rate of change in products and production technology and most importantly board size and resource.

The authors point out, interestingly, that at this stage 'professional managers' must come on board and thereby miss the important issue of balancing entrepreneurial and traditional management to ensure all important economic renewal through innovation. The organisational processes and routine developed within the firm in the case of imported professional management are therefore guided by people who do not have the same vision of the firm's direction and import processes and routines utilisation from elsewhere, aimed at maximum resource utilisation - only half of the management equation.

The stages described within the growth models are merely descriptive, each stage represents a different type and style of picking and point resources to build capability. If innovation is also an objective, the shift in the locus of entrepreneurial management over time needs to be taken into account when considering the resource and capability profiles for each growth stage. The models impart insight into the human capital resources of the board team and their capabilities. Just how resources must be configured to achieve the necessary management orientation for continued firm innovation, evolution and emergence are not addressed in any of the stage growth models. How does an early board team allocate, and deploy its resources to create the necessary new capabilities and competences required by the increasing complexity of the organisation? What are the underpinning human capital resources? How must they change as organisational complexity increases? All questions to be addressed if we are to understand how smaller firms emerge.

Flamholtz makes a rare attempt to present a conceptual framework for understanding firm growth stages involved in the transition from entrepreneurial to professional management. Unfortunately, Flamholtz, like the other lifestage growth models fails to make a sufficiently detailed level of analysis of the earlier stages of firm emergence and early growth to justify the claim of mapping the path between entrepreneurship and professional management. Factors known to influence larger organisation development are applied firstly without appreciating the dependence of emerging small firms on their board team human capital. Secondly the need to carry out management functions differently to larger firms rather using the formal structures, systems and routines of larger companies is neglected. Fragile, fluid practices and processes, continuously varied to find the best outcomes are more dependent on the human capital than on systems and structures. Flamholtz does however provide some useful pyramidal portrayals of organisational development, from a resource based perspective which can be used in adapted form to illustrate the intermediate transition process that the evolving EISME board team nneds to undertake. The concept is further developed in Chapter 6.

### 5.1.3. Team Definitions

Before going any further in the review of literature, the term board team must be defined to outline key elements of existing research. Companies House information states a board team of a private limited liability company must have a minimum of a director and a company secretary. For a PLC, two directors are required according to company law. A definition of an entrepreneurial team in the literature is harder to find according to Kamm and Shuman (Kamm and Shuman, 1990). They define an entrepreneurial team as a team where two or more individuals, jointly establish a business in which they have an equity interest. Not so different to the above companies house definition, then. Scrutiny of the literature reveals designation of the term entrepreneurial team is used to imply ambitious growth objectives with associated management styles and strategies needed to achieve fast growth. Teams referred to in this context are substantially larger, consisting of board teams representing all the management functions at the outset – a minimum of 4 or 5 people. The early board team within an EISME can therefore potentially consist of either two to four with a maximum of five people.

### 5.1. 4 Early Board Team Definition

An early board team is defined as two or more individuals acting as directors, executive or non-executive, in firms which employee 20 or more. It may be a team which is either on the threshold or in the throes of developing an effective board team. Or alternatively, it might refer to a simple board of two people, possibly in an arrested state of development for a variety of reasons. A first tier of supervisory management may exist but there are few, if any senior managers within the firm. The term is used to describe those directors of the firm, executive, and non-executive who may or may not own equity in the EISME. It is important to note that early does not necessarily mean early in time, only early in the sense of board development as a necessary part of the firm's emergence.

Cowling describes the corporate governance structures of small firms as relatively unsophisticated and non complex in one of the few papers to examine the area (Cowling, 2003). If firms are to grow, the board team structures and alignment processes must evolve for increased output and efficiency and productivity. Pettigrew identifies six themes to the study of managerial elites applied to larger organisations and institutions: interlocking directorates and the study of institutional and societal power: the study of boards and directors; the composition and correlates of top management teams; studies of strategic leadership decision making and change; chief executive compensation; chief executive selection and succession (Pettigrew, 1992). Of Pettigrew's themes, board demography, composition, and correlates are of principle interest here for examining the critical human capital resource within the EISME early board team likely to foster both managerial and entrepreneurial capability. The risks and rewards of the whole EISME board team are also significant and covered in greater detail in Chapter 6.

### 5.1. 5 The Board Team Function

Cadbury summarises board function, in his 1992 report, as the definition of company's purpose, agreement of strategies and plans to achieve that purpose, establish the company's policies, appoint the chief executive and to review his performance and those of the top management team, and generally be the driving force of the company (Cadbury, 1992). An uneasy fit is immediately apparent with what is known about the operation of smaller firms. It assumes a separation of ownership and control where the board is managing the company on behalf of the shareholders (Fama and Jensen, 1983). Cadbury's statement assumes the presence of traditional "rational" management. Board members have responsibilities enshrined within national company law and must operate within these parameters. In EISMEs, where the owners control the firm and do not necessarily have profit maximisation as their prime objective, the reality is somewhat different (Curran, 1986) (Short, 1994).

The board team, entrepreneurial or otherwise, has responsibility for direction of the firm's activities according to the objectives set by the owners, and is essential to informed decision making for strategic orientation and achieving operational and strategic change according to Huse (Huse, 2000). If the owners also control firm management than personal and business objectives become quite naturally intermingled in a way which would be most unacceptable to external shareholders. Small firms, and their board teams by implication, must evolve very quickly in order to survive and grow, even modestly. Gibrat's Law, as discussed in a previous chapter does not hold. The role of the early board team is therefore peculiarly important to firm emergence and early path dependence in EISME's. The board team has the potential to set and regulate the initial guiding and control mechanisms within the firm by adopting certain management practices. These in turn create a suitable organisational setting for continued entrepreneurship according to Covin (Covin and Slevin, 1991). The management practices and organisational processes deemed a critical part of the transition process, put in place as control mechanisms by the early board team are described in greater detail in chapter 6.

### 5.1.6 Board Teams in Established Large Organisations

Board teams, variously referred to as top management teams, managerial elites or upper echelons of management in the studies within large established firms have been an important subject for research for a long time. (Hambrick and Mason, 1984) (Conyon et al., 2001) (Daily and Dalton, 1993). Pettigrew claims the study of managerial elites is one of the most important yet neglected areas of social science research. Study of boards and their directors should rank near the top of any management scholars list of priority research areas as they play such a key role (Pettigrew, 1992) p169. The study of boards and their composition and its dearth of basic descriptive information on the composition, conduct, and performance of boards and their directors outlined by Pettigrew apply equally if not more to smaller firms.

The impetus on board team research generally was subsequently increased by two important reports by Cadbury; (Cadbury, 1992) and Hampel (Hampel, 1998) exploring issues of corporate governance. If there is a study shortage on board teams for larger firms, it is even more the case for smaller ones. Especially if the characteristics of large firm board teams are not necessarily applicable to smaller firms as Weinzimmer suggests (Weinzimmer, 1997). Board teams evolve along with the rest of the firm. Arguably board team formation is part of a path dependent process so its origins and resource characteristics, early emergence and evolution stages should be of interest to academic research across the full firm size scale, yet it is rarely studied. Between the two areas of research, the established firms and high-growth entrepreneurial independent ventures, many researchers such as Huse, Gartner and Kamm and Shuman, Cowling, Gabrielsson and Johnson, do indeed argue that a critical gap remains for further study on small firm board teams, (Gartner et al., 1992, Kamm and Shuman, 1990).(Cowling, 2003, Gabrielsson and Winklund, 2000, Huse, 2000, Johnson et al., 1996). }.

### 5.1. 7 Smaller Firms

Research on human capital in smaller firms focuses on the influence on firm performance and deals mostly either with the individual entrepreneur in start-ups or with entrepreneurial teams in high-growth, ambitiously scaled the ventures. EISME board teams are rarely examined in the research literature. Human capital resources can be approached from another direction as literature also examines the human resources necessary for innovation in smaller firms, which was addressed in the second section of the chapter. Using innovation is a performance outcome may well be more appropriate for measuring the emergence of smaller firms and board teams as previously argued

The smaller firm literature on human capital resources generally divides and into the following subdivisions:-

1. *Board team size* including its split between executive and non-executive directors and the propensity to seek external advice. For the sake of convenience firm age and the impact on the number of directors is included in this category.
2. *Board team demography*, including age, heterogeneity / diversity of experience, including management function coverage, previous experience of working together, tenure or service length within the firm and industry, firm type experience and last but not least educational attainments
3. *Ownership* including the role of the founder and its continuing impact over time, succession planning inside and outside family ownership, ownership rewards, and incentive packages.
4. *Internal dynamics and social interaction* within boards and their impact on practices and processes influencing innovation and firm performance.

### 5.1. 8 Human capital and small firm growth

Storey usefully summarises the research up to the early nineties relating to successful start up and small firm growth in his book - Understanding Small Business (Storey, 1994). His summary provides an insight into the key resources required as building blocks for firm growth but centres largely on research based on individuals rather than teams. Storey identifies 15 individual human capital factors from existing research associated with growth in firm employment including motivation, unemployment, education, and management experience, number of founders, prior self-employment, family history, social marginality, functional skills, training, age, prior business failure, private sector experience, and gender.

Storey's review helps identify simple proxies for aggregate board team human capital resource most likely to influence entrepreneurial management orientation and successful innovation in EISME's, taking into account the lack of separation and control within board teams. Using these factors as a starting point, education, management, and industry experience, number of founders, age, and sex are selected for further investigation as these resource characteristics are relatively easy to determine in practice for research purposes. The research findings for small firms, entrepreneurial venture teams and large corporation board teams are now reviewed to confirm whether these particular human resource characteristics might be appropriate for those "in the middle".

### 5.1.9 Entrepreneurial Teams

A variety of studies identify small firms as characteristically having two to three directors: Berry , Bennett and Cowling (Bennett and Robson, 2004, Berry and Perren, 2001, Cowling, 2003). The large firm literature identifies six board members as the ideal size before decreasing performance returns set in (Haleblian and Finkelstein, 1993). Just how a firm moves from three to six board members is rarely addressed but is clearly of interest if firm evolution is to be understood. Kamm and Schumann consider that entrepreneurial teams in new ventures, many in the context of high-technology or venture capital backed high growth firms have attracted considerable research attention but " relatively little is known about the process of assembling and maintaining an effective entrepreneurial team" in other smaller firms. (Huse, 2000, Kamm et al., 1990). Implicit in some of the literature, is that entrepreneurial teams belong to high growth businesses, with few recognising that many smaller companies, starting with limited resources and just two directors may well have considerable entrepreneurial capability. Vyakarnam et al. are the exception, where a clear perception of the difficulty of adding to the board team as the resources become available exists, recognising a journey fraught with difficulty according to Vyakarnam (Vyakarnam and Handelberg, 2005, Vyakarnam et al., 1999). Vyakarnam et al argue that "more fine-grained variables concerning team and individual processes have to be taken into account in order to better understand the link between entrepreneurial teams and organizational performance." They propose further examination of the links between board teams in new ventures in four separate areas; their resources, the structure of process effects of teams, task leadership and the effects of team members 'personal integration into the talks process'.

Research which examines the success factors for entrepreneurial teams, mostly in venture capital backed ventures includes work by Stuart and Abetti, Chowdhury, Aspelund et al., Thakur, Siegel, Hall, Roure and Maidique, and Kor and Mahoney (Chowdhury, 2005, Stuart and Abetti, 1990) (Aspelund et al., 2005, Hall and Hofer, 1993, Kor and Mahoney, 2000, Roure and Maidique, 1986, Siegel et al., 1993). The factor most associated with entrepreneurial team effectiveness by Stuart and Abetti's previous experience of the entrepreneur(s). In particular entrepreneurial experience of start-up and the number of previous new venture involvements at a senior level is found to be most influential factor amongst age, length of business experience, management and technical experience and education (Stuart and Abetti, 1990). For the technical ventures under study, surprisingly degree level education was negatively related to performance. The authors conclude that the best way of ensuring successful early performance was to work in a similar firm or to start-up new venture – "time spent in new ventures is dramatically more valuable than time spent in school or large firms." Chowdhury questions whether team demography (age gender and functional background) is the whole story, finding that demographic diversity is not important whereas the team process variables such as cognitive comprehensiveness and team commitment are (Chowdhury, 2005). Chapter 6 deals more specifically with process capability.

Aspeleund et al in a study of new technology based firms (NBTF) find the founding resources to affect a firm's successful evolution and indicate that they are part of the resources which are critical to successful devolution and emergence, along with heterogeneity in the functional experience of the founding team. They also find the more radical the technology to more likely they are to succeed (Aspelund et al., 2005). The Siegel study set out to determine factors which distinguished between high and low growth firms and structure the sample to determine whether growth characteristics varies at different stages in firm evolution. Substantial industrial management experience is found to be a common factor in both low and high-growth firms. Interestingly, the fact that one sample consisted of smaller firms brings them to draw the conclusion that resource constraints of the smaller firms influenced the choice of a closely focused product strategy, frequently a single product, compared to the larger firms where there was greater a product range and diversification.

Kamm and Shuman suggest that the dimensions of entrepreneurial teams need to be mapped and explored more thoroughly. But more than that is required, according to Zahra. A systematic and descriptive research approach is needed to examine the process of effectively assembling and maintaining teams as an essential stage in firm emergence and evolution as a full entrepreneurial team is not an affordable option for many firms (Zahra et al., 2000). The EISME is widely ignored despite its potential valuable contribution to the economy. Kamm and Shuman claim, quite correctly, teams with an entrepreneurial orientation are more prevalent than anyone gives them credit but no one has yet to look at the less glamorous firm sector (Kamm and Shuman, 1990). Teams emerge in various ways; not all appear at start up but can emerge at later stages of firm growth. Not all are associated with rapid growth, the centre of so much research attention.

**5.1.10 Board Team Size**

The lessons learnt from the larger corporate governance literature indicate that team size matters for a variety of reasons, all leading to improved firm performance (Knight et al., 1999). (Hambrick and Mason, 1984) (FiegenerBrown and Dreux, 2000). Size studies for smaller board teams as opposed to entrepreneurial teams, are few and far between, with work by Cowling and Eisenberg et al. the exceptions (Cowling, 2003) (Bennett and Robson, 2004, Eisenberg et al., 1998). Cowling finds that firm board size (including the presence of non executive directors) does act in a significant and positive man of an output, especially if they are owners rather than managers. (Cowling, 2003). For larger companies, generally speaking a negative correlation between firm value and a size of the board team exists. Cowling, however, finds that smaller firms are likely to benefit from increasing their board size, empowering more managers, and recruiting non-executive directors (Cowling, 2003). Smaller firm boards start however from a much lower base of one or two working directors.

Bennett and Robson find average for team size to be two to three directors but find board team size has a non-linear relation with firm size (Bennett and Robson, 2004). It takes time to generate internal capability across-the-board team and gain the maximum benefit from increased team resource according to a number of researchers (Zahra and George, 2002) (Daily and Dalton, 1993) (Haleblian and Finkelstein, 1993) (Penrose, 1959). Board team size can only expand at certain rate without causing breaks or strain in the firms resource development path as illustrated by Penrose (Penrose, 1959). Effective EISMEs board teams may be smaller than those in their larger counterparts, simply because there are yet no established routine or codes of conduct to make settling in easier. The culture is in a perpetual state of evolution with no set guiding and control mechanisms.

Eisenhardt, in research on large firms, identifies boards of six or more in publicly quoted companies as the ideal; an impossibly large number for a small firm (Eisenhardt and Schoonhaven, 1990). Bennett and Robson in a large scale survey of SMEs identify teams of two or three as the most common team size (Bennett and Robson, 2004) but find little evidence of a strong association between board size, board qualifications, or board structure. Smaller board teams seem likely to be more effective in EISME's, better able to cope with the necessary learning processes during growth, a topic explored in greater depth in the following chapter. Eisenberg finds board size and firm size for small companies in Finland are positively correlated, not with the classic performance measures but with return on assets (ROA); potentially taking into account the differing objectives of owner directors (Eisenberg et al., 1998). Smaller board size is related to profitability, not a surprising finding maybe, but a contributory factor to keeping a board size small from the owner director's point of view. An interesting conundrum thus arises, profitability goes down if the new board member is recruited, yet unless the board team resource is expanded it will ultimately limit potential growth: precisely the dilemma that Penrose identifies.

Cowling, however, looks at small firms as being led very much by one individual rather than the team, which may constitute a limitation to the research (Cowling, 2003). Whether widened share ownership and expanding board size has any material input in terms of increased efficiency and output is considered by Cowling. Cowling finds board size to act in a significant and positive manner on output, especially if these are owners rather than salaried directors. The suggestion is made that a different configuration of board team resource, in terms of numbers and mix between executive and non-executive directors, may work just as well. It is suggested that the departure of a founding entrepreneur from the board team would need to be replaced by two other board members, to replace the accumulated experience. Cowling concludes that firms would gain more from increasing their board size, empowering more managers, recruiting non executive directors and generally increasing their labour force (Cowling, 2003). Growth objectives are assumed to exist.

Aldrich and Cooper both separately consider that a board of a certain size and human capital profile provides access to skills and resources not available to an individual entrepreneur (Aldrich and Zimmer, 1986) (Cooper et al., 1994) (Chandler and Hanks, 1998). Larger board teams with greater resources, as outlined by Penrose, take time to make those resources effective, slowing expansion (and profitability) temporarily. The board's span of control is increased; more attention to development of management functions can take place (Chell and Baines, 2000). Larsen, Borch and Ostgaard and Birley all point out networking potential at personal, social and interfirm levels can potentially increase as the board size increases in a way which helps with the pursuit of a parsimonious path to entrepreneurship(Larson, 1991) (Borch and Huse, 1993) (Ostgaard and Birley, 1996).

Is there an optimum size of board team for a particular stage of firm development and industry? For top management team in large corporations, the consensus optimal number appears to be six board members (Jensen and Meckling, 1976). An entrepreneurial team is characterised by a smaller number of people but representing all the management functions (Boeker, 1997), possessing the ability to leverage growth through use of external resources (Jarillo, 1989). Particular environments may require different qualities of human capital within the early board team depending on whether the environment is benign or hostile (Covin and Slevin, 1989). Board members with engineering or science degrees are certainly associated with better success levels for high-technology ventures in many studies including Chandler's (Chandler, 1993). Quality of the human capital resource, in terms of previous experience and higher education levels, could conceivably reduce the board member 'quantity' required, facilitating communication, and mutual learning necessary to expand the team, a concept explored by Cowling with no fixed conclusion (Cowling, 2003). Eisenberg suggests board size reflects the evolving nature of the firm, and is correlated with board composition variables and can therefore explain firm performance. Companies according to Eisenberg adjust board size upwards in response to poor performance; a finding which is counter intuitive for EISME's, as this will simply slow firm's evolution as board activity is coordinated.

Little evidence exists for this but Mullins suggests that poor performance does shake previously complacent owners into action (Mullins, 1996). Eisenberg suggests maturity causes boards to evolve and change in nature, although evolution may not be beneficial. Eisenberg's study is handicapped by his use of the ROA outcome measure here, which would favour managerial over entrepreneurial capability as short-term profit is preferred over a longer term survival. Engaging in innovation - entrepreneurial capability is likely to reduce profit in the short term but ensure firm longevity and economic renewal compatible with other owner director objectives, characteristic of EISME's.

Board size can therefore be used as either a proxy or moderating variable for EISMEs, if interpreted as a sign of deliberate intent to increase the resources available to the firm. It may be a response to poor performance or a desire to grow the firm further. Board size increase may not be beneficial if the internal resource composition is not well judged. Atkinson and Storey find founding entrepreneurs frequently recruit in their own image, recruiting others with a similar skill and knowledge base to their own rather than ensuring that all management functions are systematically covered. (Atkinson and Storey, 1996). In the words of Zahra and Filatotchev, a 'lopsidedness' to the resources may exist that might limit the emerging firm's ability to import, assimilate and use knowledge from both internal and external sources (Zahra and Filatotchev, 2004). The implications of a lopsided resource base will reduce the ability of the board team to search for and share new knowledge and make decisions, vital to innovation. In Madokok's terms, new resources need to be acquired and suitably deployed to produce new resource combinations(Makadok, 2001)

Many owner directors of EISMEs are reluctant to expand their board teams, perceiving a loss of control either in promoting or recruiting additional executive or appointing non executive directors (Berry and Perren, 2001). Maintaining both entrepreneurial and managerial capabilities will become difficult as a consequence through lack of appropriate managerial resource. Owner directors within emerging firms may be unable to communicate a clear vision of the future through lack of knowledge, education and experience to other board members, even if they do recruit other team members. The degree of experience in other firms and in other industries may well have a role to play in expanding horizons. The original founding directors may find it difficult or actively not wish to share or delegate their decision-making authority to later board recruits, as Vyakarnam suggests, creating inner and outer teams where conflict may arise, producing a clash of culture, inherent beliefs and values and preventing full team integration (Vyakarnam et al., 1999). A potential problem for successful emergence of the board is thereby created, especially when share ownership rests solely with the inner team. Outer team directors can be financially motivated with short-term incentive schemes based on profit or sales, not compatible with long term survival objectives. (Baysinger and Butler, 1985). Alignment of incentives within the board team is a central to unified team direction and action is discussed later.

Additional EISME board members add resources but the potential generated is far greater than the sum of the parts. The individual human capital represented by their education, knowledge, and experience is important to the knowledge base. Learning is indicated by Lechler and Shepherd, is likely to increase through dynamic interaction between board members if knowledge levels are high and communication good, dependent on the level of social interaction and trust engendered between the team (Lechler, 2001, Shepherd and Krueger, 2002). Team human capital is more than the sum of individual component parts. Social interaction is shown to be a factor in new venture success demonstrated by Lechler.(Lechler, 2001). Board team human capital is a unique firm specific resource, created by their interactions, through sharing of knowledge and experience and taking informed decision together. The components are therefore important, as Norburn shows, albeit in the large firm context, in influencing board integration and the manner in which it functions (Norburn and Birley, 1988).

### 5.1.11 Executive Directors and Non Executive Directors

A route to board team resource expansion without the permanent commitment of appointing an executive director is to use non executive directors. Such strategies have been examined in the small firm context by a number of researchers including Berry, Huse, Bennett and Robson and Fiegener. (Berry and Perren, 2001) (Huse, 1998) (Bennett and Robson, 2004) (FiegenerBrown and Dreux, 2000). The numbers of executive and non-executive directors and the proportion to each other may be significant although Berry and Perren find no significant difference to the performance of SMEs with non executive directors on board. Bennett and Robson in their study find that external consultants act as substitutes for resources within board teams(Bennett and Robson, 2004).

Choice of the 'classic' large company performance measures may be a problem here. Non executive directors for EISME's may well be family members or possibly retired founders who may not significantly add to the resources available. (Ucbasaran et al., 2003). Berry and Perren note board member interaction is complex with the possibility of mediating variables at work. Perhaps not surprisingly, they find firms employing one to fifty had relatively few non executive directors, but rose quite sharply thereafter, suggesting that increasing complexity may require extra resource assistance. The same study finds the nature of the non executive director changes at this point too. Smaller firms find non-executive directors from amongst family, friends, and contacts, and generally sought financial advice above everything else. A finding consistent with the emphasis on the use of personal networks and social capital in new ventures and very small firms (Chell and Baines, 2000).

Firms employing above fifty, tended to look further afield employing bankers and accountants as referral agents to identify useful potential non executive directors (Berry and Perren, 1998). 'Names', non executive directors with a high community profile tended to be favoured at this point perhaps as a means of achieving network contacts and resources. Berry and Perren suggest, as does Jarillo, emerging firms need to change their non-executive director to meet a different set of resource needs as the company evolves (Jarillo, 1989). Jarillo finds that firms must make a necessary transition from dependence on personal networks to extended interfirm ones. No conclusive evidence was found by Berry and Perren to show that the presence of non executive directors (NED) influenced the company performance but it may be their contributions are more intangible in terms of knowledge, advice, and contacts. More successful innovation could well be an output of non-executive directors with the necessary experience.

On the other hand, Cowling, contrary to Berry and Perren, finds that the addition of a non executive director does increase output in equivalent manner to the entrepreneurial effect of increasing the board team. Different industry sectors may well have a different profile, not explored in either set of research. A significant factor of entrepreneurial management capability is the ability to access external resources beyond the immediate control of the founder and firm. If non executive directors are used in this manner, then they are an important indicator of an entrepreneurial capability but differentiation of type of non executive Director will not be easy in a sector where the family firm is so dominant. (In 2003 76% of all SMEs were categorised as family businesses, decreasing to 66% in 2004 according to the small business service (Small Business Service, 2002, Small Business Service, 2004, Small Business Service, 2005).

### 5.1.12 Board Team Demography

Board team tomography its diversity or heterogeneity is recognised to affect firm performance by many writers, (Chandler and Hanks, 1998, Kor and Mahoney, 2004). Pitelis considers the board team subjectively interprets their environment and its inherent restrictions using their own world view as a lens, determining their management behaviour and the decisions taken (Pitelis and Wahl, 1998). Previous personal, educational and work experience shape individual and team cognitive structures and attitudes according to Hayes and Zajac (Hayes and Abernathy, 1980, Zajac, 1990), which in turn influence the decision making of the board team (Shepherd and Krueger, 2002). If entrepreneurs, as argued by Casson, have superior decision making skills in the allocation and combination of resources, it must rest on the quality and nature of the human capital resources in the board team (Casson, 1982) Firms are collections of people with diverse ontologies temporarily collected under one roof for a specific purpose, work according to Ray (Ray, 1993). They adopt the culture and work ethic of the organisation to achieve mutual agreed objectives. But as Penrose points out, small firms are as unlike large firms as a caterpillar is to a butterfly. EISME Board member additions must share mutually agreed objectives, a point to which the research returns.

Several researchers consider the diversity of experience within the board team clearly has an impact on how the firm performs, influencing structures, and processes (Eisenhardt and Schoonhaven, 1990) (Hambrick and Mason, 1984) (Finkelstein and Hambrick, 1999) (Knight et al., 1999). Experience comes in a variety of forms; through length of board member tenure, previous company, or industry experience, functional management experience, outside industry experience and the experience of similarly sized firms or even firm stage of development such as start-up may all be factors contributing to a successful board dynamic and a propensity to innovate. Conflict as a result of diverse experiences can challenge thinking and produce better discussion and decisions according to Eisenhardt (Eisenhardt et al., 1997). In the final analysis, team diversity in terms of tenure and experience as shown by Finklestein and Hambrick, affect the choice of strategic direction by challenging existing set of values and beliefs.

In an early board team however, such diversity may be counterproductive if only minor incremental changes are sought, rather than more radical strategic change. Finkelstein considers major diversity of experience within the board team may only apply to firms in maturing markets and industries (Finkelstein and Hambrick, 1999). Insufficient evidence exists for the necessary degree of diversity of experience and for EISME board teams exists but there are clear differences between board team human capital between small and large firms, which means be appropriate for the different firm development stages. Recognising these differences may well help with firm emergence.

### 5.1.13 Industry experience

Experience from inside the firm's industry is more likely to lead to commitment to innovation from boards than experience in a non related industry according to several studies(FiegenerBrown and Dreux, 2000) (Chandler, 1996) (Hayes and Abernathy, 1980) (Hambrick, 1983) (Bantel and Jackson, 1989). Boeker likewise finds that newly arrived directors with same industry can bring valuable experience on the incremental development of products processes and markets, influencing the development direction for the firm (Boeker, 1997). Hambrick finds new members, with outside firm and outside industry help the level of discussion and decision making in a firm (Hambrick et al., 1996). The impact of outside industry experience for directors has not so far been studied for EISMEs but the propensity of SME's to seek external advice, perhaps using non-executive directorship as a route to access external resources is more common. The propensity for early board teams to seek and share information to overcome inherent resource constraints due to the small firm and board size is considered an important aspect of entrepreneurial capability and is discussed in more detail in the following chapter.

### 5.1.14 Functional Management Representation

Functional management diversity within the team is also desirable to make sure that no management areas are favoured over another and is acknowledged in a large number of studies (FiegenerBrownDreux et al., 2000, Fried et al., 1998, Timmons and Bygrave, 1986). Heterogeneity minimizes cognitive biases and strengthens decision making (Cooper et al., 1994) (Van De Ven et al., 1984). Functional management representation within an entrepreneurial team research may be represented by executive or non executive directors according to Berry (Berry and Perren, 2001). But within a smaller firm with only two to three directors' complete representation of all the functional areas is not possible. The entrepreneurial ability to leveraged resources is clearly an important factor to continued growth. The order in which the board appointments are made to management functions will depend on the founders experience and possibly the industry context.

### 5.1.15 Tenure

Board member tenure is acknowledged to influence behaviour of board teams in large established firms. Longer serving boards are likely to produce insularity and social consensus militating against change within the firm (Hambrick et al., 1996) (Goodstein and Boeker, 1991) to make significant organisational changes and less likely to undertake radical innovation (Baysinger and Butler, 1985). Large firm performance is found by Finkelstein and Hambrick to be negatively associated with top management team long tenure; a finding, which may not necessarily hold true for smaller firms. The accumulation of knowledge and learning achieved through board team continuity over a considerable period of time may be a critical part of EISME early board team development. Acs certainly finds that in-depth knowledge acquired over the years can be very helpful to successful small firm incremental innovation – (Acs and Audretsch, 1990b).

On the other hand, it can be argued such a narrow base may lead to less innovation since long exposure to the firm and industry may tend to limit the search for information and restrict the knowledge based on which innovation rests according to Bantel and Jackson (Bantel and Jackson, 1989). Outside experience from another industry can help with innovation, stimulating learning and knowledge by expanding horizons and challenging existing board team perceptions of industry recipes. Outside industry experience may be more appropriate for firms in mature industries, rather than developing ones as suggested by Gimeno et al and Eisenhardt where more sweeping forms of innovation can be funded (Eisenhardt and Schoonhaven, 1990, Gimeno et al., 1997). In larger firms long tenure at both CEO and top management team level is likely to be associated with low levels of strategic change and poor performance according to research (Hambrick et al., 1996). Other research findings show that in fast moving emerging industries, the firms' top management teams may have to change frequently in order to bring forth the organisational changes necessary to cope with major shifts in the environment (Virany and Tushman, 1986). The implication is that the necessary change in management practices and organisational process cannot be achieved sufficiently rapidly with the incumbents in firms were the organisation routines are well established. As the need for different types of innovation occur during the firm's life cycle life, the entrepreneurial management locus must shift, inevitably causing organisational disturbance.

EISME board teams in an EISME act as the driver of innovation, since there is no other middle management tier to carry out the function. If as discussed above, board team expansion involves a period of embedding and absorption of knowledge of the firm's market and industry as well as the knowledge and experience of their peers within the board team, then longer periods of service they mean may be more appropriate for smaller firm and their larger counterparts. Rapid entry and exit may be undesirable for early board teams as this would interrupt the learning within the board team. Te human capital resource of experience, its quality, quantity, and appropriateness become critical to the successful and rapid reconfiguration of resources to create new capabilities for new circumstances that must occur in EISME's.

### 5.1.16 Firm Size Experience

Experience of previous start-up ventures and other early growth firms are found to assist firm emergence by a number of researchers (Berry, 1998) (Birley and Westhead, 1994) (Pennings et al., 1998) (Mullins, 1996). Experience within large companies at a functional management level is not the type of experience is likely to be easily embedded within an early board team. Viewed from within the resource base perspective, where the balance and nature of resource picking and deploying carried out by management varies, then experience of the appropriate firm life stage becomes significant. A large firm functional manager used to maximising resource utilisation would make a poor EISME board team addition if their management practice is focused on maximum resource utilisation rather than resources leveraging as a means of acquiring resources for innovation and fun growth. As argued earlier, small firms are not just little big ones, but legitimately do things differently to overcome their resource constraints and engage in continued innovation.

### 5.1.17 Firm and Board Team Age

Early research makes an assumption firm age influences innovation levels, be firms small or large (Van Dijk et al., 1997). Arguments run in both directions, younger firms produce more innovations rather than older firms but of a lesser economic value (Tether, 2000). Older firms lose their innovation ability due to the bureaucracy and inertia (Cyert and March, 1963, Tether, 2000) suggesting that larger firms are only capable of incremental innovation (Tether, 1998a). Gray finds strong positive links between growth orientation, the setting of financial objectives (as opposed to lifestyle gold goals), and propensity to introduce changes and actual growth in the study on the small business research trust data. Age and size of firm are found to act as moderating variables, influencing these relationships (Gray, 2002). Others argue that only large companies with substantial resources can undertake major radical technological innovation (Afuah and Utterback, 1997). Mature, larger firms can achieve corporate rejuvenation by pursuing higher levels of innovation, organisational and strategic - corporate entrepreneurship outcomes, described by authors such as Stopford and Baden Fuller, Markides and Wolfe (Markides, 1998, Stopford and Baden-Fuller, 1994, Wolfe, 1994). At which point product and process innovation may have to take a backseat.

Hansen makes clear however that firm age is not a critical factor the continued innovation. Innovation continues in firms of all ages so as not likely to be a critical factor in the analysis (Hansen, 1992). EISME's cannot be assumed to be young in years but older firms, as pointed out by North and Smallbone, are perfectly capable of starting to grow at a later stages. (North and Smallbone, 2000). Firm and director age are also potential important ingredients for a successful early board team recipe. Board team individual or aggregate age can be considered a proxy for experience and accumulated knowledge but it can also represent an increase conservatism and unwillingness to change. Greater age may bring an owner director (or inner team) greater financial security with the accumulation of assets over time, in particular home ownership, which they are unwilling to jeopardise (Cressy, 1995). Penrose certainly considered "knowledge possessed by a firm tends to increase automatically as it accumulates experience, which contribute to changes in the firm capabilities.(Penrose, 1959) p 76 so greater ages would result in greater experience.

Gimeno, Gascon and Woo found that human capital in the form of owner founder education was related to firm growth but management know-how has a significant impact too (Gimeno et al., 1997). Know-how will accumulate in older board teams providing they remain stable. The authors discuss the nature of experience, indicating knowledge is obtained in two different ways. It can be taught and learnt from other people or from the written word. Knowledge can be transmitted in writing but important learning is experiential and tacit, transmitted through association and example. Nelson uses the analogy of swimming lessons to make a point about learning: a swimmer can only be taught so much by a coach, most learning occurs by doing and repeated practice (Nelson, 1991). Intuitively the same will apply to board teams, they need to learn how to achieve a successful board dynamic, either through experience or conceivably through coaching. A natural corollary is that service length combined with experience may help boards acquire management capabilities

According to some entrepreneurship literature, the ideal age for successful entrepreneurs in high growth ventures start ups, is estimated to be mid 30s to 40s, where previous work experience, preferably in the industry of start up, is present combined with higher levels of education (Timmons and Bygrave, 1986). Yet if it had accepted that the sequence of resource picking and applying varies over the firm experience of a similar firm development stage becomes even more important. EISMEs are likely to have a different and unexplored board age profile, which in turn will influence the innovation propensity.

Utterback and Abernathy, with reference to innovation, show that older managers are less likely to pursue risky courses of action, favouring incremental over radical innovation. (Utterback, 1994). Such conservative behaviour might be more of a problem for larger more mature organisations where organisational and strategic innovation is required. Many authors find smaller firms with limited resources, financial and human, engage in incremental innovation as a preferable strategy on the basis they are less likely to disrupt the continuity of the resource development path(Acs and Audretsch, 1987, Freel, 2000b, Heunks, 1998, Hite and Hesterly, 2001).

Firm age, within the large established firm literature, shows an increasing board size (Hambrick, 1987) but this is not found to hold true for smaller firms according to Bennett and Robson (Bennett and Robson, 2004). It is therefore possible to hypothesise that an increasing board size represents a willingness to develop firm organisational growth capability, which, following Penrose, will not be apparent in the firm's performance figures. If as argued later in the chapter, innovation is used by EISMEs for firm economic renewal, the associated costs are more than likely to impact profit level, as long term benefits are sought over short-term profitability by owner directors.

Increased firm age, as various authors demonstrate, Storey, Thurik and Audretsch demonstrate, will be associated with a slowing of growth but an increase in board size prior to growth may well demonstrate potential further growth(Audretsch, 1995, Storey and Sykes, 1996, Thurik, 1996a). As Smallbone and North point out, many which all firms are capable of starting to grow at a later stage (Smallbone et al., 1993), possibly as a result of continued learning and the creation of a competent board team. It has been claimed that firms ceased to innovate as they grow older but Heunks finds firm age has little impact on firm innovation activity. Firms more than 10-years-old are just as innovative as younger ones and the presence of innovation has an impact on profitability, a critical fact not be forgotten, but which many researchers tend to forget. Interestingly, Heunks argues that the role of creativity for innovation and continued success increases during the firm's life cycle, as a necessary compensation for increasing routinisation and bureaucracy as the firm grapples with the need for cost efficiencies in maturing markets. Heunks effectively recognises that loss of creativity and subsequent innovation is not desirable overtime for smaller firms.

### 5.1.18 Education

So far the section has discussed board team function and size, the split between executive and non-executive directors, and various aspects of the board team demography including industry, functional management and firm size experience, service length (tenure) and board team age. One singularly important aspect of board team demography known to be significant for both firm growth, entrepreneurial orientation and innovation, remains to be examined, namely the educational attainment level of the individual or team.

At a macro level, innovation type and level are dependent on national resources and their accumulation creating national technological trajectories (Dosi, 1982). Dakhli and De Clerq develop and empirically test a theoretically grounded model that relates human and social capital to innovation at the societal level across fifty nine countries. They find strong support for a positive relationship between human capital, social capital, and innovation (Dakhli and De Clercq, 2004). Interestingly, they also find that the relationship between the levels of human capital and social capital and innovation varies, not only within nations but within regions, creating another spatial dimension of complexity to potential analysis. Cannon also finds national levels of human capital have a bearing on innovation levels generally (Cannon, 2000).

The UK government views population educational level as a key factor for supporting innovation and wealth creation in their industrial policy for all sizes of firm especially with a increasingly driven knowledge based economy (Duggan, 1996, Storey, 1994) (Dti, 1996). Past deficiencies of the UK educational system and entry routes for management careers discussed in Chapter 2 may well have affected the human capital resource level within EISME board teams, and adversely, affected their ability to innovate. For the UK the fact remains that larger firms have attracted a greater share of educated people compare to SMEs. (Belfield, 1999). The widened access to higher education makes educational levels within the board team of EISME's an interesting resource to measure as its influence may be apparent in board team age, related to innovation.

On a UK National level, the recently introduced Household Survey of Entrepreneurship for 2003 indicates that there is a strong relationship between the level of education and entrepreneurial activity (Small Business Service, 2003). It shows that those with a higher degree or degree are more likely than average to be entrepreneurs as they define the term - 15 % compared to 13% than those from some other form of further education. With the ever widening higher education output feeding through to managerial population, this can be expected to increase innovation and may lower the average age of successful entrepreneurs for the future.

At a micro level, education level, as well as experience, may be a fundamental resource, influencing the propensity of the board team to not only achieve a balance between strategic orientation and preoccupation with operational day-to-day tasks (Hadjimanolis, 2000) but carry out innovation. Wozniak in an early study concludes that education and information as human capital endowments makes technological innovation far easier (Wozniak, 1987). The author notes that the propensity to adopt innovations varies significantly across firm size. Research prior to 1994, summarised by Storey, finds a significant amount of research with positive associations of individual founder education level with employment growth, citing such authors as Storey et al. 1989, Kinsella et al. 1993, Macrae, 1991, Johnson, 1991 (Storey et al., 1989). Some studies find no association between education level with board size or firm growth ( including Bennett and Robson(Bennett and Robson, 2004)) but, by and large, there is a consistent finding demonstrating that educated individuals are more likely to run faster growing small businesses than those that are less educated (Wiklund and Shepherd, 2003) (Storey, 1994). Knowledge vested in the early board team, acts as an important antecedent to the way competences/capabilities are formed and institutionalised as part of its social organisation, according to Galunic, and Rodan, so careful selection of board team capital may go a long way to achieving the desired entrepreneurial orientation. (Galunic and Rodan, 1997). Galunic and Rodan argue that the tacitness, context, specificity, and dispersion of knowledge within management, influences the way resources are combined; a finding that must be particularly applicable to enable effective early board teams.

Wiklund and Shepherd find that owner directors' growth aspirations are associated with the level of growth achieved but that this is not a simple relationship, depending on the level of education and experience of the small business manager as well as the dynamism of the environment in which he operates. They argue that education, experience, and environmental dynamism magnify the effect growth aspirations can have on whether it is achieved or not. (Wiklund and Shepherd, 2003). A competence deficiency may exist rather than resource efficiency (Clarysse and Moray, 2004).

Penrose considered it likely that there was firstly "a close connection between the type of knowledge possessed by the personnel of the firm and the services obtained from its material resources" and secondly "increases in knowledge can always increase the range or amount of services available from any resource" (Penrose, 1959) p 76. In other words the physical resources may remain the same but increase in knowledge helps develop the capabilities of services built on them, knowledge to be either objectively acquired through formal education, or subjectively transmitted in writing or as a form of experience. Penrose suggests that education or experience represents unused services which can be used for the internal inducement of expansion.

Accumulated experience contributes to and modifies knowledge and the way it is applied. Knowledge cannot be transmitted by itself except when codified and made explicit. In the early stages of board team development, the educational resource level of the early board and their ability to handle learning become significant. Longer lengths of experience and higher educational levels may well be associated with greater levels of innovation as an "used service "or resource slack, which would say their innovation, is present (Nohria and Gulati, 1997). In internal environments where a high degree of experimentation in the picking and deploying of resource to achieve innovation, there is no time to codify and make knowledge explicit before it needs to be modified again. Board team service length in which relationships based on trust and productive interaction may be developed as a substitute for formal education, either way education or service length (or both) contributes to the inherent advantages of smaller firm size and its early board team: flexibility, adaptability with less formal structures, and easier decision making processes. The creative spark, which drives innovation, must be retained in EISMEs through higher educational levels within the early board team without it being lost to formal organisational routines and explicit knowledge generation as the organisation becomes more complex.

The early board team is therefore very dependent not only on the starting knowledge resources conveyed by education and experience but by the way in which the board team creates, accumulates knowledge, and transmits it into the firm's operations. Creation of shared experiences within the board can be the basis for more complex resources and capabilities. The board itself forms a collective resource platform of shared learning and understanding on which further capabilities and competences can be accumulated in a path dependent manner (Boeker, 1997, Brush et al., 2001). The transfer from reliance on the individual founding entrepreneur to a group must be made at some point, assuming firm growth ambitions are present, without losing valuable entrepreneurial patterns of behaviour (Vyakarnam et al., 1999). Such transitions are a point of immense vulnerability for EISME's and their early development, dependent on the background of the individual and their propensity to reach outside the firm for information and external capital (Heunks, 1998). Hoffman et al., in a summary of SME innovation literature to 1998, find the internal factor of most importance and the determinant of innovative activity and economic success, to be the level of director education (Hoffman et al., 1998). So educated directors provide a foundation to board effort and fulfil an indispensable knowledge production function for successful innovation. Griliches argues skills and knowledge are acquired through education as well as experience and are vital for what is called the knowledge production function within firms (Griliches, 1979). Heunks finds that innovation in small firms depends more on the entrepreneur's education, self-confidence, future orientation, and leadership affinity than in larger firms. (Heunks, 1998).

Heunks paper is interesting in another key respect as finding any kind of innovation is likely to foster small firm growth (defined as employing 10 to 50 ftes). Human capital resource is acknowledged to receive by Acs receive a fair amount of attention in both the innovation and growth literatures (Acs and Audretsch, 1990b). Acs and Audretsch, Scherer find small firm growth positively related to the extent of human capital and innovation amount. Innovation, they argue, can be used as a vehicle to compensate partially for their inherent size disadvantages. (Acs and Audretsch, 1990b) (Scherer et al., 2000). Education as part of the human capital is the one most likely to foster a proactive commitment to innovation and features largely in the literature according to both Chaston and Freel (Chaston and Mangles, 1997) (Freel, 1998)

Storey suggests conflicting hypotheses as to the role of education and influencing business growth. Firstly, it provides the basis of intellectual development, for future learning of benefit to the operation of the business. A degree of confidence and ambition is imparted by the education process which is beneficial and produces higher income expectations. An educated entrepreneurs business must therefore at least yield what their qualifications would earn them in alternative employment over the same period of time, a view supported by Gimeno et al (Gimeno et al., 1997). Secondly, Storey suggests, in an outdated fashion, business ownership is not an intellectual activity but that entrepreneurship provides the means for the less academically successful to earn higher incomes! A suggestion he would undoubtedly wish to withdraw today.

### 5.2 Innovation

The innovation literature is now reviewed to find practical and appropriate innovation measurement categories for use as an outcome measure in the proposed analysis as innovation must be included to measure entrepreneurial orientation according to Lumpkin and Dess if it not just measure of strategic adaptation to the environment along the identified dimensions, (Lumpkin and Dess, 1996). Innovation is defined, the relative innovation contributions by firm size of small and large firms are discussed to determine the type of innovation most likely to be undertaken by EISMEs. The influence of industrial and market environment on innovation is examined. Specific problems with small firm innovation research are identified at the end of the section and an introductory discussion of innovation processes as a preliminary to Chapter 6 concludes. Given entrepreneurial management is often defined as possessing innovation objectives, innovation output has not been used extensively as an outcome measure for either individual or corporate entrepreneurship research studies, a point noted by Schoonhaven (Schoonhoven and Romanelli, 2001).

Innovation has received a great deal of attention from academics and government policy makers in the last two decades, as central to competitiveness and economic renewal of firm and nation alike. At its door are laid various claims as major sources of new jobs, a key driver of increased productivity and profit, a means of business improvement and economic renewal and a source of firm and national competitive advantage. SME's growth and innovation are seen to assist with national prosperity overall (O.E.C.D., 1996, Rothwell, 1989, Rothwell and Zegfeld, 1982) but evidence directly linking innovation and firm performance in SME's is scant and at times contradictory, showing links in some industries but not others (Hall, 1995). In fact, few innovation studies report of a conclusive link between innovation activity and improved firm profit performance according to Dewar (Dewar and Dutton, 1986). Tether argues entrepreneurial management, the process by which innovative opportunities are identified and brought successfully to market, may be viewed as more of an economic renewal process than one of profit maximisation (Tether, 1998a). Compromises between innovation undertaken for economic renewal and short term profit exist for EISME owner directors, which mean the link between board team human capital favouring innovation, innovation output, and firm performance may not be not related to each other in a linear manner. Owner directors may make a choice of profit now, rather than long term firm survival prospects through innovation or vice versa, consciously or unconsciously depending on their management experience.

Innovation has been is studied a national system of innovation based on accumulated resources, technological trajectories, and path dependence (Dosi, 1982, Patel and Pavitt, 1994). Evangelista et al. using the 1993 European Community Innovation Survey found that at least 50% of European firms produced a product or process innovation during a two-year period. Evidence of a variation to the pattern of innovation type according to the firm and industry concentration was found (Evangelista et al., 1998). No expectation of very high levels of innovation can be expected for any firm except those in 'high velocity environments' (Eisenhardt, 1989). Substantial regional variation in rates of innovation exists within the UK according to analysis of the SPRU (Pavitt et al., 1987) Researchers attribute the differences to external i.e. foreign, ownership concentrated in the South West (Love, 2001) but poor regional resource endowments maybe a greater contributor, especially where industrial restructuring due to the collapse of manufacturing industries has left devastated communities with little in the way of human and social capital. The innovation management literature is broad and only a limited review of the innovation type likely to occur in EISMEs is included.

### 5.2.1 Innovation Definition

Definitions of innovation have evolved over the last four decades. Initially innovation was considered as a new idea or invention but is now defined as a more applied creative process involving successful introduction of a new product service or process into use (Twiss, 1992). Kuhn suggests that "creativity forms something from nothing" but innovation "shapes something into products and services (Kuhn, 1985). Roberts is more specific and defines innovation as the successful commercial implementation and exploitation of a new idea or invention (Roberts, 1988). Innovation involves the initiation and management of commercially significant change lives at the heart of the innovation concept according to Love et al. (Love et al., 1996). Viewed within the resource base view of the firm, innovation is a process of resource variation, which may be minor (incremental) or major (radical) {Burton, 1999 #208]. The UK government perceives the innovation process as taking new ideas effectively and profitably through to satisfied customers (Dti, 2003). But when is new, new as Johannessen asks? (Johannessen et al., 2001). A more detailed definition of newness is required. Is incremental innovation sufficiently new?

Josef Schumpeter's definition and categorisation of innovation from his "Theory of Economic Development: an Inquiry into Profits Capital, Credit Interest and the Business Cycle" has been influential, and persistent in the literature (Schumpeter, 1950) and can operationalised relatively simply for research purposes. As the first economist who identified innovation as an outcome of entrepreneurship, Schumpeter (Mark 1, he later shifted his position) identifies the effect of the entrepreneur on the economic system as the disruptor of old markets, creating new ones through the introduction of innovation, forming circular economic flows. Circular flows are dynamic and change along with shifts in taste in the population. The true entrepreneur causes radical but discrete changes, discontinuous with the previous flows, by obtaining and using information causing "tides of creative destruction." Swarms or clusters of innovation then take place producing structural change and destabilising markets. Schumpterian innovation therefore refers to a competitive process, (managed by individuals and teams) involving periods of change where uncertainty and resistance can be substantial. The transition periods are more stable periods when the innovation diffuses outwards with accompanying standardisation and marketplace acceptance.

Schumpeter lists five ways in which an entrepreneur causes changes in the market which continue to be practically useful today when considering innovation. These are as follows "(1)

The introduction of a new good that is one with which consumers are not yet familiar or of new quality of good. (2) The introduction of a new method of production. (3) The opening of a new market. (4) The conquest of a new source of supply of raw materials or half-manufactured goods. (5) The carrying out of the new organisation of any industry". (Schumpeter, 1934). Innovation therefore need not be technologically new but merely applied in a new context. The market need not be an entirely new one but new to that firm. Nor does the material need to be new but merely used in an alternative application.

Expressed in more up-to-date language, Johannessen et al created a set of categories to define and measure innovation as:- new products and services, new methods of production, opening new markets, new sources of supply and new ways of organising. The Schumpeterian categories can be considered either incremental or radical innovation: introducing an existing product or process to a new market, opening a new market is clearly incremental but in introducing a new process (for example float glass production techniques) that is totally new to the world could be conceived of as radical. Johanessen's re-expression of the fifth Schumpeterian category as new ways of organising broadens the application to both organisation and industry covering organisational and strategic innovation respectively.

### 5.2.2 Innovation Contribution by Firm size

The characteristics of small and large firm innovation are examined with a view to determining what happens in the middle. The study of innovation in large firms is substantially more developed than that of smaller firms with a considerable literature in many areas {Tidd, 1997 #19}. Scant attention has been given to innovation by EISMEs on their own. Perhaps this is not unexpected as considerable debate has raged over the respective contributions of small and large firms to national innovation output in many countries (Acs and Audretsch, 1987, Tether, 1998b). Small and large firms are increasingly recognised as making different, but complimentary contributions to innovation within the economy by a number of researchers including Rothwell Acs and Audretsch, Pavitt and Tether (Acs and Audretsch, 1990b, Pavitt et al., 1987, Rothwell and Zegweld, 1982, Tether, 1998a, Tether et al., 1997). Research into small firm innovation as part of industrial economics has increased as European small firm numbers have risen.(Audretsch, 2002, Thurik and Wennekers, 2004). As shown in Chapter 2, the increasing number of small firms in the UK enterprise stock makes the search to improve SME organisational growth capability and particular their innovation capability a research and policy priority.

Large firms were once considered to be the sole engines driving innovation within the economy, (as Schumpeter believed later in his life) undertaking incremental rather than radical innovation, which was left to high-technology new ventures. New technology-based firms (NTBFs) were anticipated to be substantial contributors to the net job creation through radical innovation. But as time and research has passed this has proved not to be the case. Nooteboom suggests new high tec firms make significant contributions to radical innovation within new technological trajectories, simply because they are able to reorganise their resources more easily but confirms that net job creation is likely to occur in only a very few (Nooteboom, 1994). Tether in an examination of the SPRU innovations database finds the same (Tether, 1997, Tether et al., 1997). Innovative high-tech and new venture firms do not in fact produce substantial levels of new employment in the UK according to Westhead (Westhead, 1995), although contrary evidence for the U.S.A. exists (Rothwell and Zegweld, 1982, Rothwell, 1984). Technology convergence requiring very large-scale investment has however resulted in major alliances across large established firms to bring about introduction of major radical innovations (Stuart, 2000)

The view of large companies as the sole engines of innovation is replaced by a more considered view by Rothwell, who introduces the concept of dynamic complementarity to describe the relationship between small and large firm innovation, where each firm size has an important but different function to play in the innovation process. Tether comes to the same conclusion (Tether, 1998a) Smaller firms contribute more innovation per employee than larger firms however innovation is measured according to Audretsch and Thurik (Audretsch, 1995, Thurik, 1996b). They have however of lower economic value according to Tether. A substitution of a greater number of incremental innovations for more radical but less numerous, forms of innovation: major technology change, organisational and strategic innovation, could be an explanation for these results.

For some types of innovation, large scale capital intensive technology, smaller size, and newness are a distinct disadvantage (Rothwell, 1984). Concentrated industries with substantial resources and converging technologies also favour large firm innovation according to Acs and Audretsch.(Acs and Audretsch, 1990a) #1984} Van Dijk confirms this , showing larger advertising intensive firms, in concentrated and highly unionised industries also have innovation advantages (Van Dijk et al., 1997). Much of the innovation management literature is dedicated to the purpose focusing on the middle manager in the larger organisation as the source of product innovation necessary for market development(Barton Leonard, 1995, Kanter, 1989).

Innovation is inextricably involved with market competition, industry structure and evolution, (Acs and Audretsch, 1987). Geroski from examination of the historic data of two large innovation data bases, points out very few firms are persistently innovative: a finding consistent with an argument of sequenced management activity between entrepreneurial and "administrative" management according to life cycles (Geroski et al., 1997).Small firm size and closeness to customers permits a quicker reaction of fluctuating customer needs and market requirements (Vermeulen 2003). At the same time, small firm responsiveness is significantly limited by their resource constraints. (Verhees 2004). Smaller firms frequently undertake actions were they have less expertise than their larger equivalents simply because they do not have in-depth speciality resources (Freel, 2000b).

Smaller firms appear to have an advantage in emerging industries with high levels of innovation (Acs and Audretsch, 1990b) where they play an important role according to the OECD (Oecd., 1996) in developing technology processes and creating new markets (Reynolds, 1998). Smaller firms are unlikely to have dedicated research and development departments but will carry out a more integrated form of development within the operations environment, which may be difficult to discern through quantitative research methods as acknowledged by Kleinknetcht and Roper (Kleinknetcht, 1987, Roper, 1999b). Smaller, non technological firms are therefore likely to innovate incrementally rather than radically, a factor strangely supported by a study of board teams by Bennett and Robson (Bennett and Robson, 2004). Although the study claims innovation rates not are related to board team size and resources, closer scrutiny of the innovation variable shows innovation to have been operationalised as radical innovation. The research suggests EISMEs may rarely undertake radical innovation, defined a as product or process introduction not only new to the firm but also new to the industry, preferring more modest incremental innovation where risk is reduced.

Large firms with their own R&D departments may be more considered more adept at exploiting knowledge for large-scale technology intensive industries than their smaller counterparts. Taking ideas or inventions from such departments and bringing them to market requires a distinctive set of innovation management processes, aimed at coping with large bureaucratic organisations, which may become inert over time, (Hannan and Freeman, 1984) Large firms have difficulty in decision making which prevents rapid action and creates a bias against new projects (Audretsch, 1995). Large R&D budgets are therefore not a guarantee of successful innovation in their own right (Griffith, 2000) or the development of organisation innovation capability (Helfat, 1997).

### 5.2.3 Innovation Rate Measurement – Small and Large Firms

Differences in innovation rates may be merely a difference the measurement methods used. Measuring innovation activity presents some issues when studying firms of different size. The measures used for small and large firms are not always comparable and can lead to misleading claims on innovation rates between the two. (Brouwer and Kleinknecht, 1996). Measures of innovation activity used include R&D budgets, patents, counts of significant innovations, innovation sales as a percentage (Brouwer and Kleinknecht, 1996, Roper, 1999b) (Hausman et al., 1984), innovations per employee (Acs and Audretsch, 1990b) expert judgement, product announcements (Santarelli and Piergiovanni, 1996), number of technical employees and actual versus predicted market value (Clark and Guy, 1998) Many of these can be problematical applied to smaller firms particularly research and development as they can create downward biases in innovation measurement for smaller firms and misrepresent innovation activity (Kleinknetcht, 1987).

**5.2.4 Patents**

Measurement of patent registrations by firm size in USA and Germany show that smaller firms are not backward in this respect, being more likely to patent innovations than larger firms. This pattern is also repeated when counts of product and process innovation are used (Acs, 1990) Sussex Policy Research Unit present findings that show that counts of product and process innovations per employee decrease with firm size (Pavitt et al., 1987) Similar findings have been found for the USA and Germany (Acs, 1991) Patent counts tend to capture innovations that are more significant and may not accurately represent the true level of innovation activity across all innovation categories incremental and radical and are therefore not employed within the research.

Larger firms have formalised structures and systems for carrying out and documenting R&D. Larger firms have deep purses permitting substantial expenditures. R&D budgets are carefully recorded and presented for public inspection in various innovation scorecards. Measurement of R&D spend however does not measure innovation output but is merely one type of possible input since large R&D budgets does not necessarily result in more innovation. SME's tend not to have formal R & D structures (Hansen, 1992). This can lead to the under-estimation of R&D investment in small firms. More development work is carried out than fundamental R&D and it is carried out informally within the firm (Roper, 1999a). Development work is carried out in parallel with day to day activity so that capturing and measuring such activity is therefore difficult and not directly comparable with more conventional measures of innovation applied to larger firms. (Roper, 1999a, Rothwell, 1989, Rothwell and Zegfeld, 1982) Inputs for innovation frequently come from outside the smaller firm, utilising characteristic entrepreneurial management skills of networking and resource leveraging. In the early stages of venture dev these skills are personal to individuals and are therefore difficult to measure.

EISME's especially smaller ones cannot afford research activities of formal R&D departments, a feature of larger companies and manage to overcome the lack of R&D departments by using other sources of knowledge such as universities, research institutions and other external firm resources and through networking activities (Freel, 2000a, Freel, 2003) (Audretsch and Vivarelli, 1996). A parallel exists with large firm interfirm alliances created to access different skill sets and capabilities in cases of large-scale technological projects involving technology convergence (Tushman et al., 1986)

Highly innovative industries dominated by larger firms tended to have an innovative small firm sector taking advantage of their flexibility and rapidity of response, exploiting market niches through product and service differentiation. Smaller firms serve a purpose in developing niche markets with innovations products, processes and service, sometimes both incremental and radical (Tether, 1998b). Significant process innovation viewed as a means of achieving economies of scale scope and experience may be characteristic of firms pursuing cost advantage in maturing industries but incremental changes can be achieved by smaller firms, creating better quality and service for the customers (Richardson's of Sheffield is a good example).

So, not only is innovation type likely to vary between small and large firms but industry structure and maturity will influence small firm innovation relative to large. Ultimately whether small or large firms contribute more to innovation activity is irrelevant, as at the macro level, the critical determining factors are likely to be technology development, industry conditions, and market maturity. Innovation research, Freel suggests it is no longer a matter of the understanding the "what" and the "how many" innovations, but more a matter of "why" and "how" of the innovation process. (Freel, 1998). The human capital factors at work for any type within the innovation engaged by EISME board teams, middle managers, top management teams or CEOs of established companies, are part of the why element and how forms the basis of the next chapter. The "how" of innovation involves identifying input resources, (board team size and demography), the specific innovation processes characteristic of both the firm, market and industry life cycle stages, linking early board team management practice with innovation outcomes.

The plastics processing industry, consists largely of SMEs and supply and are supplied by many larger firms operating in a wide range of industries at varying stages of development and maturity. Multiple innovation sources exist for product, and process innovation in B2B supply chains and recognition of customer need. Product and service innovation affects customer demand, continued sales and market position whereas process innovation contributes to product quality and firm efficiency. (Heunks, 1998).

So what type of innovation is most likely for EISME's: incremental or radical? Product or process? Much innovation research does not distinguish between the two, lumping all types of innovation together. Many writers argue that innovation studies have not taken sufficient account of environmental context including Pavitt, Hoffman et al. and Koberg (Hoffman et al., 1998, Pavitt, 2003, Zahra, 1996). Koberg et al. argue that it is important for researchers to distinguish between two general types of innovation (incremental and radical) as opposed to focusing simply on product and process innovation. Factors such as greater age and smaller environmental dynamism and intrafirm are found to influence incremental rather than radical innovation (Hoffman et al., 1998). Tushman and Anderson also find environments with considerable dynamism and uncertainty tend to radical innovation (Tushman and Anderson, 1986). Utterback and Abernethy fortunately find that firm growth is mostly achieved by an accumulation of incremental innovation

Smaller firms do things differently and for good reasons. Substantial resource constraints exist but an inherent size advantage of flexibility and adaptability allows them to respond quickly to meet customer needs and market changes, valuable both in established and emerging industries. In these circumstances incremental innovation may be a favoured route. Indeed Koberg et al finds that "different mixes of environmental and organisational variables were significant predictors of incremental and radical innovation." Age and size of firm, combined with environmental dynamism, degree of interfirm networking were found to

An early board team may fail to use the advantage for one of several reasons; insufficient board resources, lopsided experience within the board team or simply a lack of a successful board team dynamic based on education and experience. A dynamic, proactive board team process, able to scan the environmental changes and interpret them through gathering and deploying new and old resources into new configurations of capability building is required.

Board team internal processes are likely to be tentative and hesitant in the early stages as they learn to manage as a group – the Penrose effect (Penrose, 1959). More sporadic but persistent incremental innovation reflecting appropriate responses to external conditions could be considered as a sign of an emerging EISME board teams. An uneven pattern to innovation and profitability could perhaps be anticipated from the uneven development across the management functions as the board team recruits and integrates new members. Some board members will seek process efficiency through innovation and others new products and new markets, potentially influencing the balance between entrepreneurial and managerial management activities. Incremental innovation, a slow and steady progression seems more appropriate to resource constrained EISME's involved in expanding the board team and firm generally.

Resources of all types for innovation are constrained in EISMEs so large-scale investment for radical innovation is not considered very unlikely. Radical innovation would seem to be an unlikely and unwise path to adopt at during emergence of the early board. Overstretch of the board team human capital resources may occur, resulting in firm failure or at the very minimum 'board team indigestion' resulting in little progress (Penrose, 1959). A propensity to innovate incrementally, both product and process, is more likely, demonstrating a balanced entrepreneurial orientation with the more traditional routine maximum resource utilisation management techniques, that will allow them continue to create owner director value and ensure firm survival and economic renewal. The board team, not just the individual, is an important processor of information and experience for the creation and generation of a successful knowledge production function at board team level, according to Pavitt (Pavitt, 2003). The resources and capabilities of the early board team are therefore critical to firm evolution and emergence. Organisational and strategic innovation - the fifth Schumpeterian category of innovation) is also unlikely. Older larger medium-size companies at the top end of the size scale may well require organisational innovation to improve their market and industry position but is an activity normally undertaken by established firms with and when established management functions and full board teams.

### 5.2. 5 The Innovation Process

The innovation process and outcome is undoubtedly influenced by two major factors – the human capital involved and the environmental context. EISME human capital composition in early board teams will influence the innovation process and its output. Innovation management research literature largely concentrates on organisational factors within large firms but as the role of smaller firms have become better appreciated, studies like that of Chandler et al , Zahra, and Rothwell had begun to examine the organisational and environmental factors supporting innovation.(Chandler et al., 2000, Rothwell and Dodgson, 1990, Zahra, 1996). The process of resource and capability examination within smaller firms is considered to have been accelerated by continuing development of resource based theory, permitting more detailed investigation. Internal organisational factors in SMEs are likely to be, in the words of Hoffman et al., core determinants of whether innovation plays a role in the success or failure of the firm (Hoffman et al., 1998)

The applicability of generic innovation process models as internal firm systems., outlined by Rothwell (Rothwell, 1994) ultimately depends on factors, which are not addressed in the models. Pavitt in an exploration of the innovation process indicates internal learning and knowledge accumulation processes within firms (and by implication within the early board team) are a significant part of the innovation process (Pavitt, 2003). Innovation processes can be cognitive, organisational, and / or economic. They happen in conditions of uncertainty and competition. Pavitt argues that the case for three broad overlapping sub processes to the overall innovation process: the production of knowledge, the transformation of knowledge into products and the creation of systems and processes to deliver them in a continuous matching of products to market needs and demands (Pavitt, 2003). The sub processes are subject to certain trends; an increasing complexity of physical artefacts, the knowledge bases underpinning them and subsequent difficulty in matching technological opportunities with market needs and organisational practices.

Innovation processes, he argues, remain unpredictable, difficult to manage and will vary widely according to firm sector and size. Innovation processes are therefore unlikely to remain generic but will become increasingly specialised for coordinating and integrating specialised knowledge and learning in conditions of uncertainty. Pavitt therefore argues, Covin and Slevin, for closer scrutiny of innovation processes in specific contexts, interpreted but this research as specific industries and specific firm sizes (Covin and Slevin, 1989). The innovation process, the management practices, and the organisational processes evolved are likely to be unique to the firm and environment, consistent with the view within RBT as a study of resource selection, adaptation, variation and retention long overdue according Aldrich (Aldrich, 1999 exploration of the links between inputs and outputs is long overdue according to link {Link, 1991 #1650).

### 5.2.6 Knowledge Gaps and Problems in the Study of Small Firm Innovation

Some generic weaknesses of innovation research are now identified. Hoffman et al. and Pavitt identify mixing service and industrial manufacturing SMEs together in a sample is likely to obscure innovation relationships specific to market and industry conditions (Hoffman et al., 1998). Damanpour finds more innovation in manufacturing and profit-making organisations than in service and non-profit ones but this could be attributed to a measurement problem (Damanpour, 1991). The general failure to take into account specific environments - markets and industries when measuring innovation is considered to be an obstacle to better understanding of innovation and its processors by a number of writers, including Dubini and Aldrich, Pavitt and Kamm and Shuman (Dubini and Aldrich, 1991, Pavitt, 2003).(Kamm et al., 1990). (Freel, 2000c) (Birley and Westhead, 1994).

Inclusion of all firm sizes and state of development could also serve to confuse analysis since the innovation process alters as the entrepreneurial management locus shifts to undertake different innovation types in response to market and industry factors. Low and Abrahamson reinforce the point by pointing out quite correctly that what works for one context will not necessarily work in another (Low and Abrahamson, 1997). Firm evolution is argued by them to present three distinct organising contexts: emerging, growth, and mature industries. A single industry approach for a specific size of firm is therefore justified for the study. Ownership and corporate governance are rarely included in innovation studies but likely to influence the type of innovation undertaken. Subsidiaries of wealthy parent firms may well undertake more radical innovation than an independent firm since risk is reduced.

Innovation research has often overemphasised a narrow focus on NTBFs to exclusion of other firm types and sizes, constituting a second problem identified by Low and Abrahamson (Low and Abrahamson, 1997). Findings derived from such studies are unlikely to be generalisable to other SMEs. They are generally better resourced, possibly with venture capital or other investment backing and can utilise the resource intensive innovation approach compared to EISMEs. Control exercised by the board team may also be modified at the cost of sharing equity and management control with financial institutions (Cressy, 1995). Hoffman et al, as do Low and Macmillan (Low and Macmillan, 1988), complain of a failure to link process, outcome and context and explore the links between inputs (such as board team human capital) and outputs (innovation achieved) of the innovation process.

Tether points out two important points for the assessment of smaller firm innovation. Firstly, that new and small firm innovation is likely to produce relatively low economic value compared to larger firms and secondly, job creation although it may be a government objective, is not shared by owner directors. (Tether, 1998a) superior profitability, sales and employment growth as measures of successful innovation in EISME's are therefore of dubious value. Differing measures of competitiveness are sometimes used in an attempt to grapple with this problem but the analysis then tends to become complicated with subjective reporting, distort the relationships found (Kirchhoff, 1994, Mullins, 1996).

### 5.2.7 Linking Innovation with Firm Performance

Although SME's growth and innovation are seen to assist with national prosperity overall (O.E.C.D., 1996, Rothwell, 1989, Rothwell and Zegfeld, 1982) evidence directly linking innovation and firm performance in SME's is scant and at times contradictory, showing links in some industries but not others (Hall, 1995). Few innovation studies report a conclusive link between innovation activity and improved firm performance (Dewar and Dutton, 1986), leading to one of two conclusions. Firstly, a potential trade off between economic renewal, firm longevity versus profit maximisation exists, especially for smaller resource constrained firms and secondly, further study of the missing explanatory link between resources and outcome, innovation processes, is required to connect the two. Process links are still largely omitted from both small and large company innovation studies according to Love and

Hoffman. (Love et al., 1996) (Hoffman et al., 1998). As Scherer notes, failure to examine innovation processes is of particular significance since large firms can be inefficient and fail to reach their full potential because of internal management bureaucracy, inertia and inappropriate organisational routines (Scherer et al., 2000). EISME early board teams may have similar problems, which need to be understood and overcome for their economic health.

Determining whether higher rates of growth in terms of sales and employment are a consequence of innovation and not other factors is not an easy task. Differing measures of competitiveness are sometimes used in an attempt to grapple with this problem (Kirchhoff, 1994, Mullins, 1996)

**Chapter Summary**

Throughout the chapter two distinct fields of research – human capital resources in the board team and innovation for small and large firms are reviewed to understand firms 'in the middle', the EISME, using the resource based perspective as an integrating theoretical framework. The review so far attempts to link innovation outputs with inputs, the early board team resources. Entrepreneurial management capability is deemed to be a complex phenomenon occurring at individual group and firm levels (Bruyat and Julien, 2000), but with a significant research gap on the vital intermediate group, level in the early board team necessary for evolution and emergence. Small firm survival and future growth according to Heunks are becoming ever more dependent on innovation, an entrepreneurship outcome (Heunks, 1998). EISMEs with minimal board teams face a considerable challenge in developing a functional board team to foster further firm growth - the Penrose effect. It is, perhaps, not reasonable, as Penrose outlines, to expect fast growth, at the time of early board expansion (Penrose, 1959). Yet researchers persistently use superior firm performance as an outcome for smaller firms, believing that a complete translation to professional management is obligatory, failing to recognise the need and difficulty of simultaneously nurturing entrepreneurial and administrative management capabilities under resource constraints.

The levels of education, firm and industry experience with and age within the early board team are proposed as fundamental resources likely to underpin innovation capability (entrepreneurial capability) within the early board team for EISMEs. UK senior management of the older age groups, lack higher education so it is anticipated that younger aggregate board teams with higher education levels will produce more incremental innovation. Radical innovation is not likely to be common for the firm size under investigation possibly due to education deficiencies

Innovation is argued to be a more useful measure of continuing entrepreneurial orientation in early board teams and their propensity to achieved modest employment and sales growth. SME Owner directors are inherently different due to lack of separation between ownership and management control. Innovation outcomes may indicate the presence of entrepreneurial management capability at the neglected intermediate level of the early board team and permit research to gauge complex transition organizational processes vital to firm evolution and emergence if they are to achieve economic renewal and continued growth.

Chapter 6 takes the inputs, the early board team human capital resources and attempts to determine the mediating management practices and organisational processes constituting an entrepreneurial management capability facilitating innovation outputs, thereby linking inputs and outputs with process within a specific firm size context of plastics processing industry EISME.

# CHAPTER 6: ENTREPRENEURIAL MANAGEMENT CAPABILITY

**6. Summary so far**

Chapter 3 identified a need to explore innovation and organisational growth capability in a needy firm size sector within the plastics processing industry: the EISME. The UK industry has a dwindling stock of EISME's, yet the capacity for economic renewal and growth through innovation continues to exist within the industry. Against a backdrop of increasing UK small firm numbers, the study of how some smaller firms may evolve, slowly but steadily, increasing in size, productivity and value added whilst maintaining innovation capability, is considered a worthwhile subject to study with benefits for practitioners and policymakers alike. A more significant established mid sized firm sector, more productive, capable of adding value and jobs will contribute to overall national economic prosperity.

Valuable accumulation of firm size specific resources and capabilities of use to the whole firm size sector may be unnecessarily squandered if no attempt is made to understand the EISME firm sector. In particular, the way in which small board teams may expand their human capital resource base to meet the increasing complexity of the organisation has been neglected. Good entrepreneurship research requires not only that context, process and outcomes be addressed together (Low, 2001, Low and Macmillan, 1988) but that the gap between inputs and outputs, the intervening processes be examined (Pavitt, 2003).

Chapter 4 identifies the key theoretical frameworks within which the study takes place, choosing the RBT path with management viewed as a process of picking and deploying resources, in sequence or together, to create capabilities. Entrepreneurial management is considered a specific type of resource picking and deploying to achieve innovation outcomes, which any size firm and state of development require for economic renewal, survival, and growth. The locus of entrepreneurial management is argued to shift within a firm as it evolves: moving from the founding individual (s) through to the group level of the early board team, middle management in larger enterprises and finally to the main board and CEO respectively for organisational and strategic innovation. At each management locus shift, the human capital resource (the inputs) management practices and organisational processes, (the link between inputs and innovation outputs), are required to change, representing a necessary evolution or reconfiguration of resources and capabilities for firm size and type of innovation required.

Within this overall framework, the limited human capital resource base of early board teams in EISMEs (the majority only 2/3 directors) is targeted for study. Chapter 5 identifies board team human capital as an understudied critical input resource for EISMEs without which long-term innovation and organisational growth capability will not develop. An examination of small and large firm entrepreneurship and innovation literature relating to board team capital, age, experience, education, and tenure identify simple human capital input resources to collect and use as data.

Small firm innovation complements that of larger firms, for EISMEs, 'in the middle', incremental, rather than radical, product and process innovation is considered to be the more likely form of innovation, undertaken by younger, better educated early board teams, with industry experience. The frequently proffered requirement for transition to professional management in emerging firms is questioned and considered to represent a fundamental misunderstanding of internal management processes of firms 'in transition' if innovation and associated processes are to continue. In EISME's a difficult balancing and sequencing of resource picking and deploying to build innovation and growth capability must take place. Innovation studies across all firms, size, industry, and market are considered inadequate by many, requiring an industry and firm size focus to advance knowledge of the process link between inputs and outputs.

### 6.1 Introduction

Management practices and organisational processes linking the early board team human capital resources and innovation output are considered a crucial link between inputs and outputs within an entrepreneurial management process. Creating a measure of entrepreneurial orientation within the early board team may prove useful as a diagnostic tool in ascertaining the management orientation of EISME boards.

Identification of theoretical underpinning for the concepts represented in the management construct are identified in the chapter through a review of the entrepreneurial and innovation management practices associated with both individual and corporate levels of entrepreneurship. A summary of references used are shown in Appendix 17 to support the construct. By using innovation as an output measure, the construct is anticipated to capture a generative as opposed to adaptive management (Senge, 1992). A generative capability is argued to represent a distinctive transition in character of entrepreneurial management practices, particularly difficult to achieve in resource constrained smaller firms. Once again, two ends of the firm size spectrum are reviewed to identify likely management practices and organisational processes in the middle. Some significant, largely unresearched, transitions occur in entrepreneurial management practices between small and large firms, are revealed by scrutiny of the literature. A firm moves from one end of the size scale to the other, undertaking a process of emergence from a caterpillar to a butterfly, the chrysalis stage. Metamorphosis between the two forms is a challenging journey and not well understood. Few firms, estimated by Storey to be four in a hundred make the transition successfully. Penrose states "

Aldrich views organisation emergence as a process meriting further study, "the absolute miracle (of large firm creation) does not seem to interest most organisational theorists. It should." "Academic studies, based within the evolutionary, resource based perspective within the corporate entrepreneurship, and firm level entrepreneurship identify aspects of organisational behaviour, attempting to relate resources/capability, principally to firm performance or strategy. Search for firm competitive advantage and profit maximisation drive the research. The EISME owner director focus, where intermingled business and personal objectives commonly exist renders firm performance output measures of dubious value. Substitution of innovation as an output measure avoids several obstacles to capability analysis inherent in the choice of traditional firm performance measures. Value creation can be created with successful innovation, benefiting the EISME owners and the economy simultaneously. Ambitious firm growth plans beyond the capabilities of modestly sized and resourced board teams should not be encouraged. Attention to early board team needs and type of management practice required for an entrepreneurial orientation and innovation output may produce dividends

In the study of large organisations, several key researchers argue for a refocus on organisational processes and knowledge generation for improved firm performance, notably Teece and Ghoshal and Sumantra. Teece, discussing RBT future research direction, join with Aldrich in acknowledging a need for greater study of organisational processes and knowledge generation as part of overall firm evolution (Teece, 1998). Ghoshal and Sumantra go further and suggest an emerging management model for organisations where structure is replaced by a set of key core management processes accompanied by new rules and managerial tasks at various levels. Three core processes are identified as essential, they argue: entrepreneurial, integrative, and renewing processes, requiring a different management mindset. As will be demonstrated, early boards team carry out all processes within the EISME, delegation not been possible. Board team members are instrumental in creating the critical processes identified, was subsequently influence emerging firm orientation. As Knox indicates "the board's role is to nurture and embed the distinctive behaviours and organisational capabilities which deliver innovative solutions" (Knox, 2002).

The entrepreneurial process starts with the recognition and pursuit of opportunities to create value for the customer, founders, investors and both shareholders and stakeholders. Individual entrepreneurship literature is considered over focused on opportunity recognition and exploitation, failing to consider need for entrepreneurial management in EISMEs / smaller firm generally for firm survival and economic renewal through innovation, demonstration of preoccupation to pick winners (Beaver and Jennings, 1995). A widespread failure to connect inputs and outputs process investigation previously existed in much management literature. Difficulty in identifying and measuring process may well account for this deficiency. In corporate entrepreneurship literature the tradition of a measurement construct is well established. A measurement construct is therefore proposed to determine whether the entrepreneurial processes linking inputs and outputs in EISMEs at the early board team level can be identified.

The premise made follows RBT material from Penrose, Kazanjian, Lichenstein, Aldrich and Brush et al,(Penrose, 1959) (Aldrich, 1999, Lichenstein and Brush, 2001) showing management (the early board team in this case) as responsible for making resource picking and deploying of resources decisions according to their objectives, creating processes to achieve them. EISME management practices and organisational processes will be characteristic and potentially exclusive to the firm size sector. Resource variation selection adaptation and retention is a dynamic, taking place continuously as the firm evolves and emerges according to Aldrich (Aldrich, 1999). Lichenstein and Brush create a dynamic model of resource acquisition and development for new ventures, asking research questions which can be adapted to apply to EISME's, which is shown below

**Table 12: Adapted Lichtenstein and Brush Dynamic Novel of Resource Acquisition, Development and Effects in New Ventures:** Entrepreneurship Theory and Practice 2001



Kazanjian sees entrepreneurs as heavily focused on on resource picking and acquisition during startup rather than deployment or allocation (Kazanjian and Rao, 1999). Lichenstein and Brush, in a longitudinal study, confirm the finding in an exploration of resources in three fast growing new ventures, identifying salient resources from existing studies, (principally stage growth models), analysing how resources change over time in an attempt to find a pattern linking the type of change with short-term performance results (Lichenstein and Brush, 2001). Individual resources of the owner are included, as is management know-how. No reference is made to the critical early board team human capital resources. Brush et al. develop a resource deployment theme for firm early growth in a virtually unique paper, arguing for a process ability to effectively pick and deploy resources to create a unique entrepreneurial resource platform from which further unique combinations may arise (Brush et al., 2001). The critical task of directing the change in emphasis from resource identification and acquisition of falls to the early board team.

The transitional management practices and organisational processes created by the early board team, necessary for continued entrepreneurial orientation and continued firm growth are now identified by examining new venture, small business and large established firm management practices and processes. For example, initial entrepreneurial networking is based on individual personal and social capital but as the firm expands, the transition to a extended or interfirm networks is necessary ( Dubini 1990)

Lichtenstein and Brush's model can be taken a step further and applied to EISMEs, as shown in the model above. Research question 1 becomes identification of salient human capital resources of the early board team, effectively carried out in Chapter 5. The second research question can also be modified from the initial question "of how resource bundles change over time" to a more specific one relating to EISME early board team resource profile, Can specific sets of input resources and processing capabilities be associated with higher levels of incremental innovation? The early board team develops, discards, and transforms resources and capabilities through of particular management practices and organisational processes to achieve desirable shifts in resource combinations for firm emergence. Management practice may potentially change fast within an early board team, depending on the complexity of the organisation and the turbulence within the external environment. Degree of entrepreneurial orientation in the early board team is therefore argued to be visible in the management practices and organisational processes and capable of being captured with a new management construct.

### 6.1.1 Role of Organisational Routines and the Entrepreneurial Processes:

Links between inputs and outputs, the mediating entrepreneurial management practices and organisation processes in which a firm engages, are clearly of importance in understanding how firm's perform and an area of much-needed research (Low and Macmillan, 1988). So far little success has been achieved in establishing a direct link between individual human capital and firm performance (Chandler and Hanks, 1994, Gimeno et al., 1997, Mosakowski, 1993). Given different objectives of independently owned smaller firms, a not surprising finding. Understanding process links between inputs and outputs will help not only help understanding of the entrepreneurship phenomena but shed light on avoidance of resource causal ambiguity outlined by Wilcox and King. Repetition of successful resource and capability combinations for further growth cannot occur if their source and nature of the linking processes to outputs is not understood (Wilcox King and Zeithaml, 2001). Board team human capital is assumed to underpin management practices and organisational processes required for innovation, without an over reliance on establish routines, systems and structures, common in larger firms and so intensively studied, linking human capital with EISME firm performance, survival and economic renewal. Researchers adopting a traditional view of management frequently attempt to apply the routines and systems from larger organisations the smaller ones, without understanding the process orientation of smaller firms. Comprehension of capability source and consequent outputs means successful configurations can be reproduced. Early board teams may be substantially handicapped during the critical stage of evolution due to a failure to recognise specific resource combinations to repeat early success.

### 6.1.2 Organisation Process Definition

For research purposes, the term organisational process is used to signify firm behaviour before it becomes an established routine. Processes are deemed to be more flexible and experiential, subject to rapid change than routines as described by Nelson and Winter, outlined below. Management practices are higher order mechanisms, which set and control organisational routines and systems. The early board team management practices act as the higher order mechanism to direct and set organisational processes, consciously or unconsciously, creating organisational processes and routines (for administrative services) by which the whole organisation is controlled. Hoffman et al and Kamm and Shuman (Hoffman et al., 1998) (Kamm and Shuman, 1990) regard organisational processes in small firms a neglected area of research, with Pavitt and Tether relating neglect specifically to small firm innovation processes (Pavitt, 2003) (Tether, 2003). Scrutinising innovation processes in tandem with the early board team human capital, (the means by resources are deployed to build firm capabilities) may help board team incumbents make better decisions on new additions to the board team likely to persist in firm survival and economic renewal through innovation as inform industrial policy and interested professionals.

Board team human capital resources must be consciously evolved in the selection, variation, adaptation and retention of resources according to Aldrich to achieve appropriate management practices and embed control mechanisms in the organisation via the organisational processes (Aldrich, 1999). Burns and Stalker argue two divergent systems of management practice exist in firms. Mechanistic systems exist where there is a clear hierarchy with rules and instructions dictating how things are done, flowing from the top to the bottom (Burns and Stalker, 1961). Freel, acknowledging that important skills and capabilities are held within a firm's organisational processes and routines, notes that routines are subject to self reinforcing path dependent development which can become restrictive and impede innovation (Freel, 1998). Early understanding of the inputs and associated processes is therefore clearly desirable for early board teams.

Nelson and Winter, pursuing an evolutionary theory to the firm growth, contribute to knowledge of processes by which firms evolve, by focusing on the behavioural patterns of organisations, both individual skills and organisational routines. (Nelson and Winter, 1977).

Routine is considered as an organisational memory in which organisational capabilities reside. Capabilities, procedures and decision rules determine what firms do given external conditions. Large and complex organisations have distinct co-ordination problems in respect of work interactions with other organisational members as well as the external environment. Smaller firms have distinct advantages inherent in their size where communication is much easier. Board teams in firms of increasing complexity, are unable to directly observe the details of the organisation's functioning and therefore rely on organisational routines to maintain control. Under the established routines used to transmit knowledge within an organisation, Ghoshal and Sumantra consider an organisation can rapidly become inert, "immobilised by conventional wisdoms that have ossified as sacred cows" (Ghoshal, 1995).

Organisations use routine operations both as a means of achieving organisational control and replicating existing internal routines for growth as well as imitating other firm's methods when perceived as advantageous. Selznick argues that the routines or processes adopted within firms may blindly or unconsciously evolve and, in addition, may not be geared to achieving firm objectives (Selznik, 1957); a dissonance which might not be fully appreciated by owner directors. EISME processes and routines develop according to chance. Standardised organisational templates at variance with owner director objectives may be imported from external sources, under the guise of professional management. Imported templates are invariably geared towards internal efficiency but fail to recognise continued innovation needs and congruent management processes. The organisational memory, composed of routines, constitutes important storage for the firm's operational knowledge. Such routines or organisational processes, management practices or capabilities are frequently tacit rather than explicit and are maintained by 'doing'.(Nelson and Winter, 1977 p 99, Nelson, 1991).

The term routine is used in a flexible manner by Nelson and Winter. Routine is a pattern of behaviour, either a repetitive pattern of activity or inherent skills within the individual or team (such as those created by the human capital resource characteristics). Here, the pattern of behaviour created by inherent skills are referred as practices and processes. Routines refer to repetitive patterns of activity, characteristic of Penrose's administrative management, whilst the term process is used to denote something potentially more fragile and transitory. According to Nelson and Winter in a steady state internal and external environments, the 'routines' remain stable but individual members should have the ability to receive and interpret a stream of incoming messages from other members and the external environment to either select and perform an appropriate routine from their repertoire or if necessary create a new one. More recent writers such as Eisenhardt and Covin and Slevin also recognise the environmental impact on internal processes. (Eisenhardt, 1989) (Covin and Slevin, 1989). Early board teams must have dynamic adaptive capability to vary their response according to circumstances, the "honing" process referred to by Teece et al. and Oktemgil (Teece et al., 1997) (Oktemgil and Greenley, 1997). Organisation members must also engage in search operations to 'discover, consider and evaluate possible changes in their ways of doing things' through interactions with the environment, internal and external as it changes (Nelson and Winter, 1977) p45.

Organic systems , as opposed to mechanistic, described by Burns and Stalker have no rigidity or specialisation and are better suited to solving problems and sharing knowledge in conditions of uncertainty and ambiguity, either due unstable marketplaces/industry conditions or during innovation and uncertainty of acceptance. Mechanistic management systems are better suited to stable environments with little change and little need to innovate. (Burns and Stalker, 1961). Burns and Stalker's suggestion of divergent management practice for different purposes is analogous to Penrose's requirement for both entrepreneurial and managerial "administrative" services within an expanding board team (Burns and Stalker, 1961). Stevenson et al also explore the difference between 'entrepreneurial and management services' still further, characterising entrepreneurial management as a proactive promoting management style stretching for resources at one end of a scale, with a trustee form of management behaviour at the other end concerned only with maximum utilisation of existing resources (Stevenson and Jarillo, 1986). The firm must somehow find a capability to maintain both sets of management practice although perhaps varying their proportions over time.

Aldrich and Martínez extend the basic Burns and Stalker framework by elaborating the concept into two poles; reproducer and innovator organisations (Aldrich and Martinez, 2001). Reproducer organisations are those defined with routines and competences that vary imperceptibly from existing organisations in established populations. Reproducer organisations bring little or no incremental knowledge to the firm population they enter, organising their activities in the same way as their predecessors. Innovating firms, are capable of varying their routines capabilities and competences to achieve better outcomes of customers, founders, investors and stakeholders. Freel finds board teams wishing to remain on the innovator side of the scale must therefore be prepared to vary their management practices, organisational processes and routines, capabilities and competences in innovative ways in an attempt to improve their performance.(Freel, 1998).

In reproducer organisations, routines and competencies are similar to existing organisations, perhaps imported and copied or based on 'rational' or 'scientific' principles. Innovation is excluded by risk adverse, 'trustees' of resources concerned with maximum resource utilisation for maximum added value, unable to think out of the box. Innovator type organisations, on the other hand, possess routines, capabilities and competences that are significantly different and infinitely variable, composing unique resource and capability combinations. They continously learn and generate new resource combinations and capabilities in support of innovative opportunities. Senge identifies this as a generative rather than an adaptive learning capability (Senge, 1992). Key team management practices and organisational processes, combined with the board human capital resource, favouring a generative orientation and innovation are sought within early board teams. Entrepreneurial management is therefore differentiated from dynamic management capability as a generative rather than an adaptive capability by generating innovation outcomes.

An effective early board team needs to both establish routines for effective and efficient resource utilisation as well as all the processes necessary for continued innovation. A simultaneous ability to undertake entrepreneurial services –management practices and organisational processes to achieve incremental innovation outcomes is required as well as tried and tested management practices and organisational processes for stable routine control, capable of carrying out repetitive tasks related to "administrative", as opposed to "entrepreneurial" services in Penrose's terms. As Hite and Hesterly indicate in their examination of network nature and their use in the stage between start-up and early growth, the development stage is a critical one, where tension exists between different types of management practices and processes, " (Hite and Hesterly, 2001).

The key management practices adopted by the early board team and the organisational processes set in place as a result are, therefore, highly influential to the way the firm develops. Managerial capability in terms of maximum efficiency and profitability can easily replace entrepreneurial capability at this stage, under the guise of professional management. Characteristic patterns of entrepreneurial behaviour: both individual and firm level have been well identified in the literature, not so firms in the middle without ambitious growth ambitions. The task of identifying specific key areas of management practice and organisation process associated with early board teams capable of innovation remains to be addressed. The question of just how a smaller firm maintains both its entrepreneurial and managerial capabilities to make the important transition through the chrysalis stage, from caterpillar to butterfly, to a larger scale of operation has not yet been addressed, yet is crucial part of firm evolution and emergence.

Learning to vary the resources picking and deployment behaviours, discarding and acquiring new resources and then recombining and reconfiguring resources and capabilities to achieve modified objectives is a substantial task for the early board team. Trying to assess the entrepreneurial orientation of EISME management practices and organisational processes through a new measurement construct may help capture the presence of an intermediate board team entrepreneurial capability at the early board team level. As a firm embarks on later growth stages, a division of management labour may occur so that the stage of early board team emergence provides a useful research opportunity.

### 6.2 Identification of Components to Entrepreneurial Management Orientation In EISME

Scrutiny individual and corporate entrepreneurship literature is combined with that of innovation management identified for key areas of significant transition required in management practice in moving from small to large. A substantial difference in the risk and reward profiles of smaller firm owner directors and those in larger firms first identified. The propensity to seek and share information inside and outside the firm was considered important to both smaller large firms but reasons driving the behaviour a different as will be discussed below. A critical process involved in information seeking a sharing is networking. Making a transition from networks based on personal and social capital of the entrepreneur to the widely accepted interfirm linkages an alliance characteristic of adaptive larger firms is a significant undertaken by the early board team. Finally but not least, decision making processes in new ventures frequently situations of uncertainty and involving innovation are different, not necessarily based on rational decision-making which dominates traditional management education in business schools.

The four entrepreneurial components deemed to possibly represent a management entrepreneurial orientation present in the early board team management practices and firm organisational processes and are discussed in turn

#### 6.2.1 Risk and Reward Profile

Risks and rewards experienced by owner directors of smaller firms and directors of large established publicly quoted companies over the different and dependent on the corporate governance issue often ignored by researchers when assessing performance in smaller firms: the lack of separation between ownership and control (Fama and Jensen, 1983).

Small firms are managed in a personalised way by their owners according to Bolton (Bolton, 1971) and their personal objectives become intermingled with those of the business (Beaver and Prince, 2004). A significant and a specific 'peculiarity' of EISMEs, generally not recognised in measurement of innovation and firm performance in smaller firms, lies in the distribution of ownership amongst board members, both executive and non-executive. Share ownership pattern among EISME board members is likely to be a major factor influencing individual management behaviour as Zahra shows. Commitment to the firm of the long-term through share ownership is likely to be a factor for continued innovation in a paper exploring share ownership and governance in medium-sized firms (Zahra et al., 2000). Zahra finds that directors with no financial interest in long-term firm performance through share ownership are more likely to leave and find other jobs for career advancement. Clearly such departures damage the resources and capabilities available to the early board team (Barnhart and Rosenstein, 1998). The development of the early board team board knowledge production function vital to innovation is interrupted, causing a setback to the integration of the board team and further interrupting the firm's resource path development.

For large firms, rewards are frequently allocated according to hierarchical position in larger organisations when they should perhaps be linked to roles and tasks according to Ghoshal and Bartlett (Ghoshal and Bartlett, 1995). Barnhardt, Daily and Dalton, Hambrick and Mason and Fama and Jensen amply demonstrate different incentives among board members cause non alignment with the interest of shareholders, impacting on longer term value creation and firm performance (Barnhart and Rosenstein, 1998, Daily and Dalton, 1993, Hambrick and Mason, 1984) (Fama and Jensen, 1983) (Papadakis et al., 1998). Nonalignment of incentives among board team members are therefore influences firm strategic orientation. Matching pay systems of board members and upper echelon managers to firm strategic orientation is desirable and found to be so by Boyd, Salamin and Conyon (Boyd and Salamin, 2001, Miner et al., 1989) (Conyon et al., 2001). Clear management objectives for directors of large publicly quoted companies: the firm is managed on behalf of the shareholders, creating value and competitive advantage, providing profit as dividend streams and share price capital growth.

Firm ownership and control is concentrated in the hands of a few directors within EISMES. Moving incrementally, by stages towards a fully resourced board team essential for unified team direction towards similar objectives is a substantial task. Reward is balanced by risk to the individual and related to firm objectives. Ascertaining pattern of share ownership within early board teams may reveal a source of potential problems. Consequences of differently incentivised board directors, oriented towards sales and profit, rather than innovation are considerable. "Getting it wrong" could be a major reason for stalled all arrested development.

New directors, motivated towards different ends will employ different management practices, creating organisational processes at odds with the objectives of share owning directors. A salaried director rewarded through a profit bonus, will behave differently to a founder interested in ensuring long-term firm survival. The original founding directors may find it difficult or actively not wish to share or delegate decision-making authority and control to later board recruits as found by Boeker and Karachalil, Jayaraman (Boeker and Karichalil, 2002) (Jayaraman et al., 2000). Creating inner and outer teams where conflict may arise, as Vyakarnam suggests, will potentially produce a culture clash where inherent beliefs and values differ and prevent full team integration (Vyakarnam and Handelberg, 2005). A potential problem for successful emergence of the board is thereby created, especially when share ownership rests solely with the inner team. Outer team directors can be financially motivated with short-term incentive schemes based on profit or sales, not compatible with long term survival objectives. (Baysinger and Butler, 1985).

Existing EISME board members attempting to expand board resource and number face critical decisions on choice of rewards offered to new directors, accompanied by the degree of management control to be relinquished. Incumbent directors can produce reward systems which are at odds with their own objectives. Board member risk and reward profile, their intrinsic motivation will depend on the objectives and rewards set. Split share ownership between inner and outer teams, as described by Vyakarnam, (Vyakarnam et al., 1999) will prevent knowledge generation achieved by learning together in the pursuit of mutually shared objectives.

New board member recruitment and founder succession - the latter well covered in the family business literature, it is argued, must be handled such that congruent objectives and motivations prevail amongst the board team. Unfortunately, smaller firm owners are reluctant to part with equity for either new directors or private equity investors, according to Binks Cressy and Murray (Binks and Ennew, 1995, Cressy, 1996, Murray, 1995). In more ambitious ventures, funded by venture capital, sharing of equity and sometimes control is taken for granted. Share ownership by non founding directors and third parties outside the firm present within an EISME would therefore seem to indicate an alignment of early board team board team objectives with rewards is proceeding in the right direction.

EISME founding directors may sell up or simply retire, becoming a non executive director or chairman, either creating a significant human capital resource gap or acting as a brake on change, especially in family businesses {Murray, 2003 , Johanisson, 2000) . As Cowling indicates "the founding entrepreneur is a unique individual with a unique arrangement of skills not easily replaced by more functional personnel" (Cowling, 2003). Founder presence may create an obstacle to change, including all important internal processes. Alternatively, additional resource may be provided. In 'larger smaller' firms studied by Boeker, significant shareholding on the part of founding CEO is found to be detrimental to firm performance, especially if their objectives diverge from other shareholders (Boeker and Karichalil, 2002). Knowledge assets can improve with time and experience but if an adaptive and generative capability is sought from firm, elderly family non executive directors can act as an impediment {Goffee, 1985, Donckels, 1991).

Board ownership structure is found to influence firm performance by Eisenberg. Non-executive director shareowners are more likely to take risks than those that do not (Eisenberg et al., 1998). EISME share capital is often closely held among sometimes extended family groups (Murray, 2003). Shifts in board membership and equity ownership are fraught with potential for disrupted board team development and effectiveness. An extensive network of family shareholders, holding non executive board positions, may represent potentially conflicting reward and risk objectives for the business, creating a pattern of family directorship impacting decision making and the development of Pavitt's knowledge production function. Innovation, in particular may suffer, if it requires long tenure as a replacement for education. Cowling finds that a transfer of ownership away from the founding entrepreneur has the effect of depressing output, holding all else constant, indicating some vital element departs with the entrepreneur (Cowling, 2003). Penrose's scenario – for new board team members is reversed with the same consequence: interrupted board team development.

Berry and Perren also consider potential influence by non founding, non executive board members may depend on how many there are and whether they own shares (Berry and Perren, 2001, Berry and Perren, 1998). Non share owning directors may be more interested in avoiding risk and potential damage to their reputation. Cowling concludes that share ownership is an important criterion for a successful board team, regardless of whether the firm is dominated by the founders or not (Cowling, 2003). If non share owning board members are incentivised through performance bonuses or profit shares, then there objectives may well be short-term compared to share owning directors long term objectives

**Risk**

The reverse side of the reward coin is risk. Rewards are potentially higher if greater degrees of risk are taken in entrepreneurial ventures. Risk for independent entrepreneurs thinking their own funds into the venture, with their own property as security, are risking considerably more than for a corporate manager or director. A corporate manager might risk losing their job, officiated salary, and reputation. A board director may survive failure of a risky venture or exit with a golden parachute. Early board team anticipated rewards are not just financial and influence their propensity and willingness to take risks in the pursuit of innovative opportunities. If greater profit is not a motivator than conceivably innovation for economic renewal and increased firm longevity might be is presented correctly.

Historically risk has been central to the definition of entrepreneurship. Cantillon describes an entrepreneur as someone who bears risk in conditions of uncertainty between supply and demand (Cantillon, 1755). Jarillo and Stevenson define an entrepreneurial individual as someone who takes risk in the pursuit of opportunity (Stevenson and Jarillo, 1986) Timmons describes an entrepreneur as some one who is willing to take calculated risks (Timmons, 1994). Forlani and Mullins take a more sophisticated view and explain risk as a reflection of the degree of uncertainty and potential loss, the significance of those losses and the uncertainty involved in them resulting from a given set of behaviours for an individual, (Forlani and Mullins, 2000).

Risk continues to feature in entrepreneurship definitions little evidence to show entrepreneurs and corporate managers perceive risks differently exist. Research findings on risk propensity are divided and inconclusive with little empirical evidence according to Busenitz (Busenitz, 1999). Hoy and Carland find risk perception between entrepreneurs and corporate managers no different. The perception is the same but action different (Hoy and Carland, 1983, Stewart et al., 1998). Begley and Boyd do find that entrepreneurs do have a slightly greater propensity to take risks than managers or a member of the general population (Begley and Boyd, 1987). According to Busenitz and Barney, a significant difference lies in use of heuristics and biases by those with entrepreneurial orientation rather than an attempt to use 'rational' traditional management techniques of information analysis and evaluation (Busenitz and Barney, 1997). Risk perception therefore becomes a function of specific information processing knowledge and capability specific to firm size and management experience of firm's life cycle stage.

Cognitive approaches to entrepreneurship, such as that of Palich and Bagby, suggest an entrepreneur pursues activities ignored or neglected by a manager simply because of a more positive perception through cognitive differences (Palich and Bagby, 1995). Newer cognitive approaches may well assist in explanations of differing risk propensities but more work is required before it can be practically useful (Baron, 1998). Education, family background, work experience in similar industries and firm sizes may all affect learning and cognition but the interplay of such factors is of such complexity they cannot easily be measured. Confidence may play a part, although according to Cooper at al wearing of "rose tinted glasses" by conceivably a function of youth and insufficient experience may cause the same facts to be interpreted differently (Cooper et al., 1988). Forbes suggests confidence may also conceivably be a result of successful team decision-making and other dynamics at board level(Forbes and Milliken, 1999). Early board teams may therefore benefit form longer tenured board teams. Stevenson and Gumpert argue that successful risk takers have the confidence to assume missing elements in a pattern will take shape as they expect (Stevenson and Gumpert, 1985).

What other factors influence risk? The degree of innovation, inherent in the project will influence the degree of risk as Shepherd finds. Risk increases according to degree of novelty for the market and according to the level of industry and management competence (Shepherd et al., 2000). Innovation by definition is new. Verification information required by traditional management for decision making is not likely to exist except by approaching the information in a different manner, through heuristics and bias. Traditionally skilled "trustee" managers will not fair well in a process orientated organic environment. Scanning for information reduces risk but risk can only be reduced if information is available. Incremental innovation decrease risk according to Utterback (Utterback, 1994) which may be continuous or sporadic. Brazeal finds continuous innovation as a preferable option for internal innovative ventures, rather than sporadic survival induced innovation, indicating it requires the loyalty of innovative minded individuals, in the presence of structural reward systems (Brazeal, 1993). Given the likely difficulty of balancing or sequencing internal resource allocation processes within the early board time, sporadic, or intermittent sequential, incremental innovation would seem to be the appropriate path for early board teams. EISME directors are also distracted by demands of operational day-to-day management.

Other research shows that risk taking decreases with firm and individual age (Scott and Rosa, 1997), as firms become more conservative (Chell et al., 1991) since presumably their owners age, although confidence could be argued to increase with age. At a national level, risk as measured by the net lending from the banking system, indicates that SMEs are conservative, very reluctant to borrow from external sources (Cressy, 1996), although according to data published by the Bank of England, smaller firms have increased their propensity to borrow (Bank of England, 2004). In summary, risk is considered to be greater for early board team development in EISMEs if the risk and reward profile of the whole board are not aligned and in the presence of radical innovation. Identifying the share ownership patterns within the early board team becomes a significant aspect in assessing its development and may well influence the propensity of EISMEs to innovate.

**6.2.2 Information Seeking and Sharing** – include climate and culture innovation supportive culture to foster the required processes (Jensen and Meckling, 1976).(Fiol, 1991)

Ability to scan the environment frequently to obtain market intelligence is a well accepted requirement associated with better large firm performance, including Thomas Dollinger and Daft (Thomas et al., 1993) (Daft et al., 1988, Dollinger, 1984). Organisations, regardless of size, need to monitor their market environment on size, growth trends, customer characteristics, competitor offerings, macro level information on population demographics, technology development and industry and economic conditions generally. Information seeking is only half the story however – what happens to the information after collection, the processing is crucial. Information processing is an acknowledged part of the entrepreneurial process in larger firms by Ghoshal and Bartlett (Ghoshal and Bartlett, 1995). Larger firms have the resources to pursue information and process it. Smaller firms with restricted resources need the same information but obtain and process it in radically different ways compared to larger firms (Aldrich et al., 1990, Mohan-Neill, 1995). A dichotomy between the processes of information seeking and sharing between small and large firms due to resource constraints exist pointing to a considerable transition in management practice for information seeking.

**Large firms**

First, larger firm findings are examined followed by those for new ventures and small firms. Corporate entrepreneurship literature views information scanning as a critical part of entrepreneurial orientation but principally as a means as a means of a increasing adaptive capability (Barrett and Weinstein, 1998). Firm level entrepreneurship for economic renewal and rejuvenation in the chore industries seeks more radical strategic and organisational innovation as well as incremental product and process innovation in an effort to match changing environmental conditions. Strategic and organisational innovation is carried out by board teams or CEOs (Stopford, 1994). product and process innovation by middle managers (Barton Leonard, 1995). Nelson and Winter and Cyert and March's earlier (Cyert and March, 1963, Nelson and Winter, 1982) organisational process interest, is pursued more recently by Ghoshal and Bartlett who emphasize large firm key strength as the incremental build up of knowledge through a heavy emphasis on mechanisms and routines. Mechanisms and routines, " the way things are done round here" become part of the accepted perspectives and norms within the firm for managing different information processing tasks, (e.g. accounting, planning and control systems) providing order and efficiency and, permitting specialisation of tasks. Separate processes acquire data, analyze, and interpret it, converting information into knowledge and wisdom. Such knowledge can be leveraged to refine operational processes in existing activities.(Ghoshal and Bartlett, 1995), providing of course the information is shared across the organisation. Cummings suggests firm's may well support large internal market intelligence gathering operations, or purchase it externally, but still be inefficient in dispersing and using it due to poor cross functional and interdisciplinary working.(Cumming, 1998, Cunningham and Moroney, 2000).

Seeking information outside the firm is only part of the equation. Internal Integration processes are required to link with and leverage the existing resources and capabilities. Information must not only be sought but shared in the entrepreneurial process. The failure to achieving cross functional, cross disciplinary working, and linking individual, group and firm levels of social capital (Floyd and Wooldridge, 1999) may also prevent knowledge sharing, particularly valuable for innovation (Hitt et al., 1999). Kanter and Barton both acknowledge barriers to innovation imposed by firm management practices and organisational processes. Barton demonstrates that sometimes core capabilities can become core rigidities when it comes to innovative product development in larger companies, whilst Kanter suggests establishing external ventures as a way of fostering new business streams of economic renewal, avoiding "sacred cows" in Ghoshal and Sumantra's terms (Barton, 1992) (Kanter, 1991)

Increasingly established large firms are seeking alliances and joint ventures for innovation purposes, to shorten development and time to market (Kanter, 1991 , Hamel, 1989) (Gulati, 1998). Alliances will only be effective if the firm takes care to develop their relational capabilities with other organisations (Gulati, 1998) (Gulati et al., 2000, Lorenzoni and Lipparini, 1999). Larger firm alliance objectives are likely to be more strategic in nature, more sophisticated than those of emerging organisations, although alliances between smaller firms especially for international a global entrepreneurship is increasing (Reynolds et al., 2002).

Scanning intensity, planning flexibility, locus of planning and control attributes, studied by Barringer and Bluedorn, to determine intensity of corporate entrepreneurship intensity found scanning intensity and planning flexibility particularly intense in firms with an entrepreneurial orientation in a study which seeks to achieve a fine-grained analysis of practical use (Barringer and Bluedorn, 1999) . A firm's scanning and planning flexibility is described as moulding and shaping firm and employee behaviour at all levels – of good example of information seeking and sharing modifying internal processes. Providing of course, they are combined with control systems rewarding creativity and pursuit of innovation opportunity. Firm strategic management practices are found to influence entrepreneurial intensity, which begs a question is to their nature in smaller firms addressed later.

**Small Firms and New Ventures.**

Small business management literature acknowledges small-business owners generally spend a significant amount of time seeking information outside the firm, consulting marketing channel members and their personal networks as a means of overcoming resource limitations for general purposes as well as well as facilitating the innovation process using informal and personal networking sources (Birley, Hartman et al., 1994).

Whilst the owner manager is operating on their own or with a single partner, knowledge transmission is not an issue but as the firm evolves, internal boundaries may be created across the management function areas if action is not taken to prevent it – especially if so-called professional management templates are adopted, with inbuilt rigidities, from other organisations. Early board team management practices and the organisational processes engendered, therefore have a critical role in ensuring cross disciplinary working necessary for continued innovation – a climate of communication must prevail for successful innovation (Chandler, 2000 ).

Firm age is acknowledged to decrease the a scanning activity intensity by Mohan Neil (Mohan-Neill, 1995) when examining scanning activities of new and smaller ventures compared to older and larger firms. Older larger firms are more likely to collect remote marketplace information and use formal methods of data collection. Without acknowledging the impact of resource constraints, she finds smaller firms are less likely to engage in formal and structured marketing research activities. Since smaller firms grow very fast in their early years (Acs and Audretsch, 1990), a preference for informal as opposed to informal is perhaps not surprising as management practices and organisational processes are continuously evolving. Mohan-Neil proceeds to make an unjustifiable assumption new smaller firms are less well informed about macro environmental conditions as a result, implying an unwarranted assumption in the necessity of formal information gathering for analysis

Lack of a formal information gathering systems does not necessarily mean that smaller firm informal strategic management processes are short of information. Internal processes exist, not formal systems in the absence of resources. The role of external networks and networking is overlooked in obtaining information, as is the type of decision making likely to be employed in smaller faster growing firms (Freel, 2000). Despite the heavy concentration on opportunity recognition within entrepreneurship research (Shane and Venkataraman, 2000), opportunity recognition is only the beginning of the entrepreneurial process. Superior entrepreneur alertness to the external environment is recognised as a necessary characteristic of entrepreneurs wishing to maintain their awareness of external opportunities arising from economic disequilibriums according to Minitti and Bygrave (Minniti and Bygrave, 1999). EISMEs early board teams must follow suit if they are to maintain an entrepreneurial orientation. Scanning the environment and finding opportunities for answers is essential to develop the application of management know-how

The information 'processing' a knowledge production unit of the founding entrepreneur or early board team in an EISME will matter too in the way information and knowledge is handled. The propensity to decrease scanning activities may decrease with increasing firm and director age (and maybe the presence of low education levels and lack of management experience). The possibility of increasing information seeking and sharing propensity by the addition of fresh resource to the early board team, amply endowed with education and experience may help regenerate important lapsed processes within the board team.

### 6.2.3 Resource Access - Networking

Networks and their use, through networking capability, is a key process in leveraging existing and facilitate access to new resources in small and new ventures (Brush, 1992, Dubini and Aldrich, 1991) (Birley and Stockley, 2000, Ostgaard and Birley, 1996). Similarly networks are recognised as important to large firm success, particularly in high velocity markets and uncertain environments (Eisenhardt, 1989). In both cases networking is achieved by spanning external and internal boundaries according to Conway and Dollinger (Conway, 1994, Dollinger, 1984). External networking dominates for the entrepreneurial process facilitating many areas; opportunity recognition, a means of accessing markets and resources. Pursuit of a parsimonious path (aka resources leveraging) to entrepreneurship, where resources are externally accessed rather than owned extends an entrepreneur's span of action and supplements their strategic competencies as well as achieving advice, emotional support and encouragement, generating social support for enterprise from the local community (Conway, 2000). Networks and networking literature is vast and cannot be covered in its entirety here. The nature of the strong and weak ties (Granovetter, 1973) within the network structure, their relationship to the founder and each other, are found to be important for continued venture performance where the presence of a few strong ties, and a greater number and diversity of weak ties are favoured (Nelson, 1989)(Boeker, 1997, Borch and Huse, 1993, Donckels and Lambrecht, 1995, Nelson, 1989).

Entrepreneurial networking is initially primarily based on founders personal and social capital (Birley, 1985, Freel, 2000, Jarillo, 1989). As a firm expands, owner networks need to transfer from those based on personal and social capital to extend and change in nature encompassing interfirm links. Others, as well as the founder, make contact with other organisations according to Dubini and Aldrich and Jarillo. (Dubini, 1991, Jarillo, 1989) Founder's networks cannot be handed over to others according to Gilmore (Gilmore et al., 2000). Network nature transition and network capability development, moving them from personal to interfirm relationships, has to be initiated by the early board team. Overtime other employees within the firm must be encouraged to develop their own links in various ways. Larger networks, both personal and into firm, continually developed, will help maintain an entrepreneurial orientation to

An early board team needs, not only to maintain their own personal and social network contacts but change their nature – developing both strong and weak ties in Granovetter's terms (Granovetter, 1973) (Nelson, 1989) but to create and encourage increasing development of interfirm linkages – by their own activity and encouraging other employees to develop their own links. Networking is an essential ingredient according Laparini for innovation in smaller firms, accessing knowledge resources to solve problems and generally leverage internal resources (Lipparini and Sobrero, 1994). Information seeking and sharing within EISME must be viewed as necessary for both adaptive and generative capabilities. The propensity to seek and share information on the part of the early board team may be a good indication of entrepreneurial management capability.

EISME management practice and an important component to board team entrepreneurial capability. Resource constraints continue to exist in EISMEs a retained entrepreneurial management orientation the board team will ensure the firm remains "resource light footed" flexible and capable of rapid change. As a firm evolves, the hierarchy expands and it comes essential to ensure that knowledge and information is transmitted throughout the organisation.

No literature was found on group networking habits but Floyd and Wooldridge in the context of firm have an entrepreneurship examine how knowledge is created and shared through the social network use across individual, group and firm levels as a means of embedding new knowledge (Floyd and Wooldridge, 1999). A mix of internal social, personal, and interfirm networks found to be essential in knowledge creation. A complete turn of the circle has occurred in networking development from dependence on external personal and social capital to dependence on internal networks based on the same individual personal and social capital for information gathering and knowledge creation is shown to take place in the transition from small and large.

### 6.2.4 Decision Making

Decision making is an inherent component to strategic planning and management processes, without which nothing happens. Strategy is defined by Grant as "the match and organisation makes between its internal resources and skills and the opportunities and risks created by its external environment" (Grant, 1991). Quinn considers "strategy is a pattern or plan that integrates an organization's major goals, policies, and action sequences into a cohesive whole. A well-formulated strategy helps to marshal and allocate an organization's resources into a unique and viable posture based on its relative internal competencies and shortcomings, anticipated changes in the environment and contingent moves by intelligent opponents" {Quinn, 1980). Decision making is the organisational process which makes strategy happens. In larger companies, it is embedded in the organisations routines systems and structures and associated with resource allocation procedures.

Significant effort examining strategic planning and management processes within the small firms has been expended attempting to further the cause of the formal business plan as part of the strategic management process. Robinson and Pearce, in a summary of literature on the subject, noted a strong undercurrent of empirical support for a positive relationship between strategic planning and performance whilst noting some contradictory evidence (Robinson, 1998, Hofer, 1975, Lindsay and Rue 1980), suggest firm size has an important contingent or moderating variable when considering design of effective strategic planning processes. Firm size affects the nature of strategic planning. Later papers in 1984, by Robinson and Pearce {Robinson, 1984, Robinson, 1984 } found that informal rather than formal planning procedures were recognised as important by small business managers to firm performance. Superior sales growth rate in another study by Lyles was found to be associated with formal planning rather than informal Lyles et al (1993).

The apparent contradiction between Lyles et al (1993) and Robinson and Pearce (1983) can perhaps be explained by differing and insufficient definition of formal planning. In both studies the depth of formal planning was assessed by the written plan detail. Mintzberg in considering formalised planning in large firms indicates a separation of thought and action divided between managers in larger firms is unlikely in smaller firms (Mintzberg, 1987). Formal, structured planning may not take place within formal systems and structures in small firms out solution evidence exists to that structure planning activity is beneficial (Bracker, 1988).

A fresh approach to decision-making and strategic management processes to comprehend the transition necessary in EISMEs is required. Borrowing from small firm marketing literature "entrepreneurial marketing" is seen to use bottom up as opposed to a top-down marketing activities {Stokes, 2000, Chaston, 1997, Coviello, 2000). An entrepreneur takes a product to market, assesses demand, modifying the product according to customer feedback. Eventually more formal marketing processes will need to be adopted as the firm grows. A clear parallel exists with strategy in smaller firms, strategy is tried and tested and amended according to results. Bottom-up as opposed to top down strategy is intuitively understandable when the educational deficiencies of the UK manager population. Accumulated experience through trial and error has a value. Marston and Forbes contribution to Jones and Tilley's book covers discusses the approach: top-down approaches are associated with larger companies were as bottom-up the smaller (Jones, 2003) p33-35. According to Jennings and Beaver, large firms deliberately seek and create competitive advantage, and are primarily a predictive process concerned with the clarification and communication of long-term objectives. In smaller firms, competitive advantage often arises accidentally as a result of the particular operating circumstances surrounding the enterprise (Jennings, 1997).

Mintzberg and Quinn tackle the heart of the matter in pointing out a difference between planned emergent strategies. Perfectly planned strategies, the way things "are supposed to get made" as opposed to how "they get made" emergence strategies closer to the reality fast-growing smaller firms (Mintzberg, 1985 ,). The implication is strategic process is one of learning, rather deliberate steps perfectly executed. Using a craftsman metaphor Mintzberg describes the connection between thought and action, between thinking and doing. Owner managers are intimately involved on a daily basis with the operations of the business and are best placed to perform a deliberate process of strategy. Thought and action are not disconnected. An early board team confronts the reality of what they would like to be and what is on a daily basis. Achieving a strategic direction depends on the resources they can access, providing a link back to resource access entrepreneurial capability component of entrepreneurially orientated EISME board teams.

Returning to the stage models, Churchill and Lewis (1983) relate strategic planning importance to the firm development stage, arguing strategic planning only becomes important when the company reaches a certain stage. Formal planning becomes critical in the "takeoff phase," open at a stage where "the key problems on how to grow rapidly and how to finance the growth" Formal planning processes are therefore not particularly significant to lifestyle businesses not contemplating rapid growth. Informal bottle bottom-up strategies may well be the most effective way of responding to market and environmental conditions.

Approaching the decision making process from the resource base perspective, it is essentially decisions picking and deploying of resources, selecting and acquiring new resources to combine and create capabilities. In the course of responding to market, external industry and environmental conditions resources may be reconfigured and combined to achieve new capabilities. Allocation of resources occurs through formal budget allocation procedures in larger firms. Individual entrepreneur's use their heads and advice from external sources. Early board teams probably need to do both to advance along the continuum from bottom up to a top-down strategy making. Thus evidence of both formal and informal planning within early board team management practices might indicate an advance from one end of the spectrum towards the other.

# CHAPTER 7

# RESEARCH CONCEPTUALISATION, DESIGN, AND OPERATIONALISATION

## 7. Introduction

The first section shows how the literature review has contributed to the conceptualisation and design of the research thesis, setting out the design with the aid of a research model. A quantitative research approach is then outlined with accompanying hypotheses to test the research model relationships. The contributions made to academic knowledge through the identification of gaps and deficiencies in existing research are highlighted. Practical and statistical significance with substantive and theoretical implications for the evolution and development of organizational growth capability for EISMEs is sought through the study of early board team resource inputs, linked by processes to innovation outputs. The research design is shown to be appropriate to the objectives, matching ontology, epistemology, and research questions with the research methods. Structural validity is achieved by matching the analysis methods chosen to the theoretical construction of the selected variables based on the literature review - the entrepreneurial capability construct, in particular.

Section 2 details the operationalisation of variables required by the research design. Section 3 contains the techniques for construct validation for the new measurement scale created. Chapter 8 sets out the research methods in detail, taking care to demonstrate the appropriate creation, validation, and execution of the research instruments according to the research design and objectives. The chapter then turns to matters of the sample design, how the data was collected and processed. Chapter 9 covers the data analysis and initial interpretation.

### 7.1 Research Design and Objectives

Low and Macmillan originally identified six key specification decisions necessary in a research design specification within entrepreneurship, which are all interrelated and cannot be made independently: purpose, theoretical perspective adopted, and focus, level of analysis, time frame, and methods used. These research design elements are all covered and take into account their call for research, which takes account process, context and outcomes of entrepreneurship (Low and Macmillan, 1988).

The RBT research perspective is chosen for the research, permitting entrepreneurship to be defined as a management resource picking and deploying activity. As Gartner point out, an appropriate theoretical and conceptual framework depends on the definition of entrepreneurship used. Few researchers can understand and embrace the enormous volume of multidimensional entrepreneurship research (the whole elephant).Clear expression of the theoretical perspective from which the entrepreneurship elephant is viewed is entirely necessary. (Gartner, 2001)

The research design also aims to address gaps in study and research deficiencies of existing research. Firstly, the enormous growth in the number of UK small firms emphasises the lack of research on how organisational growth capability can be encouraged, ensuring that some established firms can, at least, continue to grow, modestly, prosper, creating value for their owners and the economy. By doing so, valuable firms sector resources and capabilities are likely to be accumulated retained, ultimately of benefit to other firms of the same size. The established independent small and medium-sized enterprise is identified as a neglected firm size sector in research deserving of more attention.

Secondly, although the entrepreneurship phenomenon is acknowledged to be a complex one, taking place at multiple levels: individual, group and firm (Bruyat and Julien, 2000), group level entrepreneurial management behaviour appropriate for EISME development is totally neglected in research studies. Smaller independent firms will never evolve and emerge if their ability to maintain innovation, their entrepreneurial capability - capability to innovate, is never studied separately, including industry. A neglected group level of entrepreneurial management behaviour at the early board team level, previously neglected is identified addressed.

A particularly needy EISME sector, in terms of declining firm numbers and performance, is identified within the plastics processing industry. The research therefore addresses one of the recognised major flaws of much research on innovation and entrepreneurship in the SME context by simultaneously examining inputs, process and outputs in a controlled context (Hoffman et al., 1998, Low and Macmillan, 1988) Study findings may well provide insights of use to both practitioner and policymaker alike.

Finally, a gap in understanding of the entrepreneurial process is identified through the omission of innovation as an output measure. Entrepreneurial orientation measured without consideration of innovation output is merely a measure of adaptive capability, firm responsiveness rather than a generative one, capable of economic renewal through innovation.

The use of traditional firm performance measures are considered inappropriate in a situation where ownership and management control are not separated since it fails to recognise owner director propensity to manage firms to meet their own personal as well as business objectives. Given these particular preceding research issues and deficiencies, the research design aims to link inputs and outputs with their intervening processes in a manner facilitated by the adoption of the resource base view of the firm.

The links between inputs and outputs of the entrepreneurial process growth specific firm size and entrepreneurial management locus, the early board team argued to be unique.

The human capital resources of the early board team are considered as the inputs, which act through the medium of the early board team management practices and following organisational processes to produce innovation outputs. The intervening processes and the degree of entrepreneurial orientation are considered to be influenced by the early board team size and human capital composition. A new measurement construct to gauge the intervening nature of the management practices of the early board team is developed in an attempt to determine the neglected links for emerging firms.

### 7.1.1 Conceptual Framework

The overall research objective is to increase understanding of how some firms may emerge from the throng of small firms. Working within the resource based perspective, the links between early board team human capital resources, their management practices and organisational process, innovation outputs, and firm performance are examined. Hitherto much neglected, the early board team plays a crucial role in the development of organizational growth capability for a significant number of firms without ambitious growth objectives. Little is known generally about the transition processes undertaken by emerging firms as they increase in size. The means by which smaller boards may develop into effective fully functioning boards is not well understood. A needy industry sector, the plastics processing industry is identified as the context for the study, meeting calls for study of innovation processes within a specific industry context.

The research model below identifies the independent, dependent, and potentially moderating variables, accompanied by four hypotheses to test the relationships between them. A table which identifies specific references from the literature review chapters, backs up the research conceptualisation and its operationalisation, including the questionnaire used to collect data for the new measurement construct for early board team entrepreneurial capability. The structural validity of the research is demonstrated by showing the match of the analytical methods chosen to the theoretical construction of variables and model before moving on to the research process undertaken.

### 7.1. 2 Overal Objectives

The research undertaken has three principal overall research objectives:-

1. To contribute to academic knowledge by addressing acknowledged research gaps and deficiencies and identifying new ones; specifically a neglected firm size sector, the EISME, "firms in the middle," and a critical internal resource: the early board team. - required for further firm evolution and emergence from the throng of smaller firms.

2. To obtain insight and empirical validation of the resource and capability profile of early board teams and innovation in the identified firm size sector, working specifically within the resource based theory of the firm, adopting a view of entrepreneurship as a pattern of picking and deploying resources to achieve innovation.

3. To use the knowledge obtained from the research analysis to present the significant issues arising to firstly, provide practical guidance to owner directors of EISMEs in a challenged industry at a critical stage in their development. Secondly, inform and further stated government industrial policy to build SME organisational growth capability, thereby assisting UK economic development.

#### 7.1. 3 Detailed Research Objectives

**Human Capital Resource Inputs**

Chapter 5 reviews the literature to determine the likely optimum size and human capital resource composition of the EISME early board team. From the review aggregate board team age, industry and management experience, service length and education are identified as appropriate variables likely to influence early board team function, innovation, and firm growth. Early board team human capital resources form a unique firm resource platform from which further management capabilities into picking and applying resources to innovation can be developed, called an intermediate, group level entrepreneurial capability.

**Intervening Entrepreneurial Processes**

Chapter 6 identifies four broad areas of management practices and organisational processes likely represent an entrepreneurial orientation within early board teams by reviewing the entrepreneurial and organisational process literature in small and large firms. The processes by which firms evolve and successfully emerge from the throng of smaller ones have not been as well studied as they should be according to Aldrich. 'Most research on organisations focuses on structure and stability rather than emergence and change."(Aldrich, 1999) p 1. The new measurement construct aimed at determining early board team entrepreneurial orientation, based on their management practices and organisational processes, is an attempt to shed light on the nature of the firm evolution process. Little is known about the chrysalis stage of firm evolution, continuing Penrose's metaphor to describe the difference between firms small and large. The broad areas of early board team management practice and organisational process identified are risk and reward profile, information seeking and sharing propensity, resource access through networking, and decision making. All four areas are considered to feed and depend on each other to achieve successful entrepreneurial orientation for innovation within the board team.

**Outputs**

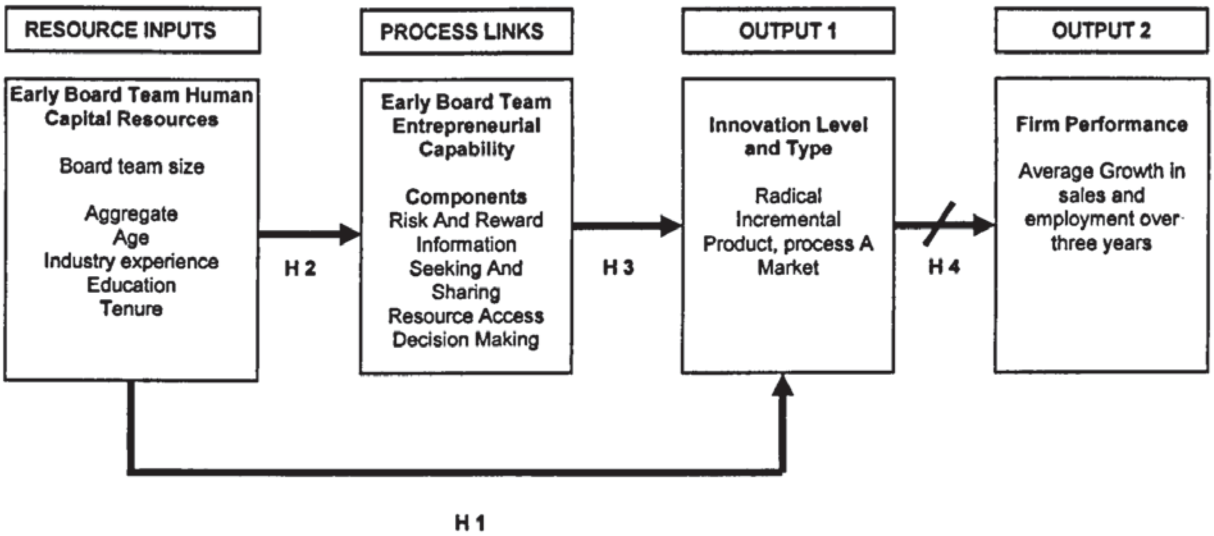
Innovation is a curious omission from entrepreneurship studies. Innovation is used as an output measure, following Schumpterian innovation, to gauge EISME ability to economically renew themselves and maintain modest but not spectacular firm growth of benefit to the owners and the economy. Incremental innovation is considered the most likely EISME output, reducing risk and potential interruption of resource path development from overstretch for resources. Superior firm performance is not expected to be linked with innovation levlels due to the resource constraints of the firm size sector. A trade-off between innovation and economic renewal and short-term superior profit exist in these independent enterprises.

Findings may inform policy makers at the central and local government level, identifying critical elements to EISME organisational growth capability. Practical assistance may also result for owner directors of firms in a state of arrested development. Such knowledge may, in the longer term, assist in the economic development of a significant UK industry sector, dominated by a neglected firm type.

### 7.1. 4 Research Model

An outline of the research model indicating the relationships between the variables to be statistically tested and the methods used for testing is shown below in Figure 7.1, accompanied by the hypotheses used to test the relationships.

**Figure 7.1: Research Model**




Multivariate analysis dependence techniques of factor analysis and multiple regressions are chosen as the research instruments to explore and test the hypothesised relationships between variables from the research model. Data was collected from a large scale postal questionnaire aimed at the EISME population of the plastic's processing industry. Given the relative simplicity of the proposed relationships between the variables, multiple regression techniques are considered a first analysis step. The new construct aims to capture data on the entrepreneurial orientation of the early board team and is subsequently incorporated into the regression analysis as a variable in its own right

Quantitative techniques, using aggregate data, can tend to be reductionist, eliminating exceptions which are at the extremes of the scale, say of management behaviour. It may be a particularly useful behaviour, none the less, as in the case of entrepreneurial management in very fast growing firms. Current study is however focused on the majority of 'firms in the middle' within the plastic's processing industry .Use of specialized techniques to identify significant outliers is therefore not required. Multivariate analysis suits the sample population targeted.

Section 3 covers the theoretical underpinning of the construct, relating the concept is applied from the literature review chapters. A discussion of the appropriate factor analysis techniques for the task of representing complex early board management practices and organisational processes follows. The process taken to determine any underlying structure to groups of related variables as well as to test the reliability and validity of the entrepreneurial capability scales is described, followed by correlation, to explore the association between pairs of variables.

**7.1. 5 Hypotheses**

**Hypothesis 1:** The following hypothesis is derived from the preceding literature review - Chapter 5:-

*Board teams with lower aggregate age but higher education will produce greater levels of incremental innovation.*

Board team education level is anticipated to have a positive impact on the level of incremental innovation, combined with lower aggregate age. Past limited access to higher education in UK will act to limit education levels in older board teams. Mature' board teams of greater age and experience with the higher levels of service length may carry out successful incremental innovation in the absence of higher education levels where accumulated experience may substitute for the younger but better educated individuals. Unlike larger firms, it is not expected that outside industry experience will be beneficial to EISME innovation since an external industry recruit will be more difficult to assimilate into the team.

**Hypothesis 2:**

*Board teams with lower aggregate age but higher education levels will produce higher entrepreneurial capability scores.*

Hypothesis 2 aims to test the degree of entrepreneurial capability present in early board teams as measured by the new construct. Boards composed of better educated directors, lower ages and shorter service lengths will produce entrepreneurial orientated management practices and organisational processes producing early board team entrepreneurial capability scores. On the other hand, boards with a lower mean educational attainment levels, longer mean service periods and of greater age will produce the lower firm scores.

**Hypothesis 3:**

*Board teams with higher board entrepreneurial capability scores will engage in higher rates of incremental product and process innovation.*

Entrepreneurially orientated board teams will produce higher entrepreneurial capability scores, representing the presence of management practices and organisational processes known to further the entrepreneurial process and innovation outputs. It is anticipated that these higher scores will be associated with higher levels of incremental innovation, either process a product. If the capability measured is not associated with incremental innovation than early board team captures 'adaptive' rather than "generative" capability. Incremental innovation is expected to be preferred in the firm size sector, as less likely to overstretch the firm resources. In particular, the early board team, limited in size and internal resource will find radical innovation particularly problematical during the tricky period of emergence as a fully functioning board.

**Hypothesis 4:**

*Board teams with higher entrepreneurial capability scores and innovation levels are not associated with higher firm performance levels as measured by average three year sales and employment growth.*

Human capital input resources of the early board team, identified Hypothesis 1 are expected to be associated with incremental innovation output through the entrepreneurial capability process link. Firm performance as measured by superior increase in average three year sales and employment growth is not anticipated to be associated with higher early board team entrepreneurial capability or higher levels of incremental innovation. A trade-off between investment in ongoing innovation for economic renewal and firm growth is expected to exist on the part of the board team. The combination of ownership and management control within the early board team must also be taken into account since the choice of firm objectives will undoubtedly be aimed at meeting and personal needs of the directors, than is the case in firms with publicly held shares.

### 7. 2 Operationalisation Of Research Variables

The manner in which the variables are operationalised are now laid out.

#### 7.2.1 Early Board Team Human Capital Resource

Simple board team human capital resources are chosen as explained in Chapter 5 in preference to some of the more complicated measures of attitude and orientation employed in entrepreneurship research. Basic facts of age, education, and experience are more likely to be reported objectively by EISME directors and are perceived as potentially more useful at a practical level.

**a) Age:** Board team age was captured as metric interval data. Age has been operationalised into six categories from 25 to 61 years plus to make responses is easier, rather than requiring precise knowledge on the part of the respondent (Oppenheim, 1992) with a board aggregate worked out on the median point.

**b) Tenure:** tenure was collected as for age above in categories as follow:- less than two years, 2 to 5 years, 6 to 10 years, in 11 to 15 years, 16 to 20 years and 20 years plus with a board aggregate worked out on the median point

**c) Education:** The education score created by allocating one for every year undertaken. Question and answer elicited board size and director category; executive or non executive. Some dichotomous questions requiring a Yes / No response are also included. The questionnaire was structured and worded to check some of the information for reliability. The board size and split of executive to non executive directors could be verified through different section responses requiring a consistent response. Educational qualifications are listed and allocated a score of one for every year of education involved. For example: A level = 2, UG Degree = 3. The years of education for all board members are summed to provide a board total

**d) Experience:** board team experience was collected as a straight number of years and an aggregate score of the board team created.

**e) Executive / Non executive**: executive and non-executive directors' numbers were collected at two separate points for cross verification

#### 7.2. 2 Innovation Output

Measuring innovation output is not an easy task as discussed in Chapter 5, with many different measures used for larger firms. For the current study of EISMEs a simple innovation count using questions based on the Schumpterian innovation categories, discussed in Chapter 5 was chosen. The table below explains these more fully, and identifies the relevant sections in the questionnaire.

**Table 7: Innovation Count Operationalisation**

| | RADICAL INNOVATION | SCHUMPETERIAN INNOVATION CATEGORY |
|---|---|---|
| A | **New Products for New Markets- Product Innovation:** introduction of a new product with which customers are not familiar, meets new PVC are met or unrecognised needs. It creates a new market for products that did not previously exist. E.g. car airbags | 1) Introduction of a new good that is one with which consumers are not yet familiar or a new quality of good. |
| B | **New Machine or Process Innovation Process Innovation:** introduction of totally new machine and production processes e.g., conical twin extruder , rapid prototyping and servo electric machines | 2) Introduction of a totally new method of production. |
| C | **Existing Products/Processes Applied to New Customers and Markets:** introduction of existing products/processes to a new market e.g. injection moulding the small-scale clarinets the children and plastic jug kettles | 3). The opening of a new market. |
| | **TOTAL RADICAL INNOVATION A + B + C** | |
| | **INCREMENTAL INNOVATION** | |
| D | **Innovative product improvement:** use of new materials in producing significantly improved quality, utility and/or of an existing product e.g. biodegradable polymers are disposable nappies | 4) Conquest of a new source of supply of raw materials or half manufactured goods. |
| E | **Innovative Machine and Process Improvements** significant but minor improvement that the use of Polymer Insights Intelligent Process Monitoring for improved product quality and performance | 2) Introduction of an innovative and improved method of production. |
| | **TOTAL INCREMENTAL INNOVATION D+E** | |
| | **Omitted** | 5) Carrying out of a new organisation of any industry. |
| | **Sixth Additional Category** | |
| F | **Innovation through Business Acquisition;** as the company acquired another business in the last three years for this reason? | |

Organisational and strategic innovation categories, effectively the fifth Schumpeterian category have been excluded as an outcome of firm level entrepreneurship, not appropriate for the majority of EISMEs. An additional category, innovation through business acquisition was added to capture any firm acquisition and possible distortion to the analysis from this source. Penrose suggests acquisition is a further growth route and can also be used to acquire desired innovative process and management capability. Inspection of the data bases revealed that many of the firms had inactive subsidiary firms that may have been the residual elements of previous acquisitions. In the event, only six firms reported acquisition for innovation purposes. An additional question requesting a broad assessment of the percentage of sales turnover contributed by each innovation was requested. Completion rates for the sales percentage question were not good and therefore not included in the analysis.

A level playing field for firm performance measurement must be established using appropriate control or moderating variables. Control variables of relevance to this study are firm and board size (Daily and Dalton, 1993, Rothwell and Dodgson, 1990), firm age (Hansen, 1992) and industry (Covin and Slevin, 1989).

### 7.3 Moderating Variables

Moderating variables of relevance are firm and board size (Daily and Dalton, 1993, Rothwell, 1992), firm age (Hansen, 1992 212), and industry (Covin and Slevin, 1989). The last factor, the external environment, is controlled for by confining the study to a single industry. Data for firm and board size and firm age is collected and included in analysis to examine their effect on variables within the analysis.

#### 7.3.1 Board Team Size:

Board team size as a moderating variable is used surprisingly little as a moderating variable in the existing research on SME firm growth and profit rates over the long term. Board team size is anticipated to be more important than firm size in the analysis, representing a greater level of resource available for development of an early board team knowledge production function, valuable for innovation. The restriction of the analysis to a particular firm size and industry is considered likely to reduce the impact of firm size as a moderating variable.

Greater board team sizes, in the presence of greater levels of educational and experience resource are anticipated to be associated with higher levels of board team entrepreneurial of capability score and innovation rates. The relationship with innovation or firm performance is not anticipated to be a linear one, but more likely to be U-shaped as found in studies to board teams in larger companies. The optimum board size is anticipated to be smaller than that for larger corporations, estimated to be six members in much of the research.(Haleblian and Finkelstein, 1993, Smith et al., 1994) (Daily and Dalton, 1993, Daily et al., 2002). Board team size includes both executive and non-executive directors.

**7.3.2 Firm size:** The importance of firm size as a moderating variable to innovation rates is included in the study in the study as it has become traditional in many innovation studies. Innovation rates per employee / patents held are known to decrease with firm size. Few innovation studies however have concentrated on a single industry or such a specific firm size as 20 - 250 employees so firm size is not anticipated to be of great significance.

The relationship between the dependent, independent and control or moderating variables are not necessarily linear. For sales and employment growth 'other systematic influences on growth apart from size' can be present. These can include demand shocks from unforeseen events (Johnson et al., 1999) Board size as discussed earlier is likely to present a curvilinear relationship with effectiveness first

**7.4 Firm Performance Measurement**

Entrepreneurial growth is defined in the literature as fast growth with above average profits (D'Amboise and Muldowney, 1988) but as discussed in chapter 3 measuring firm performance and growth in EISME's where the owners linked personal and business objectives are likely to be geared towards other forms of value creation, requires caution in using superior profits as a useful performer outcome. Measuring firm performance and growth in EISMEs in a meaningful way is acknowledged to be difficult but essential to the study of entrepreneurship and innovation (Chakravarthy, 1986, Murphy et al., 1996). If superior profit maximisation, according to reported profits is not accepted as for EISMEs as it is the high level growth ambitions entrepreneurial ventures then alternative forms of performance measurement need to be considered.

Murphy looks at 51 studies where a firm performance measure is used as an dependent variable (Murphy et al., 1996) The most popular measures, from the eight different ones and most frequently used, are the financial ones of efficiency, growth and profit measures. Efficiency measures include such items as return on investment, equity assets, and net worth. Growth measures deal with changes in sales, employees, net income margin, CEO and compensation packages, labour cost as part of revenue and growth in market share. Profit measures included return on sales, gross and net profit margin, trading profit, and pre-tax profit. Murphy et al extend an argument by Venkataraman and Ramanujaran that firm performance is best measured using multiple dimensions, preferably a combination of both operational and financial performance measures. They fail to find a combination of measures however, that could be used across entrepreneurship research concluding that different firm performance measures are needed for diverse areas of research. Innovation costs of research and development are likely to influence profit levels in firms, not yet accustomed to budgeting for the cost as for EISME's. Measuring profit as an outcome of innovation for the specific firm size sector, where resources are constrained by a reluctance to seek external investment and equity on the part of the directors with object is geared more towards a firm survival and economic renewal to achieve the reverse value creation and objectives as Brush et al find for new hi tec ventures (Brush and Vanderwerf, 1992a) does not seem an entirely appropriate measure.

Measures of profit, return on capital employed and so on, cannot take into account the idiosyncratic behaviour of the owner in removing cash or profit from view to obtain "amenity" value, such as cars for family members and other reasons in firms with closely held share ownership. Profit levels shown in SME annual accounts will not necessarily represent a 'true' profile of the inherent trading profitability of the business but be more expressive of a lack of desire to pay taxes. Profit data is therefore not a reliable of true firm success (Chandler and Jansen, 1992). Profit measures cannot be used to assess the impact of innovation on firm performance since the relationship is distorted by such factors. An alternative measure of cash flow is proposed by Brush et al (Brush and Vanderwerf, 1992a), but although this may indeed represent the inherent profitability of the firm, it may be as difficult to obtain from the board team as accurate profit figures. UK smaller company minimum financial reporting requirements, which require less information, do not permit assessment of costs in relationship to sales as in larger firm financial reporting requirements so the cost of goods sold comparisons across industry sector are not possible either

Most research in the SME and entrepreneurship area has used growth in sales and employees as a measure of performance (Brush and Vanderwerf, 1992a). Storey et al discusses the use of these measures in his paper. According to Storey et al., (Storey et al., 1987), employment growth in small firms is strongly correlated with sales growth and therefore an appropriate measure to use when assessing firm sector growth. Although useful from the economists' point of view, such a measure has limitations for EISME owner directors, interested in balancing cash and control issues. Sales level increases as the firm growth performance measure are limited since there is no guarantee that increased sales means profitable trading. Secondly, if the data is self reported there is the possibility of deliberate inflation of the figures. Use of sales and employment growth does have advantages for potential comparison with many other studies using the same measures, which has influenced its choice as a crude performance measure, which owner directors are more likely to be happy reporting in a questionnaire. Data obtained from a subjective primary source can be verified through objective secondary publicly available sources providing the firms are large enough. (Brush and Vanderwerf, 1992b, Chandler and Jansen, 1992). A significant percentage of the performance figures in the data collected have been checked by cross reference to publicly fairer secondary data.

The average increases in firm sales and employment performance for the four years 1995-1999 were therefore collected, to produce an average annual sales and employment growth figure for three years to be used as the dependent firm performance variable. Firm performance as a dependent variable is used in conjunction with an innovation count and a new measurement construct for early board team management practices constituting an board level entrepreneurial capability thus combining an operational and financial performance measure as recommended by Murphy and Venkataraman (Murphy et al., 1996).

### 7.5 Entrepreneurial Capability Construct Development and Operationalisation

Section 3 - firstly, justifies the use of factor analysis as an appropriate statistical technique to create a new construct to measure early board team entrepreneurial capability in EISMEs. The process undertaken to develop and validate the scales for the construct for use in subsequent analysis is described following Churchill's seven stages for scale creation (Churchill, 1979). Existing scales are briefly discussed and discarded as not suitable for meeting the specific research purpose previously outlined.

#### 7.5.1 Factor analysis justification

Firm specific resources and capabilities not easily imitated or substituted are likely to be difficult to measure. The potential uniqueness of the early board team entrepreneurial capability profile influenced the decision to create a new measurement scale, through the use of factor analysis, to capture the process links between the human capital resource inputs and innovation outputs. Care in choice of factor analysis method needs to be exercised since the different techniques used carry certain implications (Lee and Hooley, 2002). Principle component analysis has been used on the assumption that entrepreneurial capability is a single construct consisting of interdependent sub constructs.

#### 7.5.2 Rationale for a new construct

Management research increasingly uses constructs and measurement scales to capture data for statistical measurement of specific behaviours at different levels, related to a variety of resources and outcomes. Entrepreneurship as complex dynamic a multidimensional concept is an area where measurement scale may capture some difficult to assess management orientations, associated with specific resources and processes. (Lyon et al., 2000) (Borch et al., 1999) (Lee et al., 2001) (Lumpkin and Dess, 1996). Few studies have made any attempt to capture the key transition elements of management practice for firms 'in the middle' yet they contribute value on the number of levels. As research within the resource based view progresses, study of the way resources and capabilities evolve during firm growth has increased but applied to EISMEs. A new measurement construct also fulfils a research requirement articulated by many researchers in identifying intervening processes between resources and outcomes (Hoffman et al., 1998, Pavitt, 2003, Pettigrew, 1992, Teece, 1998). If the construct shown to have any validity it may provide some very practical guidance to both owner directors contemplating board team expansion and to policies to support early board team development in EISMEs.

Measurement of behavioural concepts generally does not lend itself to simple question and answer (Oppenheim, 1992). Organisational behaviour, and that of individuals and groups within them, are too intricate to use simple techniques of question and answer to understand and may well be interrelated to such a degree that they represent distinct concepts, which is precisely the case argued here; a concept of an early board team entrepreneurial management capability. Factor analysis is useful when applied to multiple items or variables to either summarise or reduce data to represent a concept (Hair et al., 1998). Measurement scales assign numbers to subjective data, representing a concept, permit use with other multivariate analysis techniques and reduce or avoid measurement error, by replacing a single question with multiple items, which might otherwise cloud variable interrelationships and make statistical analysis more problematical. (Peter, 1981, Hair et al., 1998, Oppenheim, 1992).

Factor analysis is a suitable statistical approach to measure and analyse the underlying structure and interrelationships among a large number of variables and to explain these variables in terms of their common underlying dimensions (factors)(Hair et al., 1998) p 14. It provides a means of condensing or summarising a wide set of information on a complex behavioural concept of early board team into a smaller set of factors, or dimensions, with minimum loss of information for meaningful use in multivariate analysis. Given a large number of potential variables factor analysis is likely to maximise understanding of the structure and underlying dimensions of a complex set of behaviours. Factor analysis " provides the empirical basis for assessing the structure of variables and potential for creating composite measure is also acting as subset of representative variables are further analysis" according to Hair et al (Hair et al., 1998). Factor analysis is therefore used to produce a new measurement construct, in an attempt to capturing a snapshot of what is, in essence a dynamic, intermediate, group level of early board team entrepreneurial management capability in EISMEs , vital to advancing the firm along its resource development path.

Factor analysis recognises that not all variables are uncorrelated and representative of distinct concepts, but that groups of variables can be interrelated and form part of a more general concept as indicated by Gartner and Shane, Chandler and Lyon, Venkataraman and Grant and Gorsuch in their research (Gartner and Shane, 1995, Chandler and Lyon, 2001, Venkataraman and Grant, 1986, Gorsuch, 1983). The authors' research relates to aspects of corporate entrepreneurship but apply equally well to measuring entrepreneurship at the group or intermediate level of the early board team. An ongoing discussion exists on the use of new constructs to measure entrepreneurship.

Entrepreneurial orientation has so far been considered a unidimensional construct by both Miller and Covin et al (Covin and Slevin, 1986, Miller, 1983) More recently some debate has opened up on whether a firm entrepreneurial orientation construct is, in fact, unidimensional or multidimensional as argued by Lumpkin and Dess. Dimensions formerly thought to co - vary might well vary independently, being contingent on other organisational and environmental factors. (Lumpkin and Dess, 2001). Poor performance of measurement construct in associating entrepreneurial orientation with firm performance is attributed to poor operationalisation of concepts into scales. The point made on the operationalisation of concepts is a valid one and a sufficiently comprehensive set of items is needed to securely link the theoretical underpinning directly to the construct and to enhance content validity of surveys despite self reporting (Lyon et al., 2000). A table shown in for Appendix 17, sets out the links in detail, relating the questionnaire items to theoretical underpinning with a research reference. The table shows that the items in the questionnaire are theoretically based in the research literature as is required to demonstrate a strong connection between concepts and their measures. Each sub construct explicitly links the theoretical constructs with their operational indicators in a manner necessary for establishing unidimensionality and content validity (Churchill, 1979) (Venkataraman and Grant, 1986).

For the construct purpose and development, the entrepreneurial components, the four key areas suggested to represent an entrepreneurial capability are considered interdependent, likely to co- vary over time and part of a unidimensional construct. It is proper to point out that the issue of entrepreneurship dimensionality and how to measure it is still very much a hotly debated issue.

### 7.5.3 Existing Scales

Existing entrepreneurial orientation scales are mostly based on North American firms, with potentially little cross cultural validity and reliability (Knight, 1997) (Antoncic, 2001) and tend to measure entrepreneurial orientation either of the individual, as in Kirton's Adoption Innovation inventory (KAI) (Kirton, 1976) or based on firm level behaviour, chiefly through the entrepreneurial orientation construct originally created by Miller and modified by both Covin and Slevin and Lumpkin and Dess (Covin and Slevin, 1986, Lumpkin and Dess, 1996, Miller, 1983). The entrepreneurial scales found in the corporate entrepreneurship literature, show every sign of being stuck in a rut, attempting to incorporate responsiveness to the environment in their measures. As seen in Chapters 5 & 6, the industry environment is likely to have a significant impact on management processes.

Differences also exist between UK culture compare to the USA, which needs to be taken into account when considering formative management behaviour in emergent enterprises (Hisrich and Drnovsek, 2002). Knight's ENTRSCALEs are based on previous scales from Khandwalla 1971, subsequently refined by Miller and Friesen in 1978 and Covin and Slevin in 1989 (Covin and Slevin, 1986, Covin and Slevin, 1989). Their usefulness is limited since they primarily measure adaptiveness – responsiveness to the environment at a firm level. If research study is confined to a single industry sector, it becomes possible to take a closer look at internal processes. No existing scale was found purporting to measure early board team entrepreneurial capability for established independent medium sized enterprises based. The creation of a successful early board team dynamic for organisational growth capability is considered important enough to justify its own management construct.

### 7.5.4 Scale Creation: the Seven Stage Process

A seven stage scale creation process, outlined by Churchill in a seminal paper on Developing Better Measures of Marketing Constructs(Churchill, 1979) and subsequently, slightly amended, by Hair et al. was undertaken and now described (Hair et al., 1998).Factor analysis type and rotation technique choice are explained and justified below accompanied by a description of the process undertaken to create and validate the measurement construct for a board level entrepreneurial capability, including scale purification and reduction and reliability and validity assessment. The link between the theoretical construct and operationalisation is made explicit to demonstrate item validity essential if the construct is to be meaningful. Five point Likert scales were used to capture the entrepreneurial and managerial tendencies in management practices of the board at one point in time, the time of the survey and subsequently subject to factor analysis as described to achieve a board team entrepreneurial management score.

#### a) Stage 1: Match of Factor Analysis to Research Task

The first stage of the scale creation process of matching the method to the task is largely demonstrated in the text above. Factor analysis is deemed an appropriate statistical technique to produce a process variable, based on the complex behavioural processes involved in entrepreneurship for incorporation in multiple regression, as discussed above and entirely appropriate to the purpose of measuring an early board team entrepreneurial capability within EISMEs. As an interdependence technique it is used to assist understanding complex relationships between aspects of management behaviour, which determine how an organisation behaves. The emergence of an early board team in directing the organisation forms a critical stage in the creation of path dependence, which will continue to influence the firm over a long period. Factor analysis assists in assessing the interrelationships between the separate dimensions of the concept and then determining the extent to which each variable is explained by others (Hair et al., 1998) p. 91. Once the factors or underlying dimensions have been identified, they can then be used to either summarise or reduce the data for further use. A large pool of items, theoretically underpinned, by the literature review was initially generated, for use in the questionnaire and reduced to provide the strongest representation of the concept. A table in Appendix 17 provides a summary, linking the item to a page number and reference(s)

**b) Stage 2 Factor Analysis Type and Design**

Factor analysis type chosen depends on whether the analysis is intended to be exploratory or confirmatory. Exploratory factor analysis, r type factor analysis, in the form of principle component analysis, was selected as the appropriate factor analysis technique for the task: exploration of correlations between variables, calculation of input data through production of a correlation matrix, determination of an initial factor solution to establish a parsimonious set of representative items from a larger set of items to represent the internal dimensions of an early board team entrepreneurial capability (Hair et al., 1998)(Gorsuch, 1990). These were carried out with the results shown in Appendix 7.

Further decisions on the overall design of the factor analysis were then made for the next stage of the scale creation process. A correlation matrix was used to group the variables and reduce the number of items, taking into account the number, and choice of variables, their type and measurement properties and sample size considerations. According to Hair et al factor analysis should not be applied to analyse a sample of fewer than 50 observations (Hair et al., 1998) p98. As a general rule there should be a minimum of five times as many observations as there are variables to be analysed. Overall a researcher should try to obtain the highest cases per variable ratio to minimise the chances of "over fitting" the data (Hair et al., 1998) p 99.

Principle component analysis not only determines any underlying structure to the variables but also provides a means of assessing the validity and reliability of the scales through application of the Cronbach's alpha as a measure of internal consistency. Confirmatory analysis, requiring structural equation modelling would be the next step, should the concept prove to have any validity from the pilot research but does require a very large sample.

**c) d) & e) Data Suitability and Variable Selection - Stages 3, 4 & 5**

Research validity, reliability and generalisability to a wider population should be addressed for factor analysis but some of the statistical assumptions relevant to other techniques do not apply to factor analysis and are in fact rarely used (Hair et al., 1998). Hair et al notes that multicollinearity is highly likely as the objective is to identify interrelated set to variables, which is likely to be the case for the entrepreneurship processes represented by the construct. Other tests that were applied during factor analysis to determine their appropriateness are discussed below. Reliability cannot establish validity, according to Lyon and Chandler (Lyon et al., 2000). Only repeated use of the instrument for data from different studies will establish validity beyond doubt, so use of the new construct must be considered as a pilot exercise to establish the concept.

**7.5.5 Content Validity**: Validity of a scale is assessed is several ways. Firstly, face or content validity must be established. Face validity requires the operationalised variable have a reasonable correspondence to the theoretical concept. The construct must be defined in a theoretically relevant manner and actually captures what was intended. Items that are not related to the theoretical construct should not be included.(Chandler and Lyon, 2001, Churchill, 1979, Peter, 1981). For example, the decision making entrepreneurial component scale must measure the board level decision making style and the information seeking and sharing entrepreneurial component should measure the board's propensity to seek information internally and externally as well as share information across the firm.

The fourth and fifth stages involve applying the chosen factor analysis technique, determining the number of factors to be retained and rotation method to be used.

### 7.5.6 Rotation Method

The technique was combined with an oblique rotation method within SPSS, direct Oblim, to enhance the interpretability of the identified factors. The method was considered the most appropriate form of rotation, since it permits a more flexible redistribution of variance from earlier factors to later ones to achieve the simplest and theoretically more meaningful factor structure (Hair et al., 1998). Oblique rotation methods permit correlated factors whereas orthogonal rotation seeks non correlated or independent factors. As the board team entrepreneurial management capability is theoretically proposed to be composed of interlocking components, an oblique rotation is most appropriate.

The factors or components identified then require interpretation through scrutiny of their loadings and amount of variance explained to determine whether the underlying dimensions represented by the components has meaning in reflecting the hypothesized underlying factors. Metric data was collected using five point Likert scales within the questionnaire. Appendix 11 contains the full analysis details.

The correlation matrix was used to assess and to determine the degree of correlation between the variables. Items not showing significance at the .01 level, indicating a sufficient number of corresponding correlations different from zero were eliminated (Hair et al., 1998) The Kaiser Meyer Olin Test (KMO) and the Bartlett's test of Sphericity, measures of sampling adequacy, were used to indicate the suitability of the data for factor analysis at the start. The KMO test was found to be above .5 indicating that the data was suitable for factor analysis. The Bartlett's test showed desirable significance levels below .05 indicating the probability of significant relationships between the variables. The test results are shown in the appendices to the chapter.

The anti image matrices (MAS) within SPSS are a measure of sampling adequacy for the pattern of correlations and were used to identify items in the diagonal, not above .50 or just above. Those items with high off diagonal values and lower than .50 on the diagonal were removed one by one, to collect all the diagonal values above .50. For the planning and control scale, partial correlations are all low indicating strength of the interrelationships between the variables. Appendices 10 & 11 show the final selections. The use of these tests, KMO, Bartlett's, and MSA (Measures of Sample Adequacy) helped in the elimination of items for a reduced set of items for factor analysis. The final stages of the factor analysis process follow

**Stages 6 & 7 Reduction Process, Factor Identification and Interpretation**

Principle component analysis was used and a first set of items prior to estimation of the factor model was obtained from the data first without rotation, the results were examined and then oblique rotation used to see if the fit could be improved. The results were scrutinised to assess factors identified by examining the eigenvalues for relative importance and explanatory value. Factors with less than 1 were further examined using a scree test, using the latent root criterion (Hair et al., 1998) p 104 to ascertain which factors explained the most. The cumulative percentage of the variance for the eigenvalue identified the factors representing the greatest percentage. Communalities tables were also used to eliminate items. The full factor analysis output before and after oblique rotation are included in Appendix 13.

The process revealed that for the 30 items only a 51% maximum loading could be obtained. Given the sample size of 93, this is barely enough to be significant. A .55 factor loading is required for a sample size of 100 to be statistically significant (Hair et al., 1998) p109. These have been used in a composite score but a further refinement process was embarked upon to determine whether a more acceptable loading could be achieved. A reduced set of variates composed of 12 items were identified and subsequently used for the ecsbis variable.

### 7.5.7 Reliability, Validity and Generalisability

Reliability of the scales were checked using Cronbach's alpha and were shown to achieve a satisfactory figure well above the .70 required. These results are shown in Appendix 12. The last task is to determine whether the factors that emerge from the data are distinct entrepreneurial components and that these tally with existing concepts as shown in previous Chapters. Do they measure what was intended: an early board team level of entrepreneurial capability? Are the scales reliable and applicable to a wider population? These issues are addressed in the final Chapter.

**Board Team Entrepreneurial Capability Variable**

The intention in the creation and application of a new measurement scale is to produce a board entrepreneurial capability score for use subsequent analysis of relationships according the research model and hypotheses. The entrepreneurial capability score was created using two methods to strengthen the analysis. The two methods are outlined in detail below and covered in detail in Appendix 7 -

**7.6 ECS using Summated Scales**

Firstly, a set of 30 representative items were identified from a larger set of 56 items and used to create a composite measure for an entrepreneurial capability score in combination with a scoring system attributed to answers to direct questions in the questionnaire. Full details for the calculation of the composite score are shown in Appendix 8. The objective of the composite measure was to create a large continuous score for board level entrepreneurial capability. The score consisted of both total summated scale score for the 30 items and scores allocated according to a scoring system described in Appendix 10.

The entrepreneurial capability score was created with deliberately large and equal scores across the original four theoretically anticipated sub dimensions to accommodate possible variations in their proportions to capture different intangible capability configurations within firms. The composite score then reflected the capability configuration present without giving undue to any one dimension. A basic tenet of resource based theory is firm resources and capabilities are heterogeneous and unique, therefore to expect identical profiles would be inappropriate. The organisational routines represent resources and capabilities that have either unconsciously evolved or been tailored to meet the firms objectives created in response to changes in environment (Selznik, 1957). Firm resource profiles may be different but highly appropriate to the task.

The 30 items were then reviewed both by the managing directors involved at the initial study stage and expert opinion within a business school. The Alpha score for these 30 items may be seen in Appendix 12. An alpha of .8229 is achieved, well above the .70 required for exploratory analysis. Items for each of the theoretically anticipated factors were represented in the separate scales and questions within the questionnaire. These items were then used to obtain a summated scale score, to which were then added further numerical scores from other questions not captured through Likert scales. The composite entrepreneurial score is referred to as ECS in the text and analysis, and is obtained through summary of data.

# CHAPTER 8

# RESEARCH METHODS

## 8.1 Introduction

The research methods and process undertaken are outlined and justified in Chapter 8. Named directors of firms, meeting the research criteria for the EISMEs were identified from multiple sources and a large scale database for mailing of the postal questionnaire was compiled to collect data. Initial design, testing and piloting of the questionnaire are discussed along with subsequent refinements for additional mailing made to achieve greater response rates, occasioned by poor pilot and initial mail out response rates. A description of the research data, collection, preparation and initial exploration follow. Finally, the analytic techniques to statistically test the relationships outlined in the theoretical model and estimate the model fit are discussed, justified, and shown to be appropriate to the research objectives. Other issues relevant to the research design and purpose including sample size, statistical power, variable type, necessary data assumptions, and type of association measures and appropriateness of the precise estimation methods for testing the hypotheses are then discussed. In order to maintain a clear chapter narrative much detail is shown in the appendices to the chapter. Some data description for instance is included in Appendices 2 to 14 rather than within the chapter itself. Reference to data features relevant to the data analysis is made where appropriate within the text.

## 8.2 Data Collection

A survey questionnaire, operationalising the concepts, indicated in the research model was considered an appropriate means of gathering aggregate data for the research for the proposed multivariate analysis to test the hypotheses. Chapter 7 and associated appendices demonstrate the links between the concepts and theoretical underpinning from existing research. A balance needs to be struck between potentially complex data collection and generation, measurement and analysis techniques with the need for reliable, valid, generalisable and replicable results.(Oppenheim 1992; Hair, Anderson et al. 1998). A parsimonious but robust research model and process have been followed as required by Hair et al.

## 8.3 Questionnaire Design

The survey questionnaire was constructed with the objective of securing data to address the research objectives by ensuring firstly, the correct focus and content of the questions to produce meaningful concept measurement for the independent and dependent variables used in the analysis. Secondly, the question sequence, context, wording and response categories are scrutinised in order to elicit an appropriate response without creating an unintentional bias (Oppenheim 1992). The questionnaire contains four main sections: 1: Introductory information, 2: Company and Board Profile, 3: Innovation activity and 4: Management Practices. Both question and answer and five point Likert scales are used to collect information. The questionnaire is made as attractive as possible as a means of ensuring the continued co-operation of respondents in completing the questionnaire (Oppenheim 1992).

The response format was tailored with a funnel approach starting with filter questions to eliminate responses from firms not meeting the research criteria of chosen industry classification SIC 252; time elapsed since establishment, independence and number of employees. Questions were carefully worded and ordered with industry assistance and accompanied by information, instructions, and examples to help response rates to ensure respondent comprehension of survey objectives and detail required. Factual question and answer was an appropriate way of gathering data for a significant proportion of the required data although some potential problems with the self reporting of data and its reliability are discussed later. The three questionnaire formats, each a refinement on the previous one are used for the survey and shown in Appendix 3

### 8.4 Preliminaries to Questionnaire Design

An initial questionnaire was created and an exploratory study carried out the managing director of three firms from the plastics processing industry, who had expressed an interest during attendance at a Partnership in Plastics Initiative Innovation event to which the researcher had contributed. The directors was sent the draft questionnaire and semi – structured interviews either at the business school or their business premises followed as a preliminary empirical method of enquiry to evaluate and cross check the operationalisation of the concepts in the questionnaire (Bryman 1988) Firstly, by verifying the directors understanding of the questions, both the wording and the sense so that the responses elicited were the ones sought to eliminate error. Inadequate question wording and questionnaire construction can be the cause of poor reliability and validity. (Oppenheim 1992). Particular attention was paid to the Likert scale item pools collecting data on attitudes to management practices and the innovation category descriptions and examples.

Secondly, the exploratory study permitted further personal familiarisation with the industry sector and facilitated the flow, layout, and order of the survey questions and measurement scales, which turned out to be of importance in addressing some issues in respondent willingness to complete the questionnaire. Firms of the sample size and nature are traditionally sensitive and unwilling to respond to questions on firm performance and shareholding even though basic figures are available through published accounts. Reluctance to detail industry work experience was evident from two of the managing directors who considered that such a question would put off directors completing the questionnaire, firm experience was considered more important.

Further discussion elicited information of limited personal industry experience prior to starting their businesses, clearly influencing their views. The potential value of industry experience was highlighted as a valuable factor in explaining innovation but from a research point of view, the questionnaire was already complex and eliciting the necessary detail would consume space. The pilot questionnaire revealed very few completions of the original section so it was considered was considered wiser to exclude the item. The directors consulted will correct but the reasons given were disingenuous. A significant percentage of directors had no educational qualifications and had spent long periods with their firms. Previous work experience was most likely of a humdrum nature and would not exhibit the typical career path development characteristics of a manager in a larger firm. A reluctance to reveal the lack of a formal management career before becoming a firm director, accompanied by low levels of education may have been present.

Valuable insights were gained from the feedback from the managing directors and resulted in the questionnaire amendment. For instance, the innovation section was brought forward since it was seen to engage their interest quickly and the importance of the performance figures was reduced, locating the relevant questions in an insignificant spot. Items for the entrepreneurial capability Likert sales were freshly worded and others eliminated. Overall, the items in the Likert scales were reduced in number since the tolerance for completing numerous items was not high, especially if it was perceived not to be relevant or a repeat question. The latter, was partly overcome by reversing some items so that although they were addressing the same issue they appeared different, requiring a reverse scoring as a later stage. Intolerance of the Likert scales did indeed turn up to be a factor even of the reduced number, as many questionnaires were returned with them scored out. An accounting qualification was added to the listed formal education qualifications as a sensible addition given the average age of directors in the sample, which proved to be 50 + years as accounting was the principal route into the business management prior to the widening of higher education access as previously discussed (Constable and Handy 1988).

A copy of the draft letter to accompany the questionnaire was also shown to the three MD's in the initial study in Appendix 1. Selected individuals within the academic environment were also shown the questionnaire and letter during the period of the initial study and several amendments made.

**Sample Design - Identification of the Sample Population**

A representative sample of the total population of EISMEs in the SIC classification - 252, plastic's processing manufacturing industry sector identified in the DTI's Statistical Bulletin on SME's (1997) was sought to achieve a probability sample for a cross sectional survey at one point in time. Sample data must be a representative sample of the larger population so findings based on the data may be generalisable to the wider population. A response from a minimum of 250 EISME directors was anticipated to achieve statistical power and a good ratio of observations to independent variables for the four basic regression models used to test the hypotheses. Insufficient sample size can mean that the statistical technique applied can cause the test to become either insensitive for small samples or overly sensitive for large ones. For multiple regression sample size has a direct and sizable impact on power (Hair, Anderson et al. 1998) The larger the sample the greater the statistical power possible but the effect size (correlation) for a specified level of significance then decreases to the point where almost everything becomes significantly correlated. A balance between effect sizes, the level and type of statistical error specified and the sample size determine statistical power (Cohen 1977).

**8.5 Data Sources & Selection Criteria**

The DTI SME statistical Bulletin indicates that the EISME population of the targeted group of firms employing 20 to 250 was 25,130 in 1997. This population proved difficult to find in its entirety from publicly available data bases and was supplemented by commercial information sources. A list of independent firms employing 20 to 500 was constructed using multiple data sources; electronic data bases Fame (A & B versions) and Juniper. Searches did not identify the total population of sector firms shown in the DTI Statistics Bulletin for 1997 for EISMEs in the plastic's processing industry. The database was supplemented with firms identified via the European Plastics Industry Directory published by RAPRA, (Rubber and Plastics Research Association: a privatised industry research association) and an internet trade directory called Applegate. The list also includes company names that have been obtained from a variety of other sources including Partnership in Plastic events invitation lists and the Plastics and Rubber weekly trade paper. Later, the Applied Market Intelligence (AMI) report on Injection moulding companies was purchased from which selected firms, meeting the research criteria, were added to the database.

Search strategy criteria of the electronic databases included firms in the SIC 252 category and 21/22/23/24/25 subsections. Firms were independent, actively trading, established for more than five years, and employing between 20 and 500 employees at the time of the search. Initial search on Fame A (larger firm data) revealed a total 1284 firms in the appropriate SIC 252 categories. 445 were independent, 23 were non trading firms but only 56.1% of these records showed the employment numbers. Firms with employment information missing were selected on the basis of size of sales turnover, combined with the net tangible asset figure and compared with firms in the same sub secondary SIC code with similar turnover where employment was shown and so likely to be similar. Firms shown as sole traders or partnerships with very small sales turnovers were eliminated from the database when encountered, even if they had a sufficient number of employees on the basis it would not be valid to test a board capability in relation to other variables if the level of activity was insufficient to prompt such a development a group level of management capability.

SIC Classification 3796 category was also included in the search subsequently following conversation with the Business Plastics Federation as it transpired the SIC classification also contained plastic's processing firms as a result of a historical accident. Fame B, not held by Aston University, the smaller company data base was accessed at another university site and provided another 298 firms meeting the basic criteria. A similar approach was adopted for the Juniper Database identifying a further 398 firms meeting the selection criteria.

Difficulty in identifying the plastics processing industry EISME population, according to the source at the British Plastic's Federation was potentially due to firm self classification as belonging to the industries they supply rather than the plastics processing industry i.e. construction, packaging, electronics etc. After consultation with further industry sources and associated bodies, a rethink involved targeting the industry by process: injection moulding rather than as an entire industry. The injection moulding process is very much subject to the changes outlined in Chapter 4 particularly the potential for restructuring of the industry around integrated processing. It was hoped that such pressures would provide an added incentives for questionnaire completion.

All firm details were entered on a database with a named Director for the mailing, with job title address and contact details. Fax and email were recorded where present. Exceptions were made when the board clearly consisted of a large number of family members. In this case, an executive board member not carrying the family name was identified and mailed to avoid mailing directors not actively involved in the business and achieve an objectivity of view that might be compromised by family issues (Westhead and Storey 1997)

**8.6 Database Size**

An initial database of 965 of established independent medium sized firms was created from initial data sources. The initial pilot questionnaire mailing consisted of 147 addresses. Response to the pilot and the full survey was disappointing, necessitating further effort to identify firms meeting the research criteria. A commercially available list of injection moulders in the UK was purchased from Applied Market Intelligence containing

1700 addresses of companies using injection moulding process technology. The list presented various problems. Firstly, no consistent indication of whether the firm was independent or employment numbers were given. As for the initial data base searches on Fame and Juniper various proxies had to be used in an attempt to identify the firms employing 20 to 250 employees.

The number of moulding machines within the firm was listed as well as detail on whether the firm was captive (i.e. an in-house facility) whether it was a trade moulder supplying component parts or a direct seller of proprietary products. Firms with three or less moulding machines were removed as likely to be too small to support even an early board team. Captive firms were eliminated as were subsidiary firms previously as likely to be influenced by their parent company, in terms of the 'parenting style', policies and resources (Goold and Campbell 1987) Companies trading as partnerships or sole proprietorships were removed as previously. Firms featuring in the original database were also removed so that only new firms were added. 893 firms were added and contacted by personal letter with accompanying questionnaire shown in Appendix 8 resulting in a total expanded database of 1858 firms.

### 8.7 Pilot Study

A pilot survey of 142 firms with a freepost return number, to test the questionnaire wording, flow and layout and response rates , from the original database was carried out in June 2000 prior to the full survey. The pilot questionnaire and accompanying letter are shown in Appendix 1. The response rate for the pilot survey was disappointing resulting in a mere 17 complete responses to the 142 sent out.

### 8.8 Full Survey

The pilot survey questionnaire was reviewed and amendments made to try and increase the response rates for the full survey. The number of pages were reduced, smaller font size used, sections and items combined with a reduced number of items in Likert scale form The request for firm details moved from the first page and placed on the last page, making their completion optional, indicating the questionnaire could be returned anonymously. A consequent inability to verify sales and employment data from public sources for the research analysis resulted from the decision. Reordering of sections and items necessitated care in coding and entering the data to the database from the questionnaires at a later stage from different versions of the questionnaire. The section requesting the sales and profit figures was dramatically reduced in size and significance and slipped in, relatively inconspicuously, at an earlier stage too. Completion rates for the section subsequently went up. The full survey questionnaire was sent out in November 2000 and is shown in Appendix 5 with the personalised letter on headed notepaper. A re-mail of the original data base to 687 firms was carried out three months later, in February, using a black and white version of the questionnaire in an attempt to improve response rates. The letter that accompanied the remail is shown in Appendix 9. Return rates of completed questionnaires remained disappointing, requiring further action to gather sufficient data analysis.

## 8.9 Injection Moulding Survey

Commercially available data was purchased as detailed above and a further questionnaire, even more reduced in size was prepared for mail out. Considerable and successful effort was made to publicise the survey in advance in the trade press, in attempt to legitimise it and improve response rates. Coverage in the form of a short piece was achieved in the Plastics and Rubber Weekly Paper alerting firms of its arrival and soliciting interested parties who wished to participate to make contact. Interestingly, amongst the firms which indicated a willingness to participate in the research were two organisations seeking access to the database, as they had also had a poor response to their own questionnaires to the same target group; a research organisation surveying polymer innovation introduction to smaller firms and RAPRA, acting on behalf of the Plastics Industry Faraday Group, carried out a very large survey of their total SME membership. The latter was possibly provoked by the researcher's activities in talking to them earlier in the research process. RAPRA publish their database as the European Plastics Industry Directory and were unwilling to permit access without a stiff fee. Despite offering free copies of the directory to all respondents, the RAPRA survey to all firms in the SME categories independent or otherwise only produced 115 responses from a far larger mail out.

At this point, some of the letters received with returned uncompleted questionnaires, claiming they were unable to complete the questionnaire due to number of similar requests they had received, began to take on new significance. Plastic's processing SMEs would appear to have been 'over surveyed' in the period and may be the cause of the disappointing overall response. Others organisations involved in the industry were recognising a problem and attempting to find answers but unfortunately producing an undesirable effect overall.

## 8.10 Sample Size

The final data base contained 2,546 names and addresses for a named individuals within firms thought to be in the research target group. Overall 130 questionnaires were returned by directors which only 96 were complete and useable, representing an extremely disappointing 3.8% response rate overall. The response rate was disappointing and substantially lower than the 250 responses planned to achieve ideal statistical power. Poor response rates from entrepreneurs and small business are a acknowledged feature of US research (Alpar and Spitzer 1989) with similar patterns reported in the UK(Tether, Smith et al. 1997) Complete sets of observation were further decreased when testing the model relationships for hypothesis four, since there were only 67 complete sets due to an accumulation of missing data within each variable set. However with a maximum of four independent variables for hypothesis 4 the minimum of a 5:1 ratio of observations to variables was still met although a long way from the ideal of 15 to 20 observations for each variable.

There have been four separate mailings of personalised letters accompanying the questionnaire to the named directors on the database. These are summarised in the table below accompanied by the response rates.

**Table 8.8: Mailing and Response Summary**

| Mailing | Number | Total Firm Response | % Response | Usable: meeting criteria | % Response |
|---|---|---|---|---|---|
| **Pilot Survey** | 142 | 24 | 5.9 | 17 | 12 |
| **Full Survey** | 823 | 59 | 3.9 | 53 | 3.5 |
| **Of which repeat mail** | 687 | | | | |
| **Injection Moulding Survey** | 894 | 47 | 5.3 | 43 | 4.7 |
| **Total Mailing** | **2546** | **130** | **4.2%** | **96** | **3.8%** |

## 8.11 Data Entry

A code book was prepared and the raw data entered into an excel spreadsheet, exported into SPSS where the transformation of the data into the variables for the regression models was carried out. Variables so obtained were transferred into a summary data sheet for regression model estimations. The analysis, originally carried out within SPSS, was subsequently performed within LIMDEP an econometrics statistics package when it was appreciated that the distribution and nature of the innovation count data, a Poisson distribution, required a negative binomial regression technique not catered for within SPSS v.9/10.

## 8.12 Data Preparation

The raw data was carefully examined in two stages to initially to identify entry errors, to thoroughly understand the basic characteristics of the data and any underlying relationships to prepare the data for multivariate analysis. The observation numbers for each parameter were checked for sufficiency, and then worked to produce the necessary variables for the analysis. Violations of the required assumptions within the statistical data were again checked as well for the presence of outliers and influential observations. Sample size is considered below.

**8.13 Self Reporting of Data**

Self reporting of data assumes but the responding director knows and what accurate for the data requested. Age, educational qualification and service length reports for fellow directors in the given groupings is relatively uncontroversial. Reporting of innovation activity is potentially more subjective. Firstly, the respondent must understand and apply correctly the brief descriptions of innovation type given in order to categorise the innovation into either incremental or radical product or process innovation. The initial preliminary study and testing of contents of the questionnaire indicated that the Schumpterian based categories used with the brief examples were well understood. It is possible that categorisation made by responding directors between radical and incremental categories was influenced by operational considerations. An incremental process innovation, gas powered injection moulding machinery for instance, may have been viewed as radical due to the degree of difficulty in implementing its use on the shop floor. The inclusion of the question as to how much each category of innovation contributed to sales in the years covered was intended as a means of assessing how significant the innovation was to the firm and an attempt to reduce over reporting of innovation rates as self or firm aggrandisement. (Podsakoff and Organ 1986). Time constraints eventually prohibited the carrying out of inter respondent consistency checks by mailing an additional director.

**8.14 Variable Calculation**

Full details of the manner in which the data was transformed into the independent and dependant variables required for the multivariate analysis are shown in the Appendices.

**8.15 Firm Performance Variables – Sales and Employment Growth**

Firm performance data was required for an analysis. Sales and employment growth are commonly used performance indicators for SME's as previously discussed. Sales and employment numbers were collected for the 4 years 1995 to 1999 to achieve a three year average sales and employment growth figure. External validity of firm performance data was achieved for 65% out of the 96 firms used for the analysis on firm sales by cross checking the figures given with publicly available information. There was evidence of rounding of the reported figures by responding directors. Four firms of the 96 usable questionnaires were found to possess significantly different results to those publicly recorded in either Juniper or Fame databases. In one case, it looked as the figures had been reported correctly but for the wrong years. The figures were adjusted to those in the public records.

Thirty five percent of firm performance figures were not crosschecked due either to anonymous return of the questionnaire or because of other missing data within the observation set. Some smaller firms also had taken the option of filing limited accounting information, which restricted the publicly available data. In the case of the latter in order to address critical missing data on both employment and sales growth, certain firms and their managing directors or finance functions were contacted by phone, email, or fax to request this information. The majority were co – operative although it was a time-consuming process but achieved a beneficial effect complete variable set numbers per observation required for testing the hypotheses. The effect on the fourth hypothesis data was marked where missing data on firm performance had reduced the number of observations from a low 43 to 67 out of the set of 93 observations used in the analysis.

### 8.16 Peformance Indicator Limitations

Sales growth is acknowledged as a limited indicator for successful firm performance. Slow sales growth can be accompanied by increasing gross profit margins especially if innovation is present. If the product is innovative or an innovative process is used in manufacturing that competitors do not possess then higher gross profit margins may be possible. Introduction costs of the innovation however may well depress sales growth and margins in the short and medium term before both go up. A longitudinal research design was needed to check to ascertain any lagged effects and beyond the scope of the current research. A check on the impact of firm innovation level and category present on sales per employee was possible and discussed further in Chapter 8.

### 8.17 Exploration and Assumptions

The data was analysed to identify the following:-

- The impact of outliers and missing values
- Whether the data met the underlying statistical assumptions necessary of linearity, constant variance of the error term, independence of error term and normality of distribution for the multivariate analysis technique proposed.
- Impact of observation number and sample size on proposed analysis

### 8.18 Outliers

Identifying outliers in data attempting to capture entrepreneurial firm behaviour is an area fraught with difficulty in the subject of some debate since it could be argued the outliers or influential observations are the entrepreneurial exceptions the analysis is endeavouring to capture. Removing outliers or influential observations can defeat the object of the exercise, simply producing a homogenized set of data for analysis. A statistical package other than SPSS and LIMDEP with a robust sampling testing element was required to truly tackle this inherent problem but unfortunately not available for use.

Descriptive statistics, histograms and box plots for each independent and dependant variable are used to identify potential outliers and influential observations. A selection of these is shown in Appendix 9. Eyeball scrutiny combined with the statistical descriptions of the data revealed outliers principally in the innovation and entrepreneurial capability score variables as shown in Appendices 5 and 6. The original questionnaires were examined to determine the firm nature and source of the high value. Company 60 was known to the researcher as a safety wear supplier and manufacturer. Further examination of their web site and Applegate entry indicated that a significant amount of their product was imported and the 111 'innovations' claimed were in fact introductions from other sources. Manufacturing capability was confined to a single injection moulding process so the innovation processes at board level were likely to be minimal so the firm and its extreme innovation value were eliminated.

Two other firms were also removed at this stage numbers 20 and 72. Company 72 was discovered to be too large when missing employment data was obtained and combined with the high innovation figure led to its removal. Company 20 possessed an extremely high entrepreneurial capability score at 584 that had a considerable influence on the analysis and was eliminated with some hesitation since it appeared to be a genuine score, scoring highly on the risk and reward element. The research aims to study the firm 'in the middle' so that extracting the observation set was thought unlikely to affect the whole. Other influential observations appeared to be present and some time was spent investigating various values to assess the impact of removal on the model estimation, which proved an illuminating lesson in data handling. Ultimately the data was left without further change.

Missing value analysis is shown in Appendix 8, which gives full details. There was an erratic level of missing data from the Likert scales employed for the entrepreneurial capability score combined with a more significant one for the resource access data. Minor missing values within the scales for otherwise complete data sets were identified, five in number and the respondents contacted by phone. Three directors were forthcoming in providing assistance over the phone in completing the scale. Their original failure to complete the scales appeared be simple oversight rather than for a systematic reason that might have affected the generalisability of the results.

The resource access questions where the total number of occasions that directors and employees travelled to or contacted external organisations or sources of information were however not well completed since respondents, judging from some of the comments scrawled on the questionnaires, did not understand the purpose of the questions and therefore failed to answer. With the benefit of hindsight, it may have been better to leave these items as measurement scales as they had been originally. Inclusion of firm size as a moderating variable in the regression model would have seen to any systematic variation due to firm size. Missing data for the resource access entrepreneurial component was the principle cause for the low number of data values for the entrepreneurial capability score at 78 out of a potential 93 responding firms. If the missing values are not missing completely at random (MCAR) then the model estimate violates a necessary assumption for the data. The estimates are then likely to be biased (Little and Rubin 1987)

Table 5:3 shows the level of observations for each variable: independent and dependant. The impact of these missing values if a complete case approach was employed would have restricted the analysis to 61 complete observations across all hypotheses. Appendix 8 includes details on the data pattern of missing values.

**Table 9: Observation Summary**

| **Variable Total Number of Observations** | 93 |
|---|---|
| Age | 91 |
| Service Length | 91 |
| Education | 92 |
| Entrepreneurial capability score 1 | 78 |
| Entrepreneurial capability score 2 | 92 |
| Total Innovation | 92 |
| Incremental Innovation | 92 |
| Radical Innovation | 92 |
| Average Sales Growth | 83 |
| Average Employment Growth | 81 |
| Firm Size | 84 |
| Board Size | 92 |

A complete case approach would have produced an inappropriate sample size that would have adversely impacted the multivariate analysis proposed. Since the missing values were concentrated in a single variable these observations were only excluded for the appropriate hypotheses. Substitution of the entrepreneurial capability score missing values by estimation was not considered an option for a composite and complex construct as the entrepreneurial capability score. Such imputation processes and /or replacements of missing data would tend to 'homogenise' the data and could artificially increase the explanatory power of the model.(Little and Rubin 1987)

### 8.19 Statistical Assumptions

The data was assessed for suitability for the planned multivariate analysis techniques; factor analysis and multiple regression and found to violate none of the underlying statistical data assumptions. Missing values, the distribution, homoscedasticity, independence of error and linearity of the independent and dependant variables and sample size considerations were all checked. Once the regression models had been estimated the regression variate is also assessed to check whether these basic assumptions are met and are discussed in the following chapter covering the data analysis and interpretation.

### 8.20 Statistical Power and Sample Size

The hypotheses to be tested using multiple regression techniques involve varying numbers of independent variables. The number of independent variables combined with sample size has a profound influence on the statistical power with a maximum number of four for Hypothesis 4; entrepreneurial capability score, innovation, average sales growth, and moderating variables firm size or board size. The determining factor in sample size for hypotheses numbers 2,3 and 4 is the number of complete firm entrepreneurial capability scores The number of complete observations data sets used in the analysis for each hypothesis is shown in the table below.

**Table 10: Number of Observations per Hypothesis**

| Hypothesis Number | Number of Observations |
|---|---|
| 1 | 92 |
| 2 | 78 |
| 3 | 79 |
| 4 | 67 |

The probability of finding statistical significance at a specified level depends on the number of the observations used in the analysis. Thus, hypothesis 4, where the entrepreneurial capability score and average sales growth have a relatively high level of missing values is combined with the other two independent variables there are only 67 complete firm data sets for the multivariate analysis. For further details, please consult the missing value analysis in Appendix 8. The statistical power or the probability of detecting a statistically significant level of R2 at .01 or .05 declines with smaller sample sizes.

Hypothesis 1 with 92 observations is a sufficiently sized sample to detect statistically significant R2 values at the lower levels 10 - 15% even when requiring a .01 significance level. If the strength of the relationship to be detected is not expected to be or is not strong, small sample size will adversely affect the analysis as the size of statistically significant regression coefficients that can be detected decreases with smaller sample sizes. At 67 observations with four independent variables, the analysis will only find R2 values in excess of approximately 20 - 22 % at .05% significance. The analysis for hypothesis 4 is therefore near the margins of acceptability in terms of achieving generalisable results. Hypotheses 2 and 3 use the human capital and innovation count data where the data sets are more complete. Variable numbers used in the regression models especially for Hypothesis 3 are less so that even when combined with the entrepreneurial capability score observations the number of complete data set number rises. The sample size achieved was substantially less than the 250 originally planned due to the very low response rates, possibly due to an over survey of the industry sector.

### 8.21 Sample Size for the Factor Analysis

Factor analysis requires a minimum sample size that consists of not less than 50 observations, preferably over 100 with five times as many observations as there are variables. The sample objective for factor analysis is to achieve the highest cases per variable ratio to avoid over fitting of the data(Hair, Anderson et al. 1998) and has to be balanced with the need for internal consistency of the data and the elimination of error.

The correlation matrix was examined revealing coefficients of .3 and above. This combined with the Kaiser Meyer Olkin measure of sampling adequacy (KMO) value was above. 6 for the sample at .701 and the Bartlett test of Sphericity were significant at .000. The sample data collected was therefore suitable for the factor analysis.

### 8.22 Distribution

The first assumption made of the data is that it must be of a known distribution and an appropriate multivariate analysis technique employed to test for the nature of the assumed relationships.

### 8.23 Ordinary Least Squares Regression

Ordinary Least Squares regression techniques require data to have a normal distribution, neither skewed nor possessing kurtosis. The variable data sets with the exception of the innovation count are all acceptably close to the normal distributions and can be examined in Appendices 3 to 7. The research model sets up four hypotheses to be tested using a number of different independent variables to predict a single metric dependent variable. The appropriate statistical regression technique to use on data with a normal distribution is Ordinary Least Squares (OLS). This technique has been used for Hypotheses 2 & 4 where the innovation count is not used as a dependent variable.

**8.24 Poisson and Negative Binomial Distribution Regression Techniques**

The innovation counts for total, radical, and incremental innovation shown below in Figures 5:2, 5:3, 5:4 with an imposed normal distribution curve have a Poisson distribution. Count data is skewed in one direction, approximately a reverse j shape, containing many zero counts. Such counts may have no upper limit, occur independently of each other or irregularly, are not continuous measurements and the probability of occurrence is constant (Cameron and Trivedi 1986) A feature of a Poisson distribution is that in such cases the mean $\mu$ is always numerically equal to its variance. Where the mean $\mu$ is less than one, a Poisson distribution is reverse j shaped - greater than one but less than 4, a humpbacked skew and greater than 4 the data becomes increasingly symmetrical.

Negative binomial distribution is applicable to the same data type except there is no assumption of a constant probability of occurrence as is the case for the innovation count. The Negative binomial distribution is useful in describing and comparing different sets of data. The nature of the innovation data distribution requires that Poisson and negative binomial regression techniques are carried out where the innovation count is included as the dependent variable in the regression model as occurs for Hypotheses 1 and 3. Poisson and Negative binomial regression techniques are used to test these hypotheses in the analysis.

**8.25 Constant Variance of the Error Term - Homoscedasticity**

Multiple regression requires an equal spread of variance across the independent variables to ensure that the variance used for the explanation or prediction contributes values equally to the prediction and the test is therefore a fair one. If there are variables included in the analysis with a skewed distribution as for the innovation count then the data is heteroscedastic. The analysis needs to be handled in a manner to remedy the effects of skewed data as is catered for with Poisson and negative binomial regression techniques.

**8.25.1 Linearity**

Multiple regression techniques tests for a linear association between the board team human capital, entrepreneurial capability score, innovation count and firm performance as independent and dependent variables as well as the moderating variables of firm and board size. If the relationships are nonlinear, regression techniques will underestimate the strength of the relationships involved. For this reason, the possibility of curvilinear relationships amongst the variables has been investigated by transforming certain variables, effectively linearizing a curvilinear relationship, notably board size and board entrepreneurial capability. Some research evidence that increasing board size reduces board capacity to function effectively (Fried, Bruton et al. 1998; Dalton, Daily et al. 1999) but mostly does not apply to EISMEs with very low board team sizes in the first place.

Analysis takes place at one point in time effecting a cross sectional study rather than a longitudinal one although the dependent variables for Hypothesis 4, firm average sales and employment growth over three years, are taken from 1995 to 1999. Firms with less than five years trading where entrepreneurial capability are more likely to be based on an individual, are not present in the data base, removing a potential skew to the data. Sample firms vary widely in age as shown in the table below with ample evidence to show decreased ability to innovate over time through inertia(Hannan and Freeman 1984). Board team entrepreneurial capability score and board size variable were therefore transformed for theoretical reasons by squaring the variable within the model to test whether a curvilinear relationship was present rather than a linear one in an exploratory analysis. The squared term represents the changing slope of the relationship over the range of the variable to which the term is applied (Hair, Anderson et al. 1998).Results are discussed in the next chapter. The data was checked for linearity using both scatterplots and simple regressions in the first instance prior to checking for strength and direction of association using the Pearson Product Moment Correlation Coefficient Matrices for each hypothesis.

**Figure 13: Distribution of Total Innovation Data for all Firms**

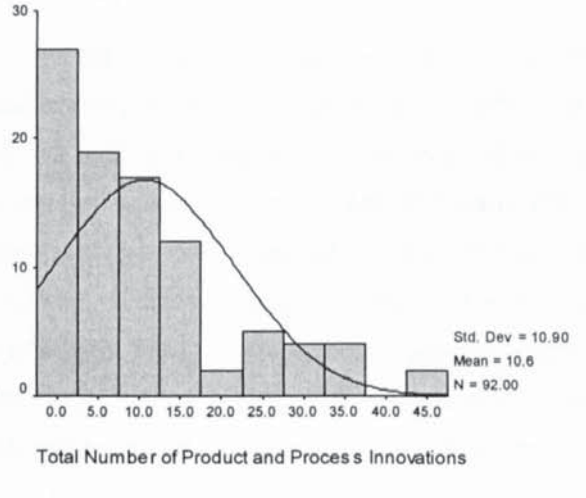


**Figure 14: Distribution of Incremental Innovation Data for all Firms**

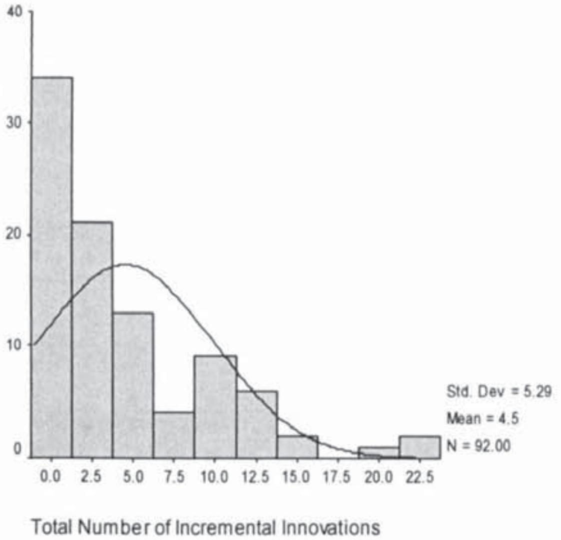
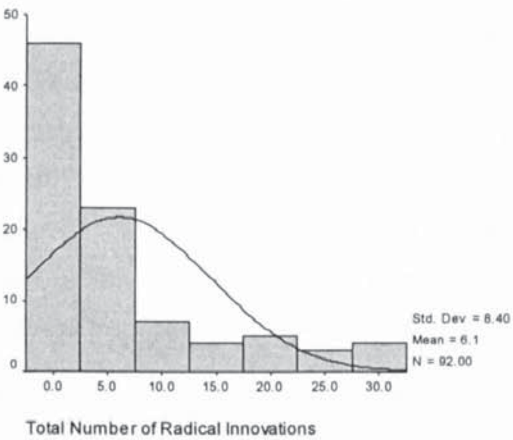



**Figure 15: Distribution of Firm Radical Innovation Data for all Firms**




### 8.26 Independence of Error

Independent variables included in the regression models to be estimated must predict the dependent variable independently. In other words, each must make a unique contribution to the regression variate. Inclusion of other independent variable must not influence the predicted values. If the independent variables are multicollinear to any degree, a danger exists of the true relationship between the independent and dependent variables being marked. Multicollinearity proved to be the case between board team human capital variable of mean board age and service length after the first estimations were carried out for Hypothesis 1. The EISME directors in the sample appeared to be founders who have remained within the firm for substantial amounts of time. The two independent variables do, however, have distinct and separate contributions in explaining the innovation dependent variable in hypothesis 1. The analysis highlighting the multicollinearity is discussed at the beginning of Chapter 6 with the SPSS detail output included in Appendix 15.

### 8.27 Response Bias

The questionnaire data was received over an eight month period. A response bias was checked for between the earlier and later questionnaire data with an independent t test, Levenes, on the key variables. The test assumes that the group variances are equal. The significance values produced by the test were greater than .10 indicating no bias evident in the variances between the two groups for key variables.

### 8.28 Descriptive Statistics

Descriptive statistics: and accompanying comment for the data are laid out in the chapter Appendices 3 to 7. The data meets the required assumptions for the proposed multivariate analysis detailed below.

### 8.29 Analysis Plan

The statistical analysis techniques employed within the research designed to meet the research objectives and the previously detailed conceptual development of research and are now detailed (Townsend and Ashby 1984). Conceptual development for the research model, identification of the independent and dependent variables and the creation of a research model along with four hypotheses for testing the fundamental relationships between the variables as indicated by the model are explained in the preceding chapters. More detail on the statistical analysis plan including justification for the choice of the multivariate analysis technique of multiple regression for the research is now discussed.

Multiple regression has been used as the statistical technique capable of analyzing the relationship between the single independent variables and the dependent variables of the four hypotheses in succession. Determining whether the known values of the independent variables are associated with, or can predict, the dependent variable in the model using a weighting procedure to produce a regression variate to best explain the dependent variable. The four hypotheses aim to 'line up' the separate resource and capability components capability required for innovation outcomes in EISMEs; board team human capital resources and board management practices in an attempt to understand the elements intrinsic in building a board level capability., which will ensure economic survival and firm growth through continued innovation for this type of firm within the plastic's processing industry. Hypotheses 1 - 4 are structured to build a cumulative profile of the key dimensions of board team human capital and firm management practices on innovation and association with firm growth as seen through the increase of sales and employment.

## 8.30 Analysis Sequence

Scrutiny of the Pearson Product Moment correlation matrices for each hypothesis in order to determine strengths of association through correlation coefficients to determine the nature and direction of any inter relationships among the variables was the first step taken. Potential multicollinearity amongst the proposed independent variables for the regression model was identified. Each regression model was run with and without the constant and with firm and board size separately as moderators. Hypotheses with board team entrepreneurial capability score and board size were run with squared terms to test for the presence of curvilinear relationships. The factor analysis used to create new variables for use in the regression models are shown in appendix 11.

Model parsimony is required for best fit in the estimation. Models were run twice for each of the two entrepreneurial capability score calculation methods with and without constants and with and without the two moderating variables of firm and board size. Chapter 9 discusses the results of the data analysis so carried out accompanied by some preliminary discussion.

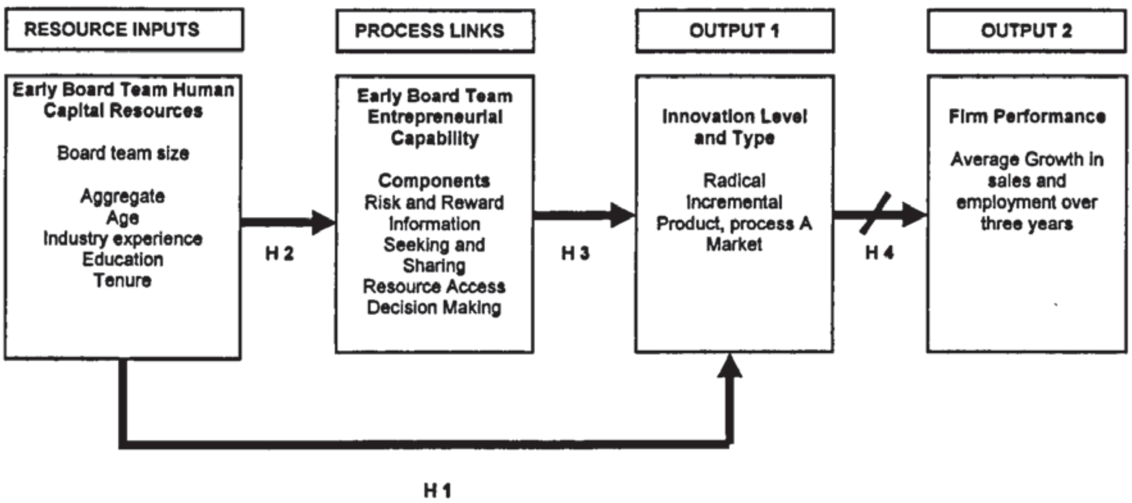
## CHAPTER 9

## DATA ANALYSIS & PRELIMINARY DISCUSSION

### 9. Introduction

Data analysis results are assembled and studied in Chapter 9. The research model fit is assessed and attempts to improve the fit discussed. Analysis findings for the hypothesized relationships shown in the research model, (see Figure 9.7 below) are objectively assessed to determine the degree and character of the statistical relationship between dependant and independent variables for each hypothesis in turn. A summary of the statistical and practical significance of any predictive and explanatory power evident follows. Problems encountered are identified and the validity, reliability, and generalisability of the research to the total population are discussed.

**Figure 16: Research Model**




### Hypothesis 1

*Board teams with lower aggregate age but higher education will produce greater levels of incremental innovation*

Of the four early board team human capital resource characteristics, data analysis supports the hypothesised relationship between incremental innovation and board team education, but not lower aggregate age. Longer service periods were associated with incremental innovation contrary to expectation. All the positive associations were at a relatively low significance level.

Longer service period for boards combine with higher educational levels to explain incremental innovation but contrary to previous research findings, higher average age, appears to substitute for education and contributes most significantly to radical innovation, a surprising finding. The UK population experienced passport access to higher education, with limited entry routes to a management career, leading to low levels of education within SME senior management, potentially explaining low levels of innovation and productivity. Higher education levels were expected of younger board teams, reflecting greater higher education access, accompanied by increased interest in new enterprise creation over the past two decades.

Greater incremental innovation was anticipated of younger better, educated teams with longer firm service lengths on the basis that their intrinsic human capital resource underpinned the formation and evolution of the early board team. Radical innovation was not expected to be a common innovation outcome for established enterprises with limited resources and board team sizes, especially in the presence of lower average education levels.

Initial data analysis with use of the Pearson Product Moment Correlation Coefficient matrix (Table 171 below) took place to examine the direction of relationships and highlight potential collinarity amongst the independent variables. Director Service length and age show potential collinarity for Hypothesis 1 leading to model instability, the likelihood of which initial scrutiny of the data made apparent. Two separate sets of regression models are therefore employed using age and service length separately with education to overcome the problem. Details on multicollinearity exhibited are shown in Appendix 14.

### 9.1.1 Correlation Coefficient Matrix

The following data features are highlighted in the Pearson Product Moment correlation coefficient matrix shown below:-

- Mean board team education level is correlated to total number of innovations at a relatively low .206 at 5% significance level
- Incremental innovation is principally responsible for the correlation with education level, .236 at 5% significance level, compared with a figure of .206 for total innovation
- The board size moderating variable is not correlated with innovation total, radical or incremental. Firm size, however, is correlated in a modest way at the 5% significance level at .244 for incremental innovation.
- Board team mean age however, is negatively associated with firm size at.-.275 indicating that larger firms have younger boards of directors on average.
- Director age and service length are significantly associated, highlighting potential multicollinearity, examined in more detail with reference to hypothesis 2 below.

The poisson and negative binomial regression models were employed in the analysis since standard ordinary least squares regression (OLS) is strictly only applicable where the dependent variable is continuous. The dependent variable for hypotheses 1 and 3, the innovation counts, take integer values and numerous zero observations exist for the dependent variable. OLS regression may provide inconsistent estimates in both these

**Table 11: Hypothesis 1 Pearson Product Moment Correlation Coefficient Matrix**

| | | Mean of all Director cAges | Mean Director cTime in post | Mean Education Score for all directors | Total Number of Product and Process Innovations | Total Number of Incremental Innovations | Total Number of Radical Innovations | Total Number of Directors | Total employment F/T + P/T for 1999 |
|---|---|---|---|---|---|---|---|---|---|
| Mean of all Director cAges | Pearson Correlation | 1 | .446** | -.072 | .027 | -.072 | .080 | -.324** | -.275* |
| | Sig (2-tailed) | . | .000 | .498 | .798 | .500 | .451 | .002 | .012 |
| | N | 91 | 91 | 91 | 91 | 91 | 91 | 91 | 83 |
| Mean Director cTime in post | Pearson Correlation | .446** | 1 | -.404** | .093 | .109 | .053 | -.293** | -.199 |
| | Sig (2-tailed) | .000 | . | .000 | .382 | .303 | .617 | .005 | .071 |
| | N | 91 | 91 | 91 | 91 | 91 | 91 | 91 | 83 |
| Mean Education Score for all directors | Pearson Correlation | -.072 | -.404** | 1 | .206* | .236* | .117 | .187 | .151 |
| | Sig. (2-tailed) | .498 | .000 | . | .049 | .024 | .269 | .074 | .169 |
| | N | 91 | 91 | 92 | 92 | 92 | 92 | 92 | 84 |
| Total Number of Product and Process Innovations | Pearson Correlation | .027 | .093 | .206* | 1 | .661** | .881** | .156 | .065 |
| | Sig. (2-tailed) | .798 | .382 | .049 | . | .000 | .000 | .137 | .557 |
| | N | 91 | 91 | 92 | 92 | 92 | 92 | 92 | 84 |
| Total Number of Incremental Innovations | Pearson Correlation | -.072 | .109 | .236* | .661** | 1 | .227* | .201 | .244* |
| | Sig. (2-tailed) | .500 | .303 | .024 | .000 | . | .030 | .054 | .025 |
| | N | 91 | 91 | 92 | 92 | 92 | 92 | 92 | 84 |
| Total Number of Radical Innovations | Pearson Correlation | .080 | .053 | .117 | .881** | .227* | 1 | .075 | -.075 |
| | Sig (2-tailed) | .451 | .617 | .269 | .000 | .030 | . | .475 | .497 |
| | N | 91 | 91 | 92 | 92 | 92 | 92 | 92 | 84 |
| Total Number of Directors | Pearson Correlation | -.324** | -.293** | .187 | .156 | .201 | .075 | 1 | .606** |
| | Sig (2-tailed) | .002 | 005 | .074 | .137 | .054 | .475 | . | .000 |
| | N | 91 | 91 | 92 | 92 | 92 | 92 | 92 | 84 |
| Total employment F/T + P/T for 1999 | Pearson Correlation | -.275* | -.199 | .151 | .065 | .244* | -.075 | .606** | 1 |
| | Sig (2-tailed) | .012 | .071 | .169 | .557 | .025 | .497 | .000 | . |
| | N | 83 | 83 | 84 | 84 | 84 | 84 | 84 | 84 |

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

cases so Poisson distribution is appropriate applied (Hausman et al 1984; Cameron and Trivedi, 1986). The poisson technique makes a critical assumption of equality between the variance and the mean of the process. A test for the presence of 'overdispersion' (i.e. the mean and variance are not equal) can be carried out, and where overdispersion occurs, the Negative Binomial as an extension of the Poisson model allowing for overdispersion.

The regression models were run twice using total, incremental, and radical innovation as the dependent variable for both board mean age and service length separately with education level to test the hypothesis, avoiding multicollinearity between age and service length. Initial use of firm size and board size as moderators revealed no clear relationship with innovation level and type. In both cases firm and board size approached significance for total and incremental innovation with t-ratios of between 1.25 and 1.71. Firm and Board size have no impact on radical innovation. The final models were therefore run without moderators. All models showed highly significant values for alpha, the over dispersion parameter, indicating that the negative binomial regression is the correct estimation technique. The regression results for total innovation as the dependent variable encompass different results for incremental and radical innovation blurring the overall total innovation picture. The results for incremental innovation and radical innovation are therefore examined first.

Firm incremental innovation level is partly explained by both higher board team educational levels and service length but not age with the mean education level as seen in Tables 12 & 13 below. The t ratio for education at 2.202 is statistically significant. The mean age coefficient is negative but not significant. The service length t ratio is also statistically significant when combined with education rather than age and produces t ratios of 3.76 and 3.96. Thus, board teams with longer serving directors with higher levels of education are associated with higher firm levels of incremental innovation. Lower age does not contribute to the explanation of incremental innovation as hypothesised but longer periods of experience with assumed accumulation of knowledge does. Director mean age at 49/50 years is relatively high; indicating significant numbers of directors in the sample received their education in the era of the eleven plus exam, secondary modern schools and 3% cohort access to higher education. The strength and significance of the relationship with education is therefore stronger than would first appear.

**Table 12: Model Results Incremental Innovation with constant with Mean board age and education: Negative Binomial Regression Maximum Likelihood Estimates**

| | | | | |
|---|---|---|---|---|
| **Dependent variable** | **Incremental Innovation** | | | |
| Number of observations | 92 | | | |
| Log likelihood function | -234.9540 | | | |
| Restricted log likelihood | -357.2602 | | | |
| Chi-squared | 244.6125 | | | |
| Degrees of freedom | 1 | | | |
| Significance level | .0000000 | | | |
| | **Coeff.** | **Std.Err.** | **t-ratio** | **P-value** |
| **Constant** | 1.33604 | 0.70643 | 1.8912 | 0.0586 |
| **Mean Age** | -0.00847 | 0.01403 | -0.6036 | 0.5461 |
| **Mean Education Level** | 0.07894 | 0.03584 | 2.2024 | 0.0278 |
| **Alpha** | 1.31148 | 0.292579 | 4.48248 | 0.0000 |

**Table 13: Model Results: Iincremental Innovation,** without constant, Board service length and education level as independent: Negative Binomial Regression Maximum Likelihood Estimates.

| | | | | |
|---|---|---|---|---|
| **Dependent variable** | **Incremental Innovation** | | | |
| Number of observations | 92 | | | |
| Log likelihood function | 233.2386 | | | |
| Restricted log likelihood | -341.8148 | | | |
| Chi-squared | 217.1524 | | | |
| Degrees of freedom | 1 | | | |
| Significance level | .0000000 | | | |
| | **Coeff.** | **Std.Err.** | **t-ratio** | **P-value** |
| **Mean Service** | 0.0551 | 0.01466 | 3.7605 | 0.0002 |
| **Mean Education** | 0.0992 | 0.02504 | 3.9628 | 0.0001 |
| **Alpha** | 1.2348 | 0.25621 | 4.8196 | 0.0000 |

Established board teams with higher educational levels incrementally innovate more regardless of board team age. A contrast to findings for salaried board teams in larger concerns where shorter director tenure is associated with higher levels of incremental innovation, not found to hold true for the sample EISMEs. The regression model for incremental innovation with service length and education as regressors is shown without the constant since the model with the constant included proved not to be statistically significant.

### 9.1.2 Incremental Innovation

A commonsense scrutiny of the innovation count, however undermines the finding value since, as can be seen from the table below, new product introductions to new markets, categorised as a radical innovation is the numerically dominant innovation form undertaken within the firm sample, a form of innovation, which is apparently favoured by older longer serving board team members. Categorising new product introductions to new markets this way has resulted in the form of innovation dominating of incremental innovation which may have further implications.

Unfortunately the questionnaire section requesting the approximate sales percentages for each innovation, intended to give an indication of value to the firm, was not widely completed and provided inadequate data for analysis. Innovation count use in assessing overall value to a firm is acknowledged to be a difficult performance measure (Chell, 2000) but it was hoped to show a link with the the early board team human capital resources with their management practices and organisational processes, indicating an entrepreneurial orientation toward a particular type of innovation. Firm acquisition as a means of acquiring innovation was not shown to be a widespread practice within the sample.

**Table 14: Innovation Count by Category (93 observations)**

| Innovation Type | New Product New Market | New Process | Product Improv'mt | Process Improv'mt | Existing Product New Market | Firm Acquisit'n | Total Number Innovation |
|---|---|---|---|---|---|---|---|
| Actual Number | 454 | 106 | 134 | 145 | 139 | 6 | 978 |
| % Of Total | 46.5% | 10.8% | 13.7% | 14.8% | 14.2% | | 100% |
| | Radical Innovation 560 | | Incremental Innovation 418 | | | Acq' 6 | 984 |

Education resource level within an EISME board team, accompanied by longer early board team tenure periods are confirmed as significant basic resources to early board team human capital in the presence of incremental innovation; a contrasting finding compared to larger organisation board teams where greater levels of innovation are associated with shorter board tenure periods (Bantel and Jackson, 1989) (Wiersema and Bantel, 1992).

Several possible interpretations are possible. Longer firm tenure and education levels could potentially mean EISME early board teams may require longer periods to establish a successful working dynamic due to the sheer complexity of simultaneously attempting to maintain Penrose's "administrative" and "entrepreneurial" services at this stage in firm development. Learning to simultaneously pick and deploy resources for effective resource utilisation, through established routines, yet also maintain more flexible and fragile processes geared towards adaptive and generative capabilities required renovation is challenging. Time is probably required for its development.

Larger firms have established routines, systems and structures, and employee specialisation, accompanied by well-recognised management techniques and concepts, permitting new directors to operate effectively with little lead-in. In smaller expanding firms, routines for management control are still developing. The highly experiential and fragile processes, required during the process of firm evolution argue likelihood buried by so-called "professional management techniques," but clearly will depend on the environmental context (Eisenhardt and Tabrizi, 1995, Eisenhardt, 1989).

Board team educational level scores, which use a score of 1 for each year of education from the GCE/GSCE exam level (previously described) show attainment levels to be low at a mean of 6.98. The most commonly occurring level of education is 6 across all board team members. Distribution is skewed towards a significant percentage, 23% of boards with little or no educational qualifications at all. The highest score was 20, where a board of two directors with both accounting qualifications and undergraduate degrees illustrates the point. .The frequency table 2 shown in the appendices giving detail. A board team score of 4 or below means very few board members have higher levels of educational qualification. A score of 7 can mean that a single board member is educated up to first degree level. Of the board teams surveyed, 50% had scores below seven.

Penrose's view of the top management team, suggests team additions will take time to settle in and fully contribute, initially slowing down expansion. (Penrose, 1959) p59. if longer service periods within early board teams are associated with innovation, frequent departures from the board are likely to have a significant impact on smaller firm board team evolution, emergence and ultimate success. Early board teams take a longer period to fully take on the responsibilities for the emerging functional management areas. Higher education levels within early board teams can be assumed to help with the vital learning function of the knowledge production function described by Pavitt, for the innovation process. (Pavitt, 2003). Higher education levels will also help the informal strategic management processes held in the heads of the prime coordinating early board team, which substitute for the more formal planning expected in larger firms. It follows that EISME early board teams rely more heavily on their intrinsic human capital resources substituting for more formal structures systems and routines of larger established organisations.

Prior large company experience, either in the industry or outside is considered unlikely to prepare new board team members for the substantial trial and error experimentation process necessary within an emerging organisation as it seeks to find "the best way of doing things." Even successful founders of new enterprises, skilled in identifying and acquiring resources, may have difficulty with the processes of deploying resources to build capabilities (Kazanjian and Rao, 1999) to create a unique resource platform for the further development of capabilities and competencies required for continued growth (Brush et al., 2001). Education might therefore reasonably be expected to combine with longer service periods and management experience of the firm development stage if a board team is to be effective in this respect. The necessarily honing of organisational processes by management in the pursuit of knowledge, described by Teece, will undoubtedly is underpinned by these early board team resource characteristics. The processes are more important and structures and systems, as both Teece and Ghoshal and Sumantra propose (Ghoshal and Bartlett, 1995) (Teece et al., 1997)

Entrepreneurial ventures or firms merely expressing a wish to grow modestly are frequently urged to accept traditional management structures, systems, concepts and techniques which may well stultify essential management and organisational processes necessary for continued innovation (Watson, 1995). A mistake made by Flamholtz, one of the few researchers to attempt an explanation for firm transition (Flamholtz, 1986).

The low level of explanation by the regression variate can be seen as a symptom of the British educational system; the restricted access to higher education and the failure to provide clear entry routes to a business management career, which includes setting up new enterprises. Given the facts of the past British higher educational system, it was hoped board team resources would have been influenced by increased participation in higher education, and management education more specifically; resulting in younger better educated age board teams. It is either too early to assess the effects of widening access to higher education at board team level or there continue to be problems in the type of management education provided by business schools, which mean students, are not easily integrated into the SME environment.

EISME board teams studied in the sample possess very different board team human capital resources compared to those found to larger firms, Directors are found to move with greater frequency (Conyon et al., 2001). Greater board diversity in large firms and shorter board member tenure have been shown as associated with greater incremental innovation levels (Bantel and Jackson, 1989).. "Owner" directors stay with their companies for long periods and are associated with smaller board size of two to three directors in the sample. A desire to maintain a lifestyle and potential loss of control are frequently attributed as the primary reason for SME board and firm size restriction (Huse, 2000) so it is interesting to see that even in these circumstances, education and innovation are associated, suggesting very conscious choices by the individuals involved.. Share owning EISME directors of the sample average age, 50 yrs, are unlikely to change their jobs but remain even in 'underperforming' firms due to lack of alternatives, especially in the absence of higher education and experience outside their own firm (Gimeno et al., 1997).

Overall innovation rates for EISMEs may change as more graduates from the expanded higher education sector, take up work within the sector, (unfortunately by default of better large company options in many cases), gain experience. Eventually accumulated experience, combined with formal education in the younger age group, may result in start-ups by those already employed within the sector, rather than those in blue-chip companies. But not if the management techniques and concepts taught in business course continue to be dominated by those based in larger firms. A longitudinal research design was required to assess the impact of accumulating education within the SME working population and ultimate evolution of SME organisational growth capability but was beyond the scope of the research.

Current findings so far suggest higher education levels within board teams may contribute a slow and accumulating benefit over a long time to smaller firm organisational growth capability but that a human capital education resource shortage exists for EISMEs. Increased supply of graduates does not necessarily lead to greater employment prospects in SMEs as a matter of course as other factors may be at work such as a reluctance for existing less well educated board members to recruit graduates, not perceiving their value or unwilling to have their control or management challenged. Management education, almost universally taught from a large company perspective, may be responsible for SME reluctance to recruit and retain graduates as additional time and effort are required to integrate them as productive firm members in a situation of constrained resources. Some government schemes, teaching company schemes/knowledge transfer partnerships, have been introduced to address the situation. Increased supply of graduates means however that they cannot afford to overlook SME job opportunities despite the less favourable conditions on offer compared to the "blue chip" companies (Belfield, 1999).

A critical factor to further organisational growth capability may well depend on addressing the developmental 'plug' of older, less well educated board members present in EISME's, without alternative employment prospects. Passage of time may well remove the problem of older board members but conceivably the firm as well, prompting possible support and regulation for the effective board team formation discussed in the next chapter. When the education early board team human capital resource deficit is combined with different risk reward profiles of equity ownership amongst board members, the effect of the "plug" becomes more acute, and potentially difficult to address. As argued previously, EISME board member personal and business objectives need to be mutually aligned through greater share participation; ensuring management practices are orientated towards the same ends. A successful learning dynamic in the creation of an internal "knowledge production and refinement function" within the early board team is vital to innovation and considered best fostered by ownership across all executive directors at a minimum. The issue of changing the behaviour of established board teams, persuading them to increase board size, recruit better educated staff and ultimately share their equity with newly appointed directors becomes a high policy priority if the UK government wishes to implement their industrial policy.

### 9.1.3 Radical Innovation

The regression model shown in Table 15, without the constant since it was statistically insignificant, shows that board team service length and education achieves statistically significant t-ratios of 5.16 and 3.48 for radical innovation. Firm service length combined with education on the part of the board is therefore just as important for radical innovation as it is for incremental innovation. However, when mean board age and education are used as independent variables to explain radical innovation, Table 16 below, age becomes statistically significant with a t ratio of 5.552 and education becomes statistically insignificant, which is intriguing. Greater board team age, associated with accumulated experience and knowledge substitutes for education in producing greater levels of radical innovation for the EISME sample.

**Table 15: Model Results without constant, radical innovation as dependent variable, Board mean service length and education level as independent.** Negative Binomial Regression Maximum Likelihood Estimates

| | | | | |
|---|---|---|---|---|
| **Dependent variable** | **Radical Innovation** | | | |
| Number of observations | 92 | | | |
| Log likelihood function | -255.8742 | | | |
| Restricted log likelihood | -549.6340 | | | |
| Chi-squared | 587.5196 | | | |
| Degrees of freedom | 1 | | | |
| Significance level | .0000000 | | | |
| | **Coeff.** | **Std.Err.** | **t-ratio** | **P-value** |
| **Mean Service** | 0.0749 | 0.01449 | 5.1692 | 0.0000 |
| **Mean Education** | 0.10649 | 0.03055 | 3.4855 | 0.0005 |
| **Alpha** | 1.8373 | 0.33112 | 5.54876 | 0.0000 |

Analysis results for radical innovation associated with greater board team age are surprising and contrary to expectation. Reassurance could be derived from the fact that accumulated wisdom through age and experience on the job can substitute for education and result in radical innovation likely to assist in firm long term economic survival. The subjective reporting of incremental and radical innovation may have a bearing on the findings, discussed in the final Chapter.

**Table 16 Model Results for Radical Innovation** as dependent variable, Board mean service and education level as independent without constant. Negative Binomial Regression Maximum Likelihood Estimates

| **Dependent variable** | **Radical innovation** | | | |
|---|---|---|---|---|
| Number of observations | 92 | | | |
| Log likelihood function | -255.8742 | | | |
| Restricted log likelihood | -549.6340 | | | |
| Chi-squared | 587.5196 | | | |
| Degrees of freedom | 1 | | | |
| Significance level | .0000000 | | | |
| | **Coeff.** | **Std.Err.** | **t-ratio** | **P-value** |
| **Mean Service** | 0.0749 | 0.01449 | 5.1692 | 0.0000 |
| **Mean Education** | 0.10649 | 0.03055 | 3.4855 | 0.0005 |
| **Alpha** | 1.8373 | 0.33112 | 5.54876 | 0.0000 |

### 9.1.4. Total Innovation

Regression model results using total innovation as the dependent variable are as expected from the aggregate results for incremental innovation and radical innovation. Firm total innovation levels are explained by greater board education levels derived from the contribution of incremental and radical innovation but the findings on firm service length and age are reduced in significance when taken to together. Tables 17 & 18 below illustrate and are included for the sake of completeness. Firm size does not contribute to the explanation of innovation level either for incremental or radical innovation, as with other studies, although board size results are on the verge of acceptability.

**Table 17: Model Results for Radical Innovation** as dependent variable, Board mean age and education level as independent without constant. Negative Binomial Regression Maximum Likelihood Estimates

| | | | | |
|---|---|---|---|---|
| **Dependent variable** | **Radical Innovation** | | | |
| Number of observations | 92 | | | |
| Log likelihood function | -255.5653 | | | |
| Restricted log likelihood | -539.3029 | | | |
| Chi-squared | 567.4753 | | | |
| Degrees of freedom | 1 | | | |
| Significance level | .0000000 | | | |
| | **Coeff.** | **Std.Err.** | **t-ratio** | **P-value** |
| **Mean Age** | 0.0275361 | 0.00496003 | 5.5516 | 0.00000 |
| **Mean Education** | 0.0558254 | 0.0355395 | 1.5708 | 0.11623 |
| **Alpha** | 1.82114 | 0.332029 | 5.48486 | 0.00000 |

**Table 18: Model Results Total Innovation as dependent variable,** Board Mean Service Length and Education Level as independent variables. Negative Binomial Regression Maximum Likelihood Estimates

| | | | | |
|---|---|---|---|---|
| **Dependent variable** | **Total Innovation** | | | |
| Number of observations | 92 | | | |
| Log likelihood function | -308.1388 | | | |
| Restricted log likelihood | -588.2902 | | | |
| Chi-squared | 560.3030 | | | |
| Degrees of freedom | 1 | | | |
| Significance level | .0000000 | | | |
| | **Coeff.** | **Std.Err.** | **t-ratio** | **P-value** |
| **Constant** | 1.00605 | 0.519406 | 1.93693 | 0.0528 |
| **Mean Service** | 0.0512654 | 0.0273759 | 1.87265 | 0.0611 |
| **Mean Education** | 0.0882307 | 0.0340892 | 2.58823 | 0.0096 |
| **Alpha** | 1.02707 | 0.175868 | 5.84 | 0.0000 |

**Table 19: Negative Binomial Regression Model Results Total Innovation with Mean board age and education** Negative Binomial Regression Maximum Likelihood Estimates

| | | | | |
|---|---|---|---|---|
| **Dependent variable** | **Total Innovation** | | | |
| Number of observations | 92 | | | |
| Log likelihood function | -310.0450 | | | |
| Restricted log likelihood | -606.5417 | | | |
| Chi-squared | 592.9933 | | | |
| Degrees of freedom | 1 | | | |
| Significance level | .0000000 | | | |
| | **Coeff.** | **Std.Err.** | **t-ratio** | **P-value** |
| **Constant** | 1.51379 | 0.780802 | 1.93877 | 0.0525 |
| **Mean Age** | 0.00769211 | 0.0140542 | 0.547319 | 0.5842 |
| **Mean Education Level** | 0.0618709 | 0.0305031 | 2.02835 | 0.0425 |
| **Alpha** | 1.0755 | 0.186041 | 5.781 | 0.0000 |

## 9.2 Hypothesis 2: Board Team Human Capital & Entrepreneurial Capability

Analysis now moves to the first stage of testing the new measurement construct for an EISME board team entrepreneurial capability by examining the relationships with the board team resources of education level, firm tenure, and age. So far board team education, greater firm service, and incremental innovation are shown to be associated albeit at a low level by the regression variate for the previous hypothesis. Can intrinsic board team human capital resources of education level and firm service length also underpin and influence intervening board management practices, represented by the board team entrepreneurial capability score as measured by the new construct? Can the board team human capital substitute for potentially cumbersome formal systems and structures during the early board development stage? The hypothesis is intended to determine whether a process link between early board team human capital resource inputs and innovation outcomes can be established.

As before, the direction of the relationships and potential collinarity was first examined using a Pearson Product Moment Correlation Coefficients matrix before running the regressions with board team human capital attributes as independent variables and the board team entrepreneurial capability score as the dependent variable to determine the degree of explanation. Two potential moderators, firm size, and total number of board directors are included in the correlation coefficient matrix shown below and used in the preliminary regressions.

***Hypothesis 2:*** *Board teams with lower aggregate age but higher education levels will produce higher entrepreneurial capability scores*

The hypothesis is partially supported as education is seen to be associated with the board team management practices as measured, albeit at a low level as for hypothesis 1 but similar relationship do not carry through for hypothesis 2. Firm service length does not contribute to the explanation of board team management practices as measured by the construct as it does for incremental innovation in hypothesis 1. Increased firm service, knowledge, and experience, within the firm do not have an impact on the management practice orientation of the board represented by the construct as hypothesised. With the benefit of hindsight, board team tenure, as opposed to firm service length, may have been a more appropriate measure to understand the early board formation process for the firm type, where separation of ownership and control can be problematical.

### 9.2.1 Correlation Coefficient Matrix – Hypothesis 2

Examination of the correlation coefficient matrix below highlights certain data features as follows:-

- Entrepreneurial capability score is associated with board team education at the 1% significance level at .228
- Mean Education score is negatively correlated with board team service length at below a 1% significance level at -.404, a not unanticipated finding, reflecting the lower educational achievements of previous .generations compared to later ones.
- Mean Service length is positively correlated to board team age at below a 1% significance level at .446 , not surprisingly and indicating the presence of a significant number of long serving directors and a potential collinarity issue.
- Mean Director Age is negatively associated with Board Team size at below the 1% significance level at -.324 suggesting that the larger the board size the lower the average age of directors, which is interesting.
- Entrepreneurial capability score is negatively associated with service length at just above 1% significance level at -.289 suggesting longer serving boards fails to maintain entrepreneurial capability levels contrary to hypothesis 1 implications and association of incremental innovation with service length. Inability to maintain entrepreneurial capability and adapt management behaviour patterns may, however, be a result of low education levels in the sample generally.

- Board team entrepreneurial capability score is strongly associated with board team size at below the 1 % significance level at .575 with the implication board size influences capability development.
- Firm Size and board team numbers are highly and significantly correlated at .606 as expected but firm size with entrepreneurial capability score is not, indicating additional explanatory power to board team size as both an independent and moderating variable for the analysis. The presence of board team entrepreneurial capability as anticipated is not directly related to numbers of firm employees.
- Board team size, was therefore used in the regression model for hypothesis 2 in preference to firm size as a moderator. The model was repeated with board size squared to check for a quadratic, U shaped, relationship, rather than a linear relationship with the entrepreneurial capability score. Increasing board size infinitely may lead to increasing coordination complexity and decreasing managerial effectiveness. An optimum board team size may exist for EISMEs, when combined with the board team human capital resources of education and firm tenure but which is smaller on average than from larger companies.

An initial regression model run with board team entrepreneurial capability score as the dependent variable and mean age, firm service and education as independent variables shows multicollinearity. Using VIF and tolerance measures, mean age, and firm service are shown to be collinear and affect the stability of the model applied to the sample. Details are shown in Appendix (14) Removal of either the mean board team service length or mean board team age from the model reduces the multicollinearity, improves the significance of the remaining independent variables and the fit of the linear regression model. The VIF and tolerance measures of multicollinearity then both closely approach a highly acceptable value of one. For full details, please see Appendix 14.

Interpretation and evaluation of the regression variate and the degree to which the independent variables of education, age, and service length predict the dependent variable in the presence of the moderating variables of firm and board size, now occurs. Education and board size contribute most to the explanation of board team entrepreneurial capability score with an adjusted R squared of .34899 for the sample, still at a low overall level. If lower director age were to contribute to the entrepreneurial capability score, the mean age coefficient value would be negative. When mean service length is substituted for mean age in the regression model, the regression coefficient for service length is negative but not significant. The initial Pearson Coefficients do not fully follow through in the linear regression model estimation.

**Table 20: Pearson Product Moment Correlation Coefficient Matrix: Hypothesis 2 Variables**

**Pearson Product Moment Correlation Coefficient**

| | | Mean of all Director cAges | Mean Director cTime in post | Mean Education Score for all directors | Entrepreneurial Capability Score | Total Number of Directors | Total employment F/T + P/T for 1999 |
|---|---|---|---|---|---|---|---|
| Mean of all Director cAges | Pearson Correlation | 1 | .446** | -.072 | -.113 | -.324** | -.275* |
| | Sig. (2-tailed) | . | .000 | .498 | .326 | .002 | .012 |
| | N | 91 | 91 | 91 | 77 | 91 | 83 |
| Mean Director cTime in post | Pearson Correlation | .446** | 1 | -.404** | -.289* | -.293** | -.199 |
| | Sig. (2-tailed) | .000 | . | .000 | .011 | .005 | .071 |
| | N | 91 | 91 | 91 | 77 | 91 | 83 |
| Mean Education Score for all directors | Pearson Correlation | -.072 | -.404** | 1 | .228* | .187 | .151 |
| | Sig. (2-tailed) | .498 | .000 | . | .045 | .074 | .169 |
| | N | 91 | 91 | 92 | 78 | 92 | 84 |
| Entrepreneurial Capability Score | Pearson Correlation | -.113 | -.289* | .228* | 1 | .575** | .297** |
| | Sig. (2-tailed) | .326 | .011 | .045 | . | .000 | .008 |
| | N | 77 | 77 | 78 | 78 | 78 | 78 |
| Total Number of Directors | Pearson Correlation | -.324** | -.293** | .187 | .575** | 1 | .606** |
| | Sig. (2-tailed) | .002 | .005 | .074 | .000 | . | .000 |
| | N | 91 | 91 | 92 | 78 | 92 | 84 |
| Total employment F/T + P/T for 1999 | Pearson Correlation | -.275* | -.199 | .151 | .297** | .606** | 1 |
| | Sig. (2-tailed) | .012 | .071 | .169 | .008 | .000 | . |
| | N | 83 | 83 | 84 | 78 | 84 | 84 |

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Results of the final regression model using mean board team age and education level with board size for hypothesis 2 are summarised below:-

**Table 21: Hypothesis 2 Summary Results OLS Regression Model Entrepreneurial capability score as dependent variable,** mean director age and education level independent variables, board size as moderator.

| | Coeff. | Std.Err. | t-ratio | P-value |
|---|---|---|---|---|
| **Constant** | 125.836 | 40.3574 | 3.11803 | 0.00259 |
| **Mean Age** | 0.71868 | 0.672501 | 1.06867 | 0.28869 |
| **Mean Education Level** | 2.71412 | 1.39363 | 1.94752 | 0.05527 |
| **Board Size** | 22.0864 | 3.89167 | 5.67531 | 0.00000 |
| | | | | |
| **R Squared** | .374354 | **Adjusted R Squared** | | .34899 |
| | | | | |
| **F Ratio** | 14.76 | **Probability** | | .000000 |
| | | | | |
| **Model size:** | Observations = 78 | | | |

### 9.2.2 Education

Better-educated directors do contribute to an explanation of higher scores of entrepreneurially oriented management practice within the board team as measured by the scale when combined with board team size. Hypothesized underpinning of the board team entrepreneurial management capability by both longer firm service length and education in line with hypothesis 1 is not supported, questioning the value of the construct as an intended process link with board team human capital and innovation outcomes. The most common executive director board size of 2/3 people, may be contributory factor to the finding since concerted board team group activity and creation of a group dynamic could be argued to be require more than 2 people.

The sample population represented 354 directors - 271 (77%) are executive directors and 83 (23%) non executive directors. The most frequently encountered total board size is three and four directors respectively at 26.9% and 24.7% of the total respectively. 18% of firms only possessed two directors. 49.5% of Boards in the sample had no non executive board members. Of the balance 26.9% had only one non executive director 15.1% 2 non executive directors. There were 83 non executive directors in 47 firms in the sample.

A number of responses by sole traders, eliminated from the sample, responded as if they represented board teams, completing items on board activity according to what must have been a 'wishful ' management orientation based on what they thought the answers should be rather than reality. A future research question is posed as to whether there is a critical mass to early board team formation and effective management capabilities and competencies identifiable by industry sector?

However, as for hypothesis 1, if the UK educational system is considered alongside these results then the explanation relevance of education to the orientation of early board team management practice increases. Board team size, squared, run as an independent variable within a regression to determine whether a positive quadratic relationship with entrepreneurial capability score existed, produced no significant results. The firm size moderator, commonly used in innovation studies, as expected, had no impact. It may merely represent a greater ability to bear additional board member costs due to increased firm turnover. No guarantee of greater managerial or entrepreneurial effectiveness can be attributed to larger board size on its own.

Diversity of background education and experience potentially increases with greater board size but board effectiveness will depend on the internal board team dynamic generated through the practice of specific management capabilities; decision making skills, the propensities to seek and share information and access external resources combined with alignment of board member risk and reward profile. Again a process link between the board team human capital and innovation outcomes needs to be demonstrated, achieved through the measurement scale. Higher board team entrepreneurial capability scores predicted by higher education levels and firm service in the absence of innovation, might indicate an adaptive as opposed to a generative management capability. Hypothesis 3 attempts to address the possibility.

Given the predominance of very small board average sizes present within the sample, early board team resource levels, its diversity, quality and quantity is restricted. Diversity of industry experience, given the reluctance of EISME owner directors to complete the questions on their careers and backgrounds meant no adequate data existed. An assumption might be made the reluctance stemmed from the absence of management careers outside the firm or within any other industry. Lack of outside influence on early board team management might prove significant, casting the developing board team onto their own limited resources, creating a vicious circle, justifying fresh injections of suitably endowed human capital resource to productively disturb the mix.

Smaller board sizes of three to four members, including executive and non-executive board members, (as opposed to the six identified as the optimum number for larger firms (Finkelstein and D'Aveni, 1994)), intuitively is a better bet if an effective board team dynamic is to develop, facilitating group communication and learning, simplifying information exchange and coordination for knowledge.

### *9.3 Hypothesis 3:*

*Board teams with higher entrepreneurial capability scores will engage in higher rates of incremental product and process innovation*

### 9.3.1 Entrepreneurial Capability

If the measurement scale does indeed capture an entrepreneurial orientation to early board team management capability, a useful tool for gauging the state of early board team progress towards emergence as a capable team, able to maintain "entrepreneurial services". Since the scale is not constructed in a way to operate at the extreme margins but to capture a more rounded profile of management practices involved in innovation, the administrative, more routine elements are largely assumed. The hypothesis effectively tests whether early board teams with a greater entrepreneurial orientation, as measured by the scale, are associated with higher levels of incremental innovation. Should firm performance be associated with higher entrepreneurial capability scores, in the absence of higher innovation levels, and incremental or radical, an adaptive rather than generative capability is demonstrated. Hypothesis aims to determine whether the scale measures generative or adaptive capability.

### 9.3.2 Correlation Coefficient Matrix

A preliminary examination of the Pearson Product moment Correlation Coefficient Matrix in Table 22 below with all the relevant variables used in the regression models reveals the following relationships:-

- Incremental innovation is significantly correlated to entrepreneurial capability score at .292 at 1% significance level
- However, radical innovation is not associated with entrepreneurial capability score, board, or firm size.
- Firm size as a potential moderator is correlated at the 1% significance level at .297 with the firm entrepreneurial capability scores.
- Board size is highly correlated with larger firm size. Larger firms have more directors.
- However, board size has a higher correlation than firm size with entrepreneurial capability score at .575 at 1% significance. Board size is therefore explaining some additional element rather than the availability of greater financial resources due to size.
- Total innovation does not score produce any meaningful correlation due to the divergent relationships of incremental innovation and radical innovation with entrepreneurial capability

**Table 22: Pearson Product Moment Correlation Coefficient Matrix: Entrepreneurial capability score,** total innovation, incremental innovation, radical

**Correlations**

| | | Entrepreneurial Capability Score | Total Number of Incremental Innovations | Total Number of Radical Innovations | Total Number of Product and Process Innovations | Total Number of Directors | Total employment F/T + P/T for 1999 |
|---|---|---|---|---|---|---|---|
| Entrepreneunal Capability Score | Pearson Correlation | 1 | .292** | .009 | .154 | .575** | .297** |
| | Sig. (2-tailed) | . | .009 | .936 | .179 | .000 | .008 |
| | N | 78 | 78 | 78 | 78 | 78 | 78 |
| Total Number of Incremental Innovations | Pearson Correlation | .292** | 1 | .227* | .661** | .201 | .244* |
| | Sig. (2-tailed) | .009 | . | .030 | .000 | .054 | .025 |
| | N | 78 | 92 | 92 | 92 | 92 | 84 |
| Total Number of Radical Innovations | Pearson Correlation | .009 | .227* | 1 | .881** | .075 | -.075 |
| | Sig. (2-tailed) | .936 | .030 | . | .000 | .475 | .497 |
| | N | 78 | 92 | 92 | 92 | 92 | 84 |
| Total Number of Product and Process Innovations | Pearson Correlation | .154 | .661** | .881** | 1 | .156 | .065 |
| | Sig. (2-tailed) | .179 | .000 | .000 | . | .137 | .557 |
| | N | 78 | 92 | 92 | 92 | 92 | 84 |
| Total Number of Directors | Pearson Correlation | .575** | .201 | .075 | .156 | 1 | .606** |
| | Sig. (2-tailed) | .000 | .054 | .475 | .137 | . | .000 |
| | N | 78 | 92 | 92 | 92 | 92 | 84 |
| Total employment F/T + P/T for 1999 | Pearson Correlation | .297** | .244* | -.075 | .065 | .606** | 1 |
| | Sig. (2-tailed) | .008 | .025 | .497 | .557 | .000 | . |
| | N | 78 | 84 | 84 | 84 | 84 | 84 |

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

The results for the analysis are briefly summarised, then considered in more detail, accompanied by the negative binomial regression results shown in Tables 23 to 28.. Results demonstrate the entrepreneurial capability construct contributes to the incremental innovation explanation but not radical innovation as hypothesised. Firm and board size do not contribute to the innovation explanation despite positive Pearson

Product Moment Correlation Coefficients. The entrepreneurial capability score captures a capability on the part of the board to incrementally innovate but does not explain radical innovation. The hypothesis is therefore supported in the regression model. Levels of explanation by the regression variate are disappointingly low however, and open to alternative interpretations.

The incremental innovation results are presented first, followed by the results for radical then total innovation.

### 9.3.3 Innovation per Employee

Innovation per employee is a frequently used measure in innovation studies (Acs and Audretsch, 1990) and was therefore used as a dependent variable to enable comparisons to be made. Examination of firm innovation per employee using Tobit analysis is shown in Table 24 to 25. Tobit is a form of censored regression useful in cases where the dependent variable is continuous but where there are observations censored at zero. Under these circumstances, OLS regression may provide inconsistent estimates, and so Tobit is appropriate. Such a situation arose for the analysis using innovation per employee data included a great many zero innovation counts for the dependent variable. Firm size is used as a moderator in the model.

**Table 23: Incremental Innovation, without constant,** as dependent variable with entrepreneurial capability score and firm size as independent variables. Negative Binomial Regression Maximum Likelihood Estimates

| **Dependent variable** | **Incremental Innovation** | | | |
|---|---|---|---|---|
| Number of observations | 79 | | | |
| Log likelihood function | -200.7325 | | | |
| Restricted log likelihood | -306.2032 | | | |
| Chi-squared | 210.9415 | | | |
| Degrees of freedom | 1 | | | |
| Significance level | .0000000 | | | |
| | **Coeff.** | **Std.Err.** | **t-ratio** | **P-value** |
| **ECS** | 0.00515 | 0.00075 | 6.85348 | 0.00000 |
| **Firm Size** | 0.00114 | 0.00199 | 0.57635 | 0.56438 |
| **Alpha** | 1.25474 | 0.301215 4.16558 | | 0.00000 |

Results show incremental innovation as significantly and positively associated with the entrepreneurial capability score, when treated as the dependent variable. A significant but negative association with firm size was also present, confirming the findings of previous studies, finding falling innovations per employee as firm size increases. Highly significant values for sigma indicate the Tobit regression was a correct estimation technique. To use. Both models exclude the constant as found not be significant.

**Table 24: Tobit Analysis Incremental Innovation** as dependent variable, no constant, entrepreneurial capability score, and firm size: Limited Dependent Variable Model – Censored Maximum Likelihood Estimates

| | | | | |
|---|---|---|---|---|
| **Dependent variable** | **Incremental innovation per employee** | | | |
| Number of observations | 79 | | | |
| Log likelihood function | -13.55495 | | | |
| Threshold values for the model: | Lower = .0000 | Upper =+infinity | | |
| | **Coeff.** | **Std.Err.** | **t-ratio** | **P-value** |
| **ECS** | 0.000442 | 0.000135 | 3.27131 | 0.001071 |
| **Firm Size** | -0.000594 | 0.000313 | -1.89582 | 0.057984 |
| Sigma | 0.232185 | 0.022012 | 10.5482 | 0.000000 |

**Table 25: Tobit analysis Radical Innovation** as dependent variable without constant, entrepreneurial capability score and firm size. Limited Dependent Variable Model – Censored Maximum Likelihood Estimates

| | | | | |
|---|---|---|---|---|
| **Dependent variable** | **Radical Innovation per employee** | | | |
| Number of observations | 79 | | | |
| Log likelihood function | -66.56742 | | | |
| Threshold values for the model: | Lower= .0000 | Upper=+infinity | | |
| | **Coeff.** | **Std.Err.** | **t-ratio** | **P-value** |
| **ECS** | 0.000499 | 0.000346 | 1.44211 | 0.14927 |
| **Firm Size** | -0.00093 | 0.000782 | -1.19394 | 0.23250 |
| Sigma | 0.583429 | 0.055471 | 10.5178 | 0.00000 |

Tables 26 to 28 show the best Negative Binomial results achieved for radical and total innovation from models with and without the constant with firm size as moderator. Table 26 shows radical innovation as the dependent variable with a significant constant but here entrepreneurial capability score contributes no explanation to radical innovation, which is as hypothesized.

**Table 26 Radical Innovation with constant,** entrepreneurial capability score and board size as independent variables. Negative Binomial Regression Maximum Likelihood Estimates

| | | | | |
|---|---|---|---|---|
| **Dependent variable** | **Radical Innovation** | | | |
| Number of observations | 79 | | | |
| Log likelihood function | -216.3962 | | | |
| Restricted log likelihood | -462.1300 | | | |
| Chi-squared | 491.4678 | | | |
| Degrees of freedom | 1 | | | |
| Significance level | .0000000 | | | |
| | **Coeff.** | **Std.Err.** | **t-ratio** | **P-value** |
| **Constant** | 1.62696 | 0.55468 | 2.93315 | 0.003355 |
| **ECS** | 0.00108649 | 0.00280661 | 0.387118 | 0.698669 |
| **Board Size** | -0.0463527 | 0.118754 | -0.390326 | 0.696295 |
| **Alpha** | 1.90632 | 0.382024 | 4.99006 | 0.0000 |

The best regression results were achieved with two models, with results approaching acceptability by using both innovation as the dependent variable, with and without constant, and the board and firm size moderating variables. Firstly, results verging on acceptability are achieved for the model with the constant and no moderators, for the entrepreneurial capability score, with a t ratio of 1.6773 at .09348 significance (table 27.). The succeeding table 28, with the constant and including firm size as moderator, shows entrepreneurial capability score again verging on acceptability with a t ratio of 1.55469, significance level of .120019. Firm size contributes nothing to the explanation of entrepreneurial capability score as previously anticipated. These results, as anticipated, show the aggregate of incremental innovation and radical innovation, total innovation produce blurred results with any clear effect

Summarizing the results for hypothesis 3, board team entrepreneurial capability score helps explain incremental but not radical innovation within the firm. The aggregate total innovation results verge on acceptability. The hypothesis is supported to the extent that incremental innovation is explained by the entrepreneurial capability school but not, as hypothesized radical innovation. So far the measure created seems to reflect entrepreneurial orientated management practices associated with incremental innovation. The entrepreneurial capability score was constructed in such a manner to take into account both incremental and radical innovation. In particular the operationalisation of new products to new markets as radical may mean that the effect is understated in the context of the plastics processing industry, a factor discussed further in the next chapter.

**Table 27: Total Innovation** as dependent variable, with constant, entrepreneurial capability score as independent Negative Binomial Regression Maximum Likelihood Estimates.

| | | | | |
|---|---|---|---|---|
| **Dependent variable** | **Total Innovation** | | | |
| Number of observations | 79 | | | |
| Log likelihood function | -265.1364 | | | |
| Restricted log likelihood | -534.4379 | | | |
| Chi-squared | 538.6029 | | | |
| Degrees of freedom | 1 | | | |
| Significance level | .0000000 | | | |
| | **Coeff.** | **Std.Err.** | **t-ratio** | **P-value** |
| **Constant** | 1.60361 | 0.418687 | 3.8301 | 0.00013 |
| **ECS** | 0.00268 | 0.001598 | 1.6773 | 0.09348 |
| **Alpha** | 1.1047 | 0.207025 | 5.3361 | 0.00000 |

**Table 28: Model Results Total Innovation** with constant as dependent variables with entrepreneurial capability score and firm size as independent variables. Negative Binomial Regression Maximum Likelihood Estimates.

| | | | | |
|---|---|---|---|---|
| **Dependent variable** | **Total Innovation** | | | |
| Number of observations | 79 | | | |
| Log likelihood function | -265.1350 | | | |
| Restricted log likelihood | -534.4074 | | | |
| Chi-squared | 538.5448 | | | |
| Degrees of freedom | 1 | | | |
| Significance level | .0000000 | | | |
| | **Coeff.** | **Std.Err.** | **t-ratio** | **P-value** |
| **Constant** | 1.5979 | 0.425076 | 3.75909 | 0.000171 |
| **ECS** | 0.00272267 | 0.00175126 | 1.55469 | 0.120019 |
| **Firm Size** | -7.51437e-005 | 0.00164535 | -0.0456703 | 0.963573 |
| **Alpha** | 1.10468 | 0.207854 | 5.3147 | 0.0000 |

### 9.4 Hypothesis 4:

*Board teams with higher entrepreneurial capability scores and innovation levels are not associated with higher firm performance levels as measured by average three year sales and employment growth.*

### 9.4.1 Correlation Coefficient Matrix

Innovation is commonly assumed to produce higher levels of firm performance, although not comprehensively supported in the literature. For the EISME firm size sector, as hypothesised no relationship was found between higher levels of entrepreneurial capability score for the board team and innovation with a firm performance measure of sales and employment growth. No link existed with the second output measure as shown in the research model. Innovation effort within the firm size sector may well detract from growth in sales and employment for a number of reasons. When average sales per employee for the period is used as an alternative dependent variable, the OLS regression models produce results confirming the lack of association shown in the Pearson Product Moment Correlation Coefficient matrix below, Table 29.

Average Sales per employee produces the most interesting result from these regression models in Tables 30 & 31 shown below. Incremental innovation does not appear to have a negative impact on sales per employee. Radical Innovation does, however, have a clear negative and significant impact on average sales per employee when combined with the firm entrepreneurial capability score, which has a highly significant positive value.

That radical innovation has a negative impact on sales for the EISME firms in the plastics processing industry is perhaps not surprising. Cost of funding radical innovation, high investment and working capital costs have to be internally funded from profit generated. Financial cross subsidisation from a parent company or is not an option as it might be for subsidiary firms. The detrimental effects a significant capital investment cannot be offset by using internal company resources from elsewhere.

External funding of large amounts of capital investment are acknowledged as difficult to obtain for manufacturing SME's in the UK in recognised finance an equity gaps (Jarvis 2001). EISME owner directors are notoriously reluctant to seek external finance, particularly if loss of control is perceived through parting with equity. Control issues and financial resource constraints tend to restrict firm growth and sales for the firm size sector not seen in larger firms. Although innovation activity may be suffocated by capital shortage, a more fundamental issue possibly lies in the management competence, of lack of, within the early board team – and management competence rather than financial capital gap. A view increasingly adopted by the Bank of England in reviewing small firm finance. Early board teams with limited experience and education may fail to perceive the value of resource investment in innovation for long term firm survival and economic renewal. A point of concern in interpreting these results is the low number of observations.

**Table 29:** Hypothesis 4 Pearson Product Moment Correlation Coefficient Matrix: all variables

| | | Entrepreneurial Capability Score | Total Number of Incremental Innovations | Total Number of Radical Innovations | Total Number of Product and Process Innovations | Average Sales Growth expressed as percentage of 1999 Sales | Average Growth in employment expressed as a percentage of 1999 Sales | Average Sales Growth per employee for period | Firm Size | Board Size |
|---|---|---|---|---|---|---|---|---|---|---|
| Entrepreneurial Capability Score | Pearson Correlation | 1 | .292** | .009 | .154 | .057 | -.145 | .240 | .297** | .575** |
| | Sig. (2-tailed) | . | .009 | .936 | .179 | .631 | .212 | .050 | .008 | .000 |
| | N | 78 | 78 | 78 | 78 | 72 | 78 | 67 | 78 | 78 |
| Total Number of Incremental Innovations | Pearson Correlation | .292** | 1 | .227* | .661** | .069 | .020 | -.040 | .244* | .201 |
| | Sig. (2-tailed) | .009 | . | .030 | .000 | .534 | .857 | .737 | .025 | .054 |
| | N | 78 | 92 | 92 | 92 | 83 | 81 | 72 | 84 | 92 |
| Total Number of Radical Innovations | Pearson Correlation | .009 | .227* | 1 | .881** | .112 | -.007 | -.335** | -.075 | .075 |
| | Sig. (2-tailed) | .936 | .030 | . | .000 | .314 | 949 | .004 | .497 | .475 |
| | N | 78 | 92 | 92 | 92 | 83 | 81 | 72 | 84 | 92 |
| Total Number of Product and Process Innovations | Pearson Correlation | .154 | .661** | .881** | 1 | .120 | .005 | -.275* | .065 | .156 |
| | Sig. (2-tailed) | .179 | .000 | .000 | . | .281 | .967 | .019 | .557 | .137 |
| | N | 78 | 92 | 92 | 92 | 83 | 81 | 72 | 84 | 92 |
| Average Sales Growth expressed as percentage of 1999 Sales | Pearson Correlation | .057 | .069 | .112 | .120 | 1 | .060 | -.106 | .105 | .049 |
| | Sig. (2-tailed) | .631 | .534 | .314 | .281 | . | 608 | .366 | .360 | 659 |
| | N | 72 | 83 | 83 | 83 | 83 | 78 | 72 | 78 | 83 |
| Average Growth in employment expressed as a percentage 96/99 | Pearson Correlation | -.145 | .020 | -.007 | .005 | .060 | 1 | .099 | -.009 | -.027 |
| | Sig. (2-tailed) | .212 | .857 | .949 | .967 | .608 | . | .409 | .940 | .812 |
| | N | 78 | 81 | 81 | 81 | 78 | 81 | 72 | 81 | 81 |
| Average Sales Growth per employee for period (salempto/totgrw) | Pearson Correlation | .240 | -.040 | -.335** | -.275* | -.106 | .099 | 1 | .086 | .142 |
| | Sig (2-tailed) | .050 | .737 | .004 | .019 | .366 | .409 | . | .474 | .236 |
| | N | 67 | 72 | 72 | 72 | 72 | 72 | 72 | 72 | 72 |
| Firm Size | Pearson Correlation | .297** | .244* | -.075 | .065 | .105 | -.009 | .086 | 1 | .606** |
| | Sig. (2-tailed) | .008 | .025 | .497 | .557 | .360 | 940 | .474 | . | .000 |
| | N | 78 | 84 | 84 | 84 | 78 | 81 | 72 | 84 | 84 |
| Board Size | Pearson Correlation | .575** | .201 | .075 | .156 | .049 | -.027 | .142 | .606** | 1 |
| | Sig. (2-tailed) | .000 | .054 | .475 | .137 | .659 | .812 | .236 | .000 | . |
| | N | 78 | 92 | 92 | 92 | 83 | 81 | 72 | 84 | 92 |

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

**Table 30: OLS Regression model: Average Sales per Employee dependent variable,** no constant, entrepreneurial capability score and radical innovation as independent variables

| | Coeff. | Std.Err. | t-ratio | P-value |
|---|---|---|---|---|
| **ECS** | 355.047 | 91.265 | 3.89029 | 0.00024 |
| **Radical Innovation** | -7491.06 | 2378.9 | -3.14896 0 | .00248 |
| **R-squared=** | .155554, | **Adjusted R-squared =** | | .14256 |
| **F Test=** 11.97, | | **Probability value =** | | .00096 |

Model size: Observations = 67

**Table 31: OLS Regression model: Average Sales per Employee dependent variable,** no constant, entrepreneurial capability score, and incremental innovation as independent variables

| | Coeff. | Std.Err. | t-ratio | P-value |
|---|---|---|---|---|
| **ECS** | 246.515 | 108.449 | 2.27311 | 0.02633 |
| **Incremental Innovation** | -3022.49 | 4020.37 | -0.751795 | 0.45489 |

**Fit:** **R-squared=**. 035121 **Adjusted R-squared =** .02028

**Model test:** **F =** 2.37 **Probability value =** .12886

**Model size:** **Observations =** **67**

### 9.4.2 Further points

Although total employment increased substantially across sample firms during the data period, 1996 -99 another data feature emerges on closer examination. Declining employment levels occurred for a substantial number of sample firms, illustrated in the histogram shown in Appendix but was counterbalanced by high growth in others. Employment decline could be explained by declining sales alternatively by increased productivity, following new process innovation. and scatter plot showing total employment growth against total sales for the period is shown in Appendix 9. Overall employment growth is positively associated with sales growth but with a marked clustering around the zero employment growth point, the slope undoubtedly influenced by the presence of outliers. A static or declining sales firm profile is accompanied by employment decline in many firms demonstrating the neediness of the industry and firm size sector.

Further discussion of the data analysts results and its implications or to be found in Chapter 10.

# CHAPTER 10

# FURTHER DISCUSSION, RESEARCH IMPLICATIONS, CAVEATS, AND CONCLUSIONS

The chapter has three principal aims. Firstly,: to further discuss and summarise the research findings on the attempt to link early board team human capital resource inputs, with innovation output via a newly created process measure of entrepreneurial capability. The implications for economic development of the EISME firm size sector studied from within the adopted resource based theory perspective, necessary for continued development are covered with tentative recommendations ways to encourage early board team development for continued modest prosperity of firms in the middle are made. Secondly, the research process undertaken is evaluated, with the expression of certain caveats. Finally, a conclusion addresses whether the research objectives were met and lists key points.

## 10.1 Further Discussion and Implications of Research

The hypotheses put forward are largely supported by previous data analysis, albeit at a relatively low significance level in places. Interesting points arise on the nature of human capital resource inputs, process links, and innovation outcomes in early board teams for EISME in the plastics processing industry. Particularly interesting firm size sector findings are related firstly, to education levels and their association with incremental innovation; the influence of board size; share ownership patterns and finally, the apparent link of early board team human capital resources via a new process measure gauging entrepreneurial orientation to innovation outputs has any merit. Tentative suggestions on the future directions and initiatives for encouraging organizational growth capability through early board team development are also made.

### 10.1.1 Education

Education association with incremental innovation is probably the most significant and interesting finding, considering past UK education deficiencies. Sample board teams, with an average age of 51, limited board size demonstrated poor average education scores of less than seven across the whole board, with the implication that added education will improve incremental innovation. Incremental innovation was not associated with younger board age - a disappointing result in one sense, as evidence of education filtering through from the widened access to higher education – business management education in particular, would have justified past and current education policy. Larger boards with younger average ages may indicate movement in the right direction, although direction of causality is not clear.

Modest growth is just as a desirable as fast growth for the firm size sector, especially given education resource deficiencies identified. Widening higher education access and, in particular providing direct routes into organisation management, appears to have had little impact so far, which begs the question of why? Time may improve matters but there maybe other underlying problems to the recruitment of educated employees, either as general staff all as directors. Traditional management education is dominated by techniques and tools created for well resourced and large organisations. Resource constrained smaller organisations neither have the time nor the inclination to sort the mismatch out on their own.

Scope, therefore, exists for improving early board team access to education resources to develop the size and resource constrained prime coordinating and directing unit of the early board team, neglected for too long. If the government wish to support, as stated, organizational growth capability development objectives for smaller firms, the issue of how early board team enlargement for continued modest growth, productivity, value added and innovation can be achieved must be addressed. Teaching company schemes are one such mechanism which may assist demonstrate the benefits of an undergraduate education to the smaller firms but may not be a sufficiently targeted approach. A clearer focus on the whole early board team, its resources, and function, as a critical primary resource may be beneficial. Sensitive and difficult issues of share ownership and management control in the firm size sector exist. Intervening to widen director share ownership could be considered a substantial attack on liberty of the individual. Difficulty is likely to be increased by board team education and management experience, creating a vicious circle.

Viewed within the resource based perspective, the early board team holds a central role in determining the future firm direction through creation of a resource path dependence on which capabilities are built. Failure to influence these early board team resources may result in continuing poor performance with respect to productivity, value-added, modest growth, and innovation for economic renewal. Board team development can be addressed in various ways. Sponsoring of early board team development programmes might be one alternative. Fiscal inducements, such as tax relief, for directors joining existing EISMEs, encouraging equity investment after a suitable probationary period, might also communicate an important message to existing board teams. Corporate tax relief might also be considered as an inducement to the existing board team directors to add to their board team resources, bridging the gap between increase sales and profit.

Education level is not the whole story however. Education association at the 5% level conceals some potential underlying problems related to the industry and sector board team age levels. Previous management experience outside the firm, either inside or outside the industry or similar management experience of firm size are not present. Given the findings in relation to large companies, there is every reason to believe greater future diversity of management experience of industry and firm size sector may produce significant effects on various indicators of firm performance, most critically innovation. Means of encouraging greater diversity of industry, management, and firm size experience in early board teams must be found.

Existing directors have started and remained with their businesses in the sample studied. At an average age of 51, they are going nowhere else, and represent a potential 'plug' to further development, if no means are found to intervene.

### 10.1.2 Incremental Innovation

As hypothesised, incremental innovation appears to be the favoured innovation output. Value creation through incremental innovation is confirmed as a better objective for limited size board teams, poorly endowed with education. Innovation output may have been hindered by the lack of education resource. The human capability resource platform will only stretch just so far without overstretch which might interrupt the development path. It was therefore a surprise to find older board team age and tenure, associated with radical innovation. Age and service length seems to have substituted for education for the industry sample, whether successfully or not could not be ascertained.

Older boards attempting to jump along a resource development path by engaging in radical innovation may cause an abrupt discontinuity within the evolving an emerging firm, stretching the firm beyond the boundaries of its core competencies (Hoskinsson et al., 1991). Organisational capability is built gradually and sequentially overtime in a path dependent process (Mosakowski, 1998). The same must be true of the early board team resources and capabilities. Interruptions to (Podsakoff and Organ, 1986) the capability development process by 'resource departures' - director resignations, are likely to cause resource and capability discontinuities and a failure to thrive on the part of the firm. A requirement to facilitate recruitment and retention of new board members suitably endowed with appropriate human capital resource to supplement existing board teams is further highlighted.

### 10.1.3 Board Size and Tenure

For the sample firms, board size appears to be associated with increased innovation and entrepreneurial management orientation. Greater board size constitutes significant resource increase with which the early board team may work to build effective function, both administratively and entrepreneurially. When board size is combined with longer board team tenure findings and education, a picture of an evolving resource emerges, distinct to the firm size sector. Evidence for an optimal board size was not confirmed in such a small sample but is still likely. Large board size would simply serve to increase communication and coordination difficulties as the organisation increasing complexity, slowing board team development. Effective board size is likely to be much smaller for the firm size sector, compared to the optimum six members found to be appropriate for larger established board teams for this reason.

Arrested firm evolution may be attributable to a "plug" of older less educated directors within a board team, not possessing the necessary educational or experience resources to facilitate capability development within the board team dynamics or encourage innovation. Longer board team tenure findings seem to confirm the need for early board teams to spend greater time together to produce incremental innovations. Intuitively the finding makes sense; effective groups are not formed overnight. As Penrose indicates, absorbing new team members takes time, interrupting growth. Early board teams, with non-aligned risk and reward profiles toward similar objectives can result in a different management orientation either towards routine administrative or entrepreneurial management. Maintaining the two simultaneously is a challenging task and must be based on united board team personal and business objectives. For the firm size, the human capital of the early board team replaces formal routines, systems, and structures as the firm evolves and emerges.

Contrary to findings in larger firm literature, where directors moved frequently to advance their careers, longer service length were associated with incremental innovation and incremental innovation, indicating greater periods of working together of team working produced results for early board teams. Alternatively, it could be construed as an effect of restricted resources within the early board team. Either way, early board teams of limited size and educational endowment face substantial difficulties in developing the human capital resource base for capability development.

### 10.1.4 Process Links

Education, board size link with incremental innovation findings are particularly relevant when considering the likely necessary nature of EISME board team capability development. An early board team forms the prime coordinating unit, controlling the future direction of the firm in its advance along a development path, creating path dependence. Increasing board size and getting the human capital resource inputs "right most of the time" is likely to produce a more effective board team, capable of understanding the requirements fro continued entrepreneurial orientation in the management practices and the organisational processes daily establish. Entrepreneurial orientation, captured by the management construct, of the management practices is seen to be associated with incremental innovation, indicating

Penrose's argument for retention of both entrepreneurial and administrative services for firm growth and evolution.

Understanding the way in which management processes evolve and change during firm emergence, for those firms in the middle, will help show the way to the many smaller firms in respect of their resource path development, from basic board team demography, for modest growth through continued incremental innovation. Existing EISMEs with restricted board teams can be helped to manage their human capital resource inputs to influence prevailing management practice and organisational process. A particular obstacle lies in the ownership patterns of EISMEs, likely to generate fundamentally different management behaviours on the part of their differently rewarded directors, which is not fully addressed in the research.

The measurement constructed aimed at gauging the entrepreneurial orientation of EISME early board teams, is shown to have some validity in linking resource inputs with incremental innovation outcomes, and as such is an interesting development which may have some practical utility in assessing effective early board team function in EISMEs. An entrepreneurial orientation to management practice and organisational process, through use of the construct, can confirm whether the configurations of human capital board team resource are configured in a manner likely to produce desirable incremental innovation. As argued previously, complete transition from entrepreneurial to professional management, is a much mistaken requirement for the firm size sector. It fails to take on board the reality how EISMEs and the early board teams actually operate and evolve.

Maintaining an entrepreneurial orientation, requires early board team management practices to foster appropriate organisational processes rather than formal systems, in a state of continual evolution relying heavily on the quality of the directing human capital resource, in the search for solutions to resource and capability allocation and configuration problems. Board team service continuity greatly assists in the process. Job hopping by salaried directors to advance themselves is likely to badly interrupt the development process and be counterproductive. Unique to the firm, management practices and organisational processes likely to be successful must evolve within the early board team.

Addressing patterns of ownership and encouraging and alignment of risk and reward amongst the early board teams as a way of retaining valuable resources becomes a critical issue. Taking and practical approach, the pattern of ownership and reward packages, the risk and reward profile or board team members, may well influence the management orientation or board members. The risk and reward items were eliminated from the construct item pool so the construct cannot be said to measure a critical aspect for long-term entrepreneurial orientation towards innovation. Findings confirm an additional need to investigate ownership pattern and influence on management orientation, more specifically innovation in emerging firms in the firm size sector for future research.

Construct use is not proven by one application but demonstrates an interesting avenue for further exploration to confirm its generalisability, reliability and validity in other industry contexts. An important assumption made by the construct one which could usefully be taken on board by many management education providers. Tacit, experiential management practices based on human capital resources engender organisational evolution in a continuous process of honing internal process in the search for desired ends by their directors. Entrepreneurial management orientation, entrepreneur or capability, cannot be measured satisfactorily by examining routines dedicated towards maintaining administrative management, represented by stable routines systems and structures. Firms within the firm sample size studied may have developed formal routines, systems, and structures, at the expense of its innovation capabilities, resulting in a state of arrested development. An widespread emphasis on process in enterprise education, as recommended by Alan Gibb (Gibb, 2000), would be well advised if the evolution process of firms in the middle is to be encouraged.

### 10.2 Research Evaluation.

#### 10.2.1 Research Design

Research undertaken is believed to have met all the conditions of good research according to low and Macmillan, as well as addressing acknowledged problems and identifying further gaps in research coverage for a neglected firms sector, within a fast developing theoretical perspective. By linking resource inputs and innovation outcomes through a process link process the sake firm size and management group the research makes a contribution to the increasing volume of RBT. It expands the application of resource base view to understanding entrepreneurial management generally on the part of the neglected group, critical for firm evolution, the early board, shifting a study focus away from the individual in new venture start ups. By attempting to bridge the gap between new, small and large enterprises, it is hoped that some missing pieces of the puzzle of why some small firms grow and others do not are identified and a contribution to knowledge made.

The research task set was undoubtedly complex, spanning several sets of literature, combined under a single to right a framework of resource base theory. Identifying the estimated plastics processing industry population proved difficult and undoubtedly affected the response rates at a time when the industry was over surveyed.

### 10.2.2 Statistical Power – Small Sample Size

The small sample affects the statistical power and the generalisability, reliability and validity of the research. In an area of research, fraught with statistical analysis difficulty in examining non-standard performance for what are effectively data outliers, the basic research techniques used were thought entirely appropriate for the type of firm under study, the EISME, the solid majority, rather than the exceptions despite the association was the term entrepreneurial. Regression analysis carried the implicit assumption that relationships are linear. Firm performance is shown not to be related to innovation, a significant finding of the firm sector in its own right.

The use of factor analysis was made more difficult in particular by the smallness of the dataset, where a failure to link organisational configurations to outcomes is acknowledged as attributable to small sample size (Ferguson and Ketchen Jr, 1999). The initial stages for the creation of the management skills were soundly based and theoretical underpinning from existing research theory and concept and produced unacceptable Cronbach's Alpha score of .70 reliability but further use a factor analysis to achieve data reduction techniques proved not possible due to insufficient number of observations. The summated scales used as an alternative to achieve the entrepreneurial capability score used as a variable in the analysis, made certain assumptions in the relationship of each entrepreneurial capability component to each other, which may undermined its value. Findings for hypothesis 4 with four independent variables meant that the probability of detecting a statistically significant level R2 was a decreasing probability.

### 10.2.3 Variable Issues

Specific issues, relating to the way variables were operationalised and the data collected include single respondent reporting, and potential subjectivity. The innovation count, a subject report from a single director may well have caused the finding for radical innovation associated with older longer serving board teams. Common method variance can occur when data for both independent and dependent variables come from the same respondent using similar methods (Podsakoff and Organ, 1986). The small size scale of the firms under study may have helped mitigate any bias.

The multicollinearity of age and service length, with the benefit of hindsight, was perhaps not surprising although findings in large firms suggested the contrary. Initial warning of the problem presence was apparent very early but was handled by separate regressions.

### 10.2.4 Industry Context

A single industry context was considered appropriate for the nature of the research. The plastics processing industry could be argued not to be a single industry. The difficulty in finding firms may have resulted SIC classification is to the industry which the firm supplied, rather than as a process industry in its own right would tend to point. A major influence on the innovation process was controlled by the presence of common very large-scale suppliers, controlling one end of the innovation process at the macro level. In terms of outputs, the multiplicity of potential applications of the increasingly diverse set of polymers available meant that innovation potential was and is considerable. Market and industry influence was therefore reduced.

### 10.2.5 Generalisability and Validity-Single Industry Study

Findings are specific to the single plastics processing industry. Any generalisability and validity from the research will depend on further applications to other separate industry sectors. It is of course entirely possible within research based theory that the configurations of resources and capabilities are entirely different in different industry contexts. The research approach adopted however is one of interest for exploring different resource and capability configurations for the firm size sector, regardless of industry.

## 10.3 Conclusions

The research broadly achieved its three objectives contributing to academic knowledge by addressing acknowledged research deficiencies and identifying a neglected firm size sector and group level of entrepreneurial management for study within the resource base theory perspective. The small sample size, despite considerable effort, may have jeopardised the empirical validation of the research concepts and hypothesised relationships but the approach and design was considered appropriate.

Treating entrepreneurial management as a distinctive characteristic pattern of management behaviour to pick and deploy resources in the pursuit of innovation, which permits analysis of the links between resource inputs and innovation outputs, is considered a valuable one for studying firm evolution and emergence with a view to furthering their own economic prosperity as well as that of the nation. Use of innovation as an outcome measure for EISMEs was considered a successful alternative to traditional firm performance measures with the added benefit of measuring generative as opposed to adaptive management capability. Application of a similar research approach in different context could prove useful to develop a fuller understanding of resources and capabilities within different environments and different firm sizes.

A contribution to understanding organizational growth capability processes for smaller firms and so furthering government industrial and economic policy is made. Perhaps more significantly, potential advice on the configuration of early board team resource for effective entrepreneurial management orientation can be offered to owner directors. The potential for dedicated early board team development programmes within a business school, specific to a particular firm, specifically addressing some of the issues discussed exists. Tackling the sensitive area of firm ownership patterns can perhaps only be addressed at the macro level, by providing fiscal inducements for expansion of share ownership for newly recruited directors, (after a probationary period). Aligning risk and reward achieve this way may well ensure early board teams act in harmony to achieve their ends. Adjustment to salaried director's responsibilities in law with respect of non - executive owners, as has occurred in Germany, may contribute to creating a level playing field of the development of a critical resource base.

### 10.3.1 Concluding summary points

- Restricted access to higher education during the middle years of the last century has handicapped the development of established independent small and medium sized enterprises in the UK plastics processing industry.
- Development of established independent small and medium sized enterprises within the UK has been neglected, particularly the critical development of early board resources and capabilities for further organizational growth capability.
- Differing personal and business objectives within owner directors firms requires management education to adapt their approach to focus on organisation process for specific tasks, rather than routines systems and structure.
- Human capital resources of the early board team represent a critical resource, influencing the overall the orientation of future management practices.
- Early board team resources and capabilities create early path dependence, will influencing firm long-term prospects.
- Early intervention and support in early board team development through appropriate targeted management education and government fiscal measures may help remedy education deficiencies
- Education, longer periods of service and board size are important factors to be considered for the development of the first primary control and knowledge production unit within an emerging firm.
- Entrepreneurial management is acknowledged to occur at individual, group, and firm level. A curious study gap exists for the group or board level in established independent smaller enterprises.

- Intervention and assistance to smaller emerging firms, in the continued presence of education deficiencies may be the better way of accumulating a pool of resources, and capabilities available to the whole firm size population.
- Smoothing the way for better educated individuals to join EISME board teams may be a necessary short term measure, given the existing low levels of education resource in boards of EISME.
- A group level of analysis for the development of board entrepreneurial capability is a useful contribution to advancing understanding of the evolution of resources and capabilities, bridging the knowledge gap on how firms make the transition from small to large within resource based theory.
- The pattern of equity ownership may be a significant obstacle to developing effective board teams within EISMEs. Alignment of the risk and reward profiles may result may assist in achieving a single management orientation towards mutually shared objectives. .
- Possible introduction of appropriate legislation to provide a fiscal inducement for equity participation for incoming directors after a probationary period, and for existing incumbent equity owning directors to mitigate the risk.
- Clarification of the legal responsibilities between owners and salaried directors of independent enterprises may also help, particularly for family owned businesses.
- Increased recognition of the legitimacy of differing management practice between small and large firms should be encouraged along with its communication to boards of EISMEs. Traditional 'rational' management techniques taught by business schools may actively hinder the development of resources and capabilities in EISMEs, despite increased access to higher education.
- Conscious development of resources and capabilities in EISMEs should be encouraged as key to entrepreneurial management orientation and innovation.
- Whilst innovation activity generally is not shown to produce increased sales and employment growth, there are associations between education, board size, and incremental innovation. The benefits of sustained entrepreneurial capability may result in increased firm longevity and economic renewal but not superior firm performance.
- The research makes a practical contribution to knowledge of the firm type and the role of the early board team during firm evolution and emergence, effectively helping firms metamorphose helping firms metamorphose from Caterpillar to butterfly.

- To director understanding of the evolution or transition process needed to acquire and deploy resources to build entrepreneurial capability at board level for continued economic survival, renewal, and growth for established firms in an important sector of the economy.

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# Appendices

## APPENDIX 1: 1 MAIL MERGE LETTER FOR PILOT SURVEY
## ASTON BUSINESS SCHOOL HEADED NOTEPAPER

«Title» «FirstName» «LastName»
«JobTitle»
«Company»
«Address1»
«Address2»
«City»
«State»
«PostalCode»

12/7/00

Dear «Title» «LastName»,

**Plastics Industry Survey On Management Practices And Innovation In Medium Sized Independent Enterprises**

We appreciate that you are extremely busy but we write to ask for some of your time to complete this survey on management practice and innovation in medium sized independent firms within the Plastics Industry. In return for your time we will send you a summary of the findings, potentially providing useful guidance on management practice that facilitates innovation.

The study seeks to identify characteristic management attributes and practices associated with innovation within this manufacturing sector, size and type of company.

**Why?** The study aims to help mid range companies, neither very small nor large achieve competitive advantage through innovation in a fast changing environment. The findings will be used to inform company management such as yourselves within the industry, support agencies and government initiatives.
**Who?** Your firm forms part of this important sector selected for study and we hope that you (or one of your executive directors) will take part by completing the questionnaire enclosed. A good response rate is essential to obtain a representative sample of companies for the success of the study and validity of findings.
**How and Where?** The questionnaire has been designed for easy completion and should not take too much of your valuable time. A freepost addressed envelope is enclosed for your convenience in returning the questionnaire. The information gathered from the questionnaire will be treated confidentially and analysed in aggregate. Your company will not be identified in any way. If you prefer the questionnaire may be completed anonymously.
**Findings.** We will send a summary of the research findings on completion of the research next year to all respondents providing contact details.
Your co-operation in the prompt completion and return of the questionnaire is much appreciated. If you have any queries, please do not hesitate to make contact using the details below.
Yours sincerely,

Catherine Gurling

Contact Details: gurlicmd@aston.ac.uk Tel. 0121 359 3611 ext. 4420 Aston University Aston Business School South Wing, Room 1007, Aston Triangle, Birmingham B4 7ET.

# ASTON BUSINESS SCHOOL

# PLASTICS INDUSTRY SURVEY

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## MANAGEMENT PRACTICE & INNOVATION In SMALL AND MEDIUM SIZED INDEPENDENT ENTERPRISES

### SECTION 1: INTRODUCTORY INFORMATION

| | | | |
|---|---|---|---|
| 1. | **Title of Director completing the questionnaire.** | | |
| | | | |
| 2. | Brief description of Business including nature of Product / Services, their application and broad customer type. | | |
| 3. | **When was the company established?** Approximately if precise date not known | | |
| 4. | **Has the turnover of the company between 1996 and 1999** been affected by any of the following in the last five years? | | |
| 5. | Merger or Acquisition of another enterprise? | Yes | No |
| 6. | Sale or closure of part of the enterprise? | Yes | No |
| 7. | If yes to the questions above, approximately what percentage increase in sales income did this represent at the time | M/A<br>Sale/ Closure | %<br>% |
| 8. | Is the company independent? | Yes | No |

*All information will be treated confidentially. Your company will not be identified in any way. If you prefer to return the questionnaire without these details but wish to receive a summary of findings please do not complete sections 9 –12 and clip your business card to the address space. The card will be detached from the questionnaire to ensure anonymity.*

| | |
|---|---|
| 9. | **Name of Director completing questionnaire** |
| | |
| 10. | **Name of Company** |
| 11. | **Company Registration No.** |
| 12. | **Address.** Do we have your correct name, title and address? Yes / No<br>If not please correct<br><br>Tel. Fax E-Mail |

**Innovation** is when a *new idea, invention or technology* is applied to a product or process and successfully introduced to a market

**Management Practices** are *the organisational routines and activities* in which managers engage within the company.

Some of these practices are known to facilitate innovation activity in large companies. We are seeking to find out whether there is any particular profile for the mid size range company in the plastics industry.

**Management Attributes**
The top management team's nature, composition and experience are significant factors in any successful management equation.

**Small to Medium Size**
This is defined for the purposes of this research as companies with total employment around 25 to 500. This may include subsidiaries

The UK Plastics Industry possesses the greatest number of manufacturing companies of this size
SIC Codes 2521/22/23/24

**Contact Details:** Catherine Gurling, Strategic Management and Innovation Group, South Wing Room 1007. Aston Business School, Aston Triangle, Birmingham B4 7ET. Tel 0121 359 3611 ext 4420 Fax 0121 333 3474 e-mail gurlicmd@aston.ac.uk

## SECTION 2: INNOVATION ACTIVITY

### 2.1 New Products for New Markets

**Product Innovation:** Introduction of a new product with which customers are not familiar. Such a product meets new, previously unmet or unrecognised needs. This creates a new market for products that did not previously exist. E.g. Car Air bags.

| | | | |
|---|---|---|---|
| **a)** | Has the company developed and introduced any products that were totally new and did not previously exist for customers since 1996? | **Yes** | **No** |
| **b)** | If Yes, how many? | | |
| **c)** | What % of current products are under 3 years old? | | % |
| **d)** | Approximate % share of total company turnover represented by product innovations over the last 3 years | | |
| | Last Year % | Previous Year % | Year before last % |

### 2.2 Product Improvements

**Innovative Product Improvement:** Use of new materials, producing significantly improved quality, utility and / or cost of an existing product. E.g. Biodegradable polymers for disposable nappies.

| | | | |
|---|---|---|---|
| **e)** | Has the company introduced any significant improvements to products with **New Materials** since 1996? | **Yes** | **No** |
| **f)** | If Yes, How many? | | |
| **g)** | Approximate % share of total company turnover contributed by innovative new materials over the last 3 years? | | |
| | Last Year % | Previous Year % | Year before last % |

### 2.3 Existing Products / Processes applied to New Customers and Markets

**Innovative Product / Process Application:** Introduction of existing products / processes to a new market. E.g. injection moulding for small-scale clarinets for children and plastic jug kettles.

| | | | |
|---|---|---|---|
| **h)** | Has the company introduced and applied **existing products/processes to new markets** between 1996 and 1999? | **Yes** | **No** |
| **i)** | If Yes, how many? | | |
| **j)** | Approximate % share of total company turnover represented by new market applications over the last 3 years | | |
| | Last Year % | Previous Year % | Year before last % |

### 2.4 New Machine or Process Innovation

**Machine and Process Innovation:** Introduction of totally new machine & production processes. E.g. Conical twin extruder, rapid prototyping and servo electric machines.

| | | | |
|---|---|---|---|
| **k)** | Has the company introduced any significant and totally new **machines and / or production processes** that are new to both to the industry and your markets since 1996? | **Yes** | **No** |
| **l)** | If Yes, How many ? | | |
| **m** | Approximate % share of total company turnover contributed by totally new machines and production process innovations over the last 3 years? | | |
| | Last Year % | Previous Year % | Year before last % |

### 2.5 Machine & Process Improvements

**Innovative Machine or Process Improvement:** Significant but minor **improvement** such as use of Polymer Insights Intelligent Process Monitoring for improved product quality and performance.

| | | | |
|---|---|---|---|
| **n)** | Has the company introduced any significant improvements to **machines** and / or **processes** since 1996? | **Yes** | **No** |
| **o)** | If Yes, How many? | | |
| **p)** | Approximate % share of total company turnover represented by these process innovations and improvements over the last 3 years | | |
| | Last Year % | Previous Year % | Year before last % |

## SECTION 3: MANAGEMENT PRACTICES

**EXTERNAL LINKS TO ASSIST IN INNOVATION:** S.M.E's generally do not have the same order of resources to undertake research or development work for innovation as larger companies. This section is designed to identify the ways information and resources (money, plant, people) needed to achieve product and process innovation are accessed.

**3.1 External sensing and environment scanning:** How often do employees including directors do any of the following during a year? Give an average figure.

| | | | | | |
|---|---|---|---|---|---|
| **a)** | Attend external training and development programmes | | **f)** | Attend trade shows, conferences and exhibitions | |
| **b)** | Visit organisations involved in Industry relevant research | | **g)** | Send employees on external training and development programmes? | |
| **c)** | Attend external meetings of a Trade Body or Association | | **h)** | Associate with other employers in the local community | |
| **d)** | Travel to meet suppliers on their premises | | **i)** | Travel to meet customers on their premises | |
| **e)** | Meet Competitors | | **j)** | Request Technical details from outside sources | |

**3.2 External Contact.** How often does the company consult any of the following for purposes related to innovation?

| | | | | | |
|---|---|---|---|---|---|
| **a)** | Academics / Universities | | **e)** | External Market Research Sources | |
| **b)** | Customers | | **f)** | Production Subcontractors | |
| **c)** | Suppliers | | **g)** | Recruitment and selection consultants | |
| **d)** | Agencies such as TEC's and Business Links | | **h)** | Potential further Sources of Finance | |
| **e)** | PIRA, RAPRA or Commercial Research organisation | | **i)** | Training and Development Consultancies | |
| **f)** | Government Research Organisation | | **j)** | Other specify | |

**3.3 Reasons** for consulting these may have been some of the factors below. Please rate the importance of these factors to the company by circling a number closest to your opinion.

| | *External Contact Motivation* | Not at all Important | | Neutral | | Very Important |
|---|---|---|---|---|---|---|
| **a)** | Looking for ideas and opportunities | 1 | 2 | 3 | 4 | 5 |
| **b)** | Lack of own dedicated R & D resources | 1 | 2 | 3 | 4 | 5 |
| **c)** | Trying to save time | 1 | 2 | 3 | 4 | 5 |
| **d)** | Solving a problem | 1 | 2 | 3 | 4 | 5 |
| **e)** | Trying to find new resources ( people, money, equipment) | 1 | 2 | 3 | 4 | 5 |
| **f)** | Minimise risk | 1 | 2 | 3 | 4 | 5 |
| **g)** | Cost reduction | 1 | 2 | 3 | 4 | 5 |
| **h)** | Response to competitor action | 1 | 2 | 3 | 4 | 5 |
| **i)** | Specific information gathering | 1 | 2 | 3 | 4 | 5 |
| **j)** | Lack of internal resources for a task | 1 | 2 | 3 | 4 | 5 |
| **k)** | Other (specify) | 1 | 2 | 3 | 4 | 5 |

**3.4 DECISION MAKING Board / Development Meetings**

| | | | | |
|---|---|---|---|---|
| **a)** | How many Board Meetings take place in a year on average? | | | |
| **b)** | Approximately how is time at Board meetings split between | | | |
| | Operational planning and problem solving | e.g. *55%* | | % |
| | Strategy Development and Review | e.g. 45% | | % |
| **c)** | Are Board Meetings Formal (agenda / prepared presentations ) | | Yes | No |
| **d)** | How many Development Meetings take place in a year on average for product or process innovation | | | |

**3.5 Strategic Management :** Please circle on a scale of 1 to 5 the extent to which you agree or disagree with statement as far as your company is concerned

| | | Strongly Disagree | | Neither Agree or Disagree | | Strongly Agree |
|---|---|---|---|---|---|---|
| a) | Operations and day to day decisions often push strategic planning and review into second place | 1 | 2 | 3 | 4 | 5 |
| b) | The Directors meet regularly to monitor progress against the company's strategic objectives. | 1 | 2 | 3 | 4 | 5 |
| c) | The Directors sometimes have difficulty in finding time to set long term objectives for the company | 1 | 2 | 3 | 4 | 5 |
| d) | Strategic Plans are amended according to circumstances during the year. | 1 | 2 | 3 | 4 | 5 |
| e) | Long term strategy objectives and how they are to be achieved are known to everyone in the company | 1 | 2 | 3 | 4 | 5 |

**3.6 Strategic Management Routines:** If you agree with the statement circle Yes, if not circle No.

| | | | |
|---|---|---|---|
| a) | The Company has a set annual routine for strategic planning : setting long term objectives for company activity and performance | Yes | No |
| b) | The Company reviews its activities continuously and has no set routine | Yes | No |
| c) | The Company produces an internal business plan every year for its own use covering products and markets, operations and finance | Yes | No |
| d) | The Company produces a Business Plan for the bank and other sources of funds | Yes | No |
| e) | Produces Monthly Management Reports containing Sales, Production and Financial Results | Yes | No |
| f) | The Company produces cash flow forecasts on a regular basis | Yes | No |
| g) | The Company produces detailed production /operation reports on labour and material usage on a regular basis | Yes | No |

## INTERNAL ENVIRONMENT

**3.7 Innovation Climate.** Please circle on a scale of 1 to 5 the extent to which you agree or disagree with statement as far as your company is concerned

| | | Strongly Disagree | | Neither Agree or Disagree | | Strongly Agree |
|---|---|---|---|---|---|---|
| a) | A Research and Development department is needed to develop new products and processes. | 1 | 2 | 3 | 4 | 5 |
| b) | We allow employees time to develop their own innovative ideas | 1 | 2 | 3 | 4 | 5 |
| c) | We reward individuals who put forward and pursue innovative ideas for products or processes | 1 | 2 | 3 | 4 | 5 |
| d) | Suggestions about how to do things better are always examined | 1 | 2 | 3 | 4 | 5 |
| e) | Development work is carried out alongside other work | 1 | 2 | 3 | 4 | 5 |
| f) | Everyone tends to work together to develop new opportunities | 1 | 2 | 3 | 4 | 5 |
| g) | Directors are responsible for pursuing new ideas and opportunities | 1 | 2 | 3 | 4 | 5 |
| h) | Day to day work gets in the way of development work | 1 | 2 | 3 | 4 | 5 |

**3.8 General Communication.** Please circle on a scale of 1 to 5 the degree to which you agree or disagree with the statement as far as your company is concerned

| | | Strongly Disagree | | Neither Agree or Disagree | | Strongly Agree |
|---|---|---|---|---|---|---|
| **a)** | Some managers are particularly good at working with other management functions to get things done. | **1** | **2** | **3** | **4** | **5** |
| **b)** | Information is frequently exchanged in written form | **1** | **2** | **3** | **4** | **5** |
| **c)** | Different management areas come together for development work | **1** | **2** | **3** | **4** | **5** |
| **d)** | Information is informally exchanged continuously between all levels of employee | **1** | **2** | **3** | **4** | **5** |
| **e)** | Formal Meetings are common means of communication for management | **1** | **2** | **3** | **4** | **5** |
| **f)** | E-mail is a useful means of internal communication | **1** | **2** | **3** | **4** | **5** |
| **g)** | Directors communicate informally with managers / supervisors on a daily basis | **1** | **2** | **3** | **4** | **5** |
| **h)** | A lot of information is exchanged informally during the day between employees and managers | **1** | **2** | **3** | **4** | **5** |
| **i)** | E-mail / Internet are very useful for contacting people and organisations outside the company | **1** | **2** | **3** | **4** | **5** |
| **j)** | Management meetings are used to exchange information between management areas | **1** | **2** | **3** | **4** | **5** |

## SECTION 4: TOP MANAGEMENT TEAM CHARACTERISTICS

**4.1 Board Composition** Please give total number of board members

| | | |
|---|---|---|
| **a)** | Total Number of Board Members | |

**4.2 Executive / Non Executive split.** Please indicate split

| | | |
|---|---|---|
| **b)** | How many Executive Board Members are there? | |
| **c)** | How many Non Executive Board Members are there? | |

**4.3. Formal Education:** Please indicate the highest qualification of each Board Member.

| | **Qualification** | Numbers |
|---|---|---|
| **a)** | Accountancy Qualification | |
| **b)** | Doctorate | |
| **c)** | Masters Degree | |
| **d)** | Undergraduate Degree | |
| **e)** | A Level | |
| **f)** | GSCE's or equivalent | |
| **g)** | Other / Say | |
| **h)** | None | |
| | **Total Number of Directors** | |

**4 .4. Age Profile:** Please indicate the age group for each Board Member. *Tick ✓ for status and correct age group boxes for each Director. E=Exec N=Non Exec.*

| *Board Member* | *Ex* | *N* | *25/ 35* | *36/ 45* | *46/ 50* | *51/ 55* | *56/ 60* | *61+ yrs* |
|---|---|---|---|---|---|---|---|---|
| **1** | | | | | | | | |
| **2** | | | | | | | | |
| **3** | | | | | | | | |
| **4** | | | | | | | | |
| **5** | | | | | | | | |
| **6** | | | | | | | | |
| **7** | | | | | | | | |
| **8** | | | | | | | | |
| **9** | | | | | | | | |

**4.5 Time with Company:** Tick to indicate the total time each director has spent with the company.

| *Board Member* | **Less than 2yrs** | **2- 5yrs** | **6- 10yrs** | **11- 15yrs** | **16- 20yrs** | **20+ yrs** |
|---|---|---|---|---|---|---|
| **1** | | | | | | |
| **2** | | | | | | |
| **3** | | | | | | |
| **4** | | | | | | |
| **5** | | | | | | |
| **6** | | | | | | |
| **7** | | | | | | |
| **8** | | | | | | |
| **9** | | | | | | |

## SECTION 5: COMPANY PROFILE & PERFORMANCE

**5.1 Company Performance:** Please rank the importance of each performance criteria on a scale of I to 6 to the company? Items may rank equally

1 = Most important 6 = least important

| | | |
|---|---|---|
| a) | Increased Profitability | |
| b) | Increased Sales | |
| c) | Cost Reduction | |
| d) | Increased Product and Process Quality | |
| e) | Market Share | |
| f) | Share Value | |
| g) | Other specify | |

**5.2 Reward:** Are any of the following schemes used to reward director performance?

| | | | |
|---|---|---|---|
| a) | Share Purchase Scheme | Yes | No |
| b) | Profit Share based on Sales / Profit (or similar) | Yes | No |
| c) | Performance Bonus against specified goals | Yes | No |
| d) | Straight Salary increase negotiated with CEO/MD/Owner | Yes | No |
| e) | Other specify | | |

**5.3 Employment**

| Numbers Employed At Year End | 1995/96 | 1996/97 | 1997/98 | 1998/99 |
|---|---|---|---|---|
| **Full Time** | | | | |
| **Part Time** | | | | |

**5.4 Number, Type of Shareholder and Board Representation..**

The shareholding structure of S.M.E's in the manufacturing sector is of particular interest due difficulty in obtaining small (£50 - 250k) amounts of equity. We would be grateful if you would complete the following details so that we can gain a clear picture.

Please could you indicate the type and number of shareholders present (unless PLC) and tick ✓ those that have board representation either an executive or non executive capacity.

| | | | | |
|---|---|---|---|---|
| a) | Is the company a PLC with publicly held and traded Shares? **If yes ignore b and f below** | | Yes | No |
| b) | How many Shareholders of the company are there? Circle as appropriate | 1 2 3 4 5 6 7 8 if more, say | | |
| | | Number | Board Representation | |
| | | | Executive | Non Executive |
| c) | **Corporate** (Trade Partner or other organisation) less than 25% | | | |
| d) | **Corporate** (Trade Partner as above) more than 25% | | | |
| e) | **Financial Institution inc. Venture Capitalist** | | | |
| f) | **Private Individual Investor (Business Angel)** | | | |
| g) | **Founder** | | | |
| h) | **Family Members** | | | |
| i) | **Other** (Specify) | | | |

**5.5 Company Performance:** These figures will be treated with the utmost confidentiality and will be used to relate innovation activity and management practices to firm performance.

| Financial Year End | 1995/96 | 1996/97 | 1997/98 | 1998/99 |
|---|---|---|---|---|
| | £000's | £000's | £000's | £000's |
| **Sales Turnover** | | | | |
| **Gross Profit** ( Optional ) | | | | |

**Thank you very much for spending your time in completing this Questionnaire. It is appreciated. If you have requested them, we will send you summary findings as soon as they are available.**

## APPENDIX 1.2 :FINAL MAIL MERGE LETTER

«Title» «FirstName» «LastName»
«JobTitle»
«Company»
«Address1»
«Address2»
«City»
«State»
«PostalCode»

12/7/00

Dear «Title» «LastName»,

**Plastics Industry Survey On Management Practices And Innovation In Medium Sized Independent Enterprises**

We appreciate that you are extremely busy but we write to ask for some of your time to complete this survey on management practice and innovation in medium sized independent firms within the Plastics Industry. In return for your time we will send you a summary of the findings, potentially providing useful guidance on management practice that facilitates innovation.

The study seeks to identify characteristic management attributes and practices associated with innovation within this manufacturing sector, size and type of company.

**Why?** The study aims to help mid range companies, neither very small nor large achieve competitive advantage through innovation in a fast changing environment. The findings will be used to inform company management such as yourselves within the industry, support agencies and government initiatives.
**Who?** Your firm forms part of this important sector selected for study and we hope that you (or one of your executive directors) will take part by completing the questionnaire enclosed. A good response rate is essential to obtain a representative sample of companies for the success of the study and validity of findings.
**How and Where?** The questionnaire has been designed for easy completion and should not take too much of your valuable time. A freepost addressed envelope is enclosed for your convenience in returning the questionnaire. The information gathered from the questionnaire will be treated confidentially and analysed in aggregate. Your company will not be identified in any way. If you prefer the questionnaire may be completed anonymously.
**Findings.** We will send a summary of the research findings on completion of the research next year to all respondents providing contact details.
Your co-operation in the prompt completion and return of the questionnaire is much appreciated. If you have any queries, please do not hesitate to make contact using the details below.
Yours sincerely,

Catherine Gurling

Contact Details: gurlicmd@aston.ac.uk Tel. 0121 359 3611 ext. 4420 Aston University Aston Business School South Wing, Room 1007, Aston Triangle, Birmingham B4 7ET.

PAGE NUMBERING AS ORIGINAL

## APPENDIX 1.2 FINAL QUESTIONNAIRE

## APPENDIX 1.3.1 INJECTION MOULDING MAIL MERGE LETTER: ASTON BUSINESS SCHOOL HEADED NOTEPAPER

«Title» «FirstName» «LastName»
«JobTitle»
«Company»
«Address1»
«Address2»
«Address3»
«City»
«State»
«PostalCode»

Dear «Title» «LastName»

**Survey of Management Practice and Innovation Activity in Injection Moulding Companies**

I would like to ask for your help in conducting this survey on management practice and Innovation within injection moulding companies.

The information received from completed questionnaires will be analysed to provide practical assistance to Directors who wish to achieve foster increased innovation as a means of economic survival and growth. Successful Innovation is as much about the people, their attitudes and what they do, as the physical level of introduction of new materials, products or processes.

I would greatly appreciate your finding time in a busy life to quickly complete the questionnaire attached. The more completed questionnaires that are returned ensure better quality research and more reliable results.

As a small return for the time involved in responding you will be invited to a seminar and sent a written summary of the findings on completion of the project. To signal that you wish to receive such an invitation and summary please return this letter attached to the questionnaire with any title and address amendments necessary. If you wish to complete the questionnaire anonymously simply tear this letter off the questionnaire and return it in the Freepost envelope enclosed.

I thank you in advance for your assistance on this practically orientated project. Please do not hesitate to contact me at the above address if you have any queries

Yours sincerely,

Catherine Gurling
gurlicmd@aston.ac.uk

| Are the title & address details correct? | Yes |
|---|---|
| If No, please amend the address above as necessary | |

ASTON
BUSINESS SCHOOL

# PLASTICS INDUSTRY SURVEY

## MANAGEMENT PRACTICE & INNOVATION IN MEDIUM SIZED INDEPENDENT ENTERPRISES

Strategic Management and
Innovation Group
Aston Triangle
Birmingham B4 7ET
United Kingdom
Tel +44 (0)121 359 3611
Fax +44 (0)121 333 5620

**To the Director completing the questionnaire:** *Information given in this questionnaire is absolutely confidential and will not be disclosed under any circumstances. Information will be analysed in aggregate and be individually unidentifiable.*

### SECTION 1: INTRODUCTORY INFORMATION

| | | | |
|---|---|---|---|
| 1. | **Title of Director completing the questionnaire.** | | |
| | | | |
| 2. | Name of Company & Brief description of Business including nature of Product / Services, their application and broad customer type. | | |
| | If your business does not belong to any of the Plastics Processing Industry Sectors please accept our apologies. We would be grateful if you would tell us by returning the questionnaire identified with the company name. | | |
| 3. | **When was the company established?**<br>Approximately if precise date not known | | |
| 4. | **Is the company independent?** | **Yes** | **No** |

### SECTION 2: COMPANY AND BOARD PROFILE

2.1 **Board Composition** Please indicate total number of board members & the split between executive & non executive

| | | | | |
|---|---|---|---|---|
| a) | Total Number of Board Members | | | |
| b) | Number of Executive Board Members? | | | |
| c) | Number of Non Executive Board Members? | | | |
| d) | Do you consider this number<br>Tick box ✓ | Too few? | Just right? | Too many? |

2.2 **Board Meetings:** Number and Nature of meetings

| | | | |
|---|---|---|---|
| e) | How many Board Meetings take place in a year on average? | | |
| f) | Are Board Meetings Formal (agenda / prepared presentations ) | Yes | No |
| | or Informal (no agenda / prepared preparation) Please circle | Yes | No |
| g) | How, approximately, is time at Board meetings split between:- | | |
| h) | Review of Results & Strategy development e.g. 45% | | % |
| i) | Operational planning and problem solving e.g. 55% | | % |

**Innovation** is when a *new idea, invention or technology* is applied to a product or process and successfully introduced to a market

**Management Practices** are *the organisational routines and activities* in which managers engage within the company.

Some of these practices are known to facilitate innovation activity in large companies. We are seeking to find out whether there is any particular profile for the mid size range company in the plastics industry.

**Management Attributes**
The top management team's composition and experience are significant factors in any successful management equation.

**Medium Size**
This is defined for the purposes of this research as companies with total employment around 25 to 500. This may include subsidiaries

The UK Plastics Industry possesses the greatest number of manufacturing companies of this size

**Contact Details:** Catherine Gurling, South Wing Room 1007 at the address above. Tel 0121 359 3611 ext. 4420 Fax 0121 333 3474 e-mail gurlicmd@aston.ac.uk

## SECTION 2: COMPANY AND BOARD PROFILE continued

**2 .3. Age Profile:** Please indicate the age group for each Board Member. *Tick ✓ for status and correct age group boxes for each Director. E=Exec N=Non Exec.*

| *Board Member* | *Ex* | *N* | *25/ 35* | *36/ 45* | *46/ 50* | *51/ 55* | *56/ 60* | *61+ yrs* |
|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | |
| 2 | | | | | | | | |
| 3 | | | | | | | | |
| 4 | | | | | | | | |
| 5 | | | | | | | | |
| 6 | | | | | | | | |
| 7 | | | | | | | | |
| 8 | | | | | | | | |
| 9 | | | | | | | | |

**2.4 Time with Company:** Tick to indicate the total time each director has spent with the company.

| *Board Member* | **Less than 2yrs** | **2-5yrs** | **6-10yrs** | **11-15yrs** | **16-20yrs** | **20+ yrs** |
|---|---|---|---|---|---|---|
| 1 | | | | | | |
| 2 | | | | | | |
| 3 | | | | | | |
| 4 | | | | | | |
| 5 | | | | | | |
| 6 | | | | | | |
| 7 | | | | | | |
| 8 | | | | | | |
| 9 | | | | | | |

**2.5 Formal Education:** Please indicate the number of Board Members with the following formal qualifications

| | **Qualification** | Numbers |
|---|---|---|
| a) | Accountancy Qualification | |
| b) | GSCE's or equivalent | |
| c) | A Level | |
| d) | Undergraduate Degree | |
| e) | Higher Degree - Masters | |
| f) | Higher Degree - PhD | |
| g) | NVQ's 3,4 & 5 | |
| h) | Other say | |
| i) | None | |

**2.6 Number of Company Employees**

| Yr. End | **95/96** | **96/97** | **97/98** | **98/99** |
|---|---|---|---|---|
| Full time | | | | |
| Part Time | | | | |

**2.7 Reward:** Are any of the following schemes used to reward director performance?

| | | | |
|---|---|---|---|
| **a)** | Share Purchase Scheme | **Yes** | **No** |
| **b)** | Profit Share based on Sales / Profit (or similar) | **Yes** | **No** |
| **c)** | Performance Bonus against specified goals | **Yes** | **No** |
| **d)** | Straight Salary increase negotiated with CEO/MD/Owner | **Yes** | **No** |
| **e)** | Other specify i.e. owner/ founder | **Yes** | **No** |

**2.8 Shareholders:** Please could you **indicate the type and number of shareholders** (PLCs excepted). *Tick ✓ those that sit on the board either in an executive or non-executive capacity*

| **Total number of shareholders ( excluding PLC's)** | | | |
|---|---|---|---|
| | **Exec** | **Non Exec** | **Director Numbers** |
| Founder | | | |
| Family Member | | | |
| Corporate / Trade Partner | | | |
| Financial Institution | | | |
| Individual Private Investor | | | |
| Director | | | |
| Other specify | | | |
| **Total** | | | |

**2.9 Company Results:** These figures will be treated with the utmost confidentiality and will be used solely to relate innovation activity and management practices to company results.

| **Yr End** | **1995/96** | **1996/97** | **1997/98** | **1998/99** |
|---|---|---|---|---|
| | **£ 000's** | **£ 000's** | **£ 000's** | **£ 000's** |
| **Sales** | | | | |
| **Gross Profit** (Optional) | | | | |

## SECTION 3: INNOVATION ACTIVITY

### 3.1 New Products for New Markets:

**Product Innovation:** Introduction of a new product with which customers are not familiar, meets new, previously unmet or unrecognised needs. This creates a new market for products that did not previously exist. E.g. Car Air bags.

| | | | |
|---|---|---|---|
| a) | Has the company developed and introduced any **products that were totally new and did not previously exist** for customers since 1996? | Yes | No |
| b) | If Yes, how many? | | |
| c) | What % of current products are under 3 years old? | % | |
| d) | Approximate % share of total company turnover represented by these over the last 3 years | | |

| | Last Year | Previous Year | Year before last |
|---|---|---|---|
| | % | % | % |

### 3.2 Innovative Product Improvement:

Use of new materials, producing significantly improved quality, utility and / or cost of an existing product. E.g. Biodegradable polymers for disposable nappies.

| | | | |
|---|---|---|---|
| e) | Has the company introduced any significant improvements to products with **New Materials** since 1996? | Yes | No |
| f) | If Yes, How many? | | |
| g) | Approximate % share of total company turnover contributed by these over the last 3 years? | | |

| | Last Year | Previous Year | Year before last |
|---|---|---|---|
| | % | % | % |

### 3.3 Existing Products / Processes applied to New Customers and Markets:

Introduction of existing products / processes to a new market. E.g. injection moulding for small-scale clarinets for children and plastic jug kettles.

| | | | |
|---|---|---|---|
| h) | Has the company introduced and applied **existing products/processes to new markets** between 1996 and 1999? | Yes | No |
| i) | If Yes, How many? | | |
| j) | Approximate % share of total company turnover represented by these over the last 3 years | | |

| | Last Year | Previous Year | Year before last |
|---|---|---|---|
| | % | % | % |

### 3.4 New Machine or Process Innovation:

**Process Innovation**: Introduction of totally new machine & production processes. E.g. Conical twin extruder, rapid prototyping and servo electric machines.

| | | | |
|---|---|---|---|
| k) | Has the company introduced any significant and totally new **machines and / or production processes** that are new to both to the industry and your markets since 1996? | Yes | No |
| l) | If Yes, How many ? | | |
| m) | Approximate % share of total company turnover contributed by these over the last 3 years? | | |

| | Last Year | Previous Year | Year before last |
|---|---|---|---|
| | % | % | % |

### 3.5 Innovative Machine & Process Improvements:

Significant but minor **improvement** such as use of Polymer Insights Intelligent Process Monitoring for improved product quality and performance.

| | | | |
|---|---|---|---|
| n) | Has the company introduced any significant improvements to **machines** and / or **processes** since 1996? | Yes | No |
| o) | If Yes, How many? | | |
| p) | Approximate % share of total company turnover represented by these over the last 3 years | | |

| | Last Year | Previous Year | Year before last |
|---|---|---|---|
| | % | % | % |

### 3.6 Innovation Through Business Acquisition:

Has the company acquired another business in the last three years for these reasons?

| | | | |
|---|---|---|---|
| q) | Either to acquire innovative products range | Yes | No |
| r) | Or Acquire process technology and know- how? | Yes | No |
| s) | Unrelated to innovation needs | Yes | No |
| t) | Give broad reason for Acquisition(s) | | |
| u) | Approximate % share of total company turnover represented by the acquisition(s) in q and r above | | |

| | Last Year | Previous Year | Year before last |
|---|---|---|---|
| | % | % | % |

## SECTION 4: MANAGEMENT PRACTICES

**PRACTICES TO ASSIST IN INNOVATION:** Medium sized established companies generally do not have the same level of resources to undertake their own research or development work for innovation as in larger companies. This section is designed to identify the ways in which you find information, access resources (finance, equipment, people, time) and share this with others to achieve product and process innovation.

**4.1 Planning and Control:** Please circle on a scale of 1 to 5 the extent to which you agree or disagree with these statements as far as your company is concerned

| | | Strongly Disagree | | Neither Agree or Disagree | | Strongly Agree |
|---|---|---|---|---|---|---|
| a) | Directors meet informally to discuss and plan future strategy | 1 | 2 | 3 | 4 | 5 |
| b) | Strategy discussion tends to take place only at board meetings | 1 | 2 | 3 | 4 | 5 |
| c) | It is sometimes difficult to find time to work out and set long term objectives for the business | 1 | 2 | 3 | 4 | 5 |
| d) | A formal strategy set out in a written business plan is essential | 1 | 2 | 3 | 4 | 5 |
| e) | Strategy is informally amended according to circumstances during the year. | 1 | 2 | 3 | 4 | 5 |
| f) | Production and day to day decisions often push strategic planning and review into second place | 1 | 2 | 3 | 4 | 5 |
| g) | Getting information on material usage and labour is difficult | 1 | 2 | 3 | 4 | 5 |
| h) | Three year financial forecasts should be made every year (Cash Flow, Profit and Loss, Balance Sheets) | 1 | 2 | 3 | 4 | 5 |
| i) | A Business Plan is only necessary for the bank and other sources of funds | 1 | 2 | 3 | 4 | 5 |
| j) | Sales and Production levels and efficiency are regularly reviewed against plans. | 1 | 2 | 3 | 4 | 5 |
| k) | A set annual routine for strategic planning for setting long term business objectives and performance is necessary | 1 | 2 | 3 | 4 | 5 |
| l) | Progress on achieving current business strategic objectives is regularly reviewed at board meetings. | 1 | 2 | 3 | 4 | 5 |
| m) | The Company reviews its activities continuously at management meetings and has no set planning routine | 1 | 2 | 3 | 4 | 5 |
| n) | An internal business plan covering products and markets, production and finance is carried out each year | 1 | 2 | 3 | 4 | 5 |

**4.2 External sensing and environment scanning:** How often do employees including directors do any of the following during a year? Give an average annual figure.

| | | | | | |
|---|---|---|---|---|---|
| a) | Attend external training and development programmes | | f) | Attend trade shows, conferences and exhibitions | |
| b) | Visit organisations involved in Industry relevant research (PIRA / RAPRA) | | g) | Associate with other employers in the local community | |
| c) | Attend external meetings of a Trade Body or Association (BPF) | | h) | Travel to meet customers on their premises | |
| d) | Travel to meet suppliers on their premises | | i) | Request Technical details from outside sources | |

**4.3 External Contact.** How often does the company consult any of the following for purposes related to innovation? Give an average annual figure.

| | | | | | |
|---|---|---|---|---|---|
| a) | Academics / Universities | | e) | External Market Research Sources | |
| b) | Customers | | f) | Production Subcontractors | |
| c) | Raw Material Suppliers | | g) | Recruitment and selection consultants | |
| d) | Machine and Tool Makers | | h) | Potential further Sources of Finance | |
| e) | Agencies such as TEC's and Business Links | | i) | Training and Development Organisations | |
| f) | PIRA, RAPRA or Commercial Research organisation | | j) | Other specify | |

4.4 **Reasons** for consulting any of these may have been some of the factors below. Please rate the importance of these factors to the company by circling a number closest to your opinion.

| | *External Contact Motivation* | Not at all Important | | Neutral | | Very Important |
|---|---|---|---|---|---|---|
| a) | Looking for ideas and opportunities | 1 | 2 | 3 | 4 | 5 |
| b) | Lack of own dedicated R & D resources | 1 | 2 | 3 | 4 | 5 |
| c) | Trying to save time | 1 | 2 | 3 | 4 | 5 |
| d) | Solving a problem | 1 | 2 | 3 | 4 | 5 |
| e) | Trying to find new resources (people, money, equipment) | 1 | 2 | 3 | 4 | 5 |
| f) | Minimise risk | 1 | 2 | 3 | 4 | 5 |
| g) | Cost reduction | 1 | 2 | 3 | 4 | 5 |
| h) | Response to competitor action | 1 | 2 | 3 | 4 | 5 |
| i) | Specific information gathering | 1 | 2 | 3 | 4 | 5 |
| j) | Lack of internal resources for a task | 1 | 2 | 3 | 4 | 5 |
| k) | Other (specify) | 1 | 2 | 3 | 4 | 5 |

4.5 **Development Work:** Please circle on a scale of 1 to 5 the extent to which you agree or disagree with statement as far as your company is concerned

| | | Strongly Disagree | | Neither Agree or Disagree | | Strongly Agree |
|---|---|---|---|---|---|---|
| a) | A Research and Development department is needed to develop new products and processes. | 1 | 2 | 3 | 4 | 5 |
| b) | Suggestions about how to do things better are always examined | 1 | 2 | 3 | 4 | 5 |
| c) | We encourage and reward individuals who put forward and pursue innovative ideas for products or processes | 1 | 2 | 3 | 4 | 5 |
| d) | Everyone in the business tends to work together to develop new opportunities | 1 | 2 | 3 | 4 | 5 |
| e) | Directors are responsible for pursuing new ideas and opportunities | 1 | 2 | 3 | 4 | 5 |
| f) | Day to day work gets in the way of development work | 1 | 2 | 3 | 4 | 5 |

4.6 **General Communication.** Please circle on a scale of 1 to 5 the degree to which you agree or disagree with the statement as far as your company is concerned

| | | Strongly Disagree | | Neither Agree or Disagree | | Strongly Agree |
|---|---|---|---|---|---|---|
| a) | Some managers are particularly good at working with others managers to get work done. | 1 | 2 | 3 | 4 | 5 |
| b) | Information is frequently exchanged in written form | 1 | 2 | 3 | 4 | 5 |
| c) | Different management areas come together for development work | 1 | 2 | 3 | 4 | 5 |
| d) | There are communication gaps between directors and/or managers | 1 | 2 | 3 | 4 | 5 |
| e) | Much information is exchanged informally during the day between employees and managers | 1 | 2 | 3 | 4 | 5 |
| f) | Management communication occurs at formal meetings | 1 | 2 | 3 | 4 | 5 |
| g) | E-mail is a useful means of internal communication | 1 | 2 | 3 | 4 | 5 |
| h) | Directors communicate informally with managers / supervisors on a daily basis | 1 | 2 | 3 | 4 | 5 |
| i) | The different management functions should work independently. | 1 | 2 | 3 | 4 | 5 |
| j) | E-mail / Internet are very useful for contacting people and organisations outside the company | 1 | 2 | 3 | 4 | 5 |

**Thank you very much for spending your time in completing this Questionnaire. It is appreciated.**

**If you would like to receive a summary of the findings, please complete the section below and they will be sent as soon as they are available.**

| | |
|---|---|
| 1. | **Name of Director completing questionnaire** |
| | |
| 2. | **Name of Company** |
| 3. | **Address.** Did we have your correct name, title and address on the original envelope? Yes / No<br>If not please correct<br><br><br><br>Tel. Fax E-Mail |

**If you know of other directors in independent companies employing 25 employees or over who might like to participate in the survey please give them a copy or contact us for a copy of the questionnaire.**

ALL INFORMATION GIVEN WILL BE TREATED WITH THE UTMOST CONFIDENTIALITY
IF YOU HAVE ANY QUERIES PLEASE CONTACT

**Catherine Gurling**

Strategic Management and Innovation Group
South Wing Room 1007
Aston Business School
Aston Triangle
Birmingham B4 7ET
Tel 0121 359 3611 ext 4420
Fax 0121 333 3474
e-mail gurlicmd@aston.ac.uk

## APPENDIX 1.3.2 INJECTION MOULDING QUESTIONNAIRE

# Survey of UK Injection Moulders: Management Practice & Innovation Activity

**Questionnaire Objective:** To obtain data for an analysis of management practice and innovation activity to provide a reliable basis for specifically tailored and targeted assistance schemes to assist increased innovation in this industry sector.

We appreciate your taking the time to complete the questionnaire and returning it in the freepost envelope enclosed. We thank you in advance.

## Section 1 Introductory Information

| | |
|---|---|
| a) | **Title of Director completing the questionnaire.** |
| b) | **Brief description of Business** including nature of Product / Services, their application and broad customer type. |

## Section 2 Company and Board Profile

**2.1 Board Composition** Please indicate total number of board members & the split between executive & non executive

| | | |
|---|---|---|
| a) | Total Number of Board Members | |
| b) | Number of Executive Board Members? | |
| c) | Number of Non Executive Board Members? | |
| d) | Do you consider this number<br>Tick box as appropriate ✓ | |

| | | |
|---|---|---|
| Too few? | Just right? | Too many? |

**2.2 Board Meetings:** Number and Nature of meetings

| | | | |
|---|---|---|---|
| e) | How many Board Meetings take place in a year on average? | | |
| f) | Are Board Meetings Formal? (agenda / prepared presentations ) | Yes | No |
| | or Informal? (no agenda / prepared preparation) Please circle | Yes | No |
| g) | How, approximately, is time at Board meetings split between:- | | |
| | Review of Results & Strategy development e.g. 45% | % | |
| | Operational planning and problem solving e.g. *55%* | % | |

**2.3 Formal Education:** Please insert the number of Directors with the following formal qualifications . i.e. Accountancy Qualification 2 (*people)*

| | Qualification | Numbers |
|---|---|---|
| a) | Accountancy Qualification | |
| b) | GSCE's or equivalent | |
| c) | A Level | |
| d) | Undergraduate Degree | |
| e) | Higher Degree - Masters | |
| f) | Higher Degree - PhD | |
| g) | NVQ's 3,4 & 5 | |
| h) | Other say | |
| i) | None | |

**2.4 Company Experience:** Tick to indicate the total time each director has spent with the company.

| *Board Member* | Less than 2yrs | 2-5yrs | 6-10yrs | 11-15yrs | 16-20yrs | 20+ yrs |
|---|---|---|---|---|---|---|
| 1 | | | | | | |
| 2 | | | | | | |
| 3 | | | | | | |
| 4 | | | | | | |
| 5 | | | | | | |
| 6 | | | | | | |
| 7 | | | | | | |
| 8 | | | | | | |
| 9 | | | | | | |

**CONFIDENTIALITY: To the Director completing the questionnaire:** Information given in this questionnaire is absolutely confidential and will not be disclosed under any circumstances. Information is analysed in aggregate and individually unidentifiable.

**CONTACT DETAILS: For queries please contact** Catherine Gurling, Aston Business School, Aston University, Aston Triangle, Birmingham B4 7ETTel 0121 359 3611 ext. 4420 Fax 0121 333 3474 e-mail gurlicmd@aston.ac.uk

## SECTION 2: COMPANY AND BOARD PROFILE continued

**Board Member details continued:**

**2 .5. Age Profile:** Please indicate the age group for each Board Member. *Tick ✓ for status and correct age group boxes for each Director. E=Exec N=Non Exec.*

| Board Member | Ex | N | 25/ 35 | 36/ 45 | 46/ 50 | 51/ 55 | 56/ 60 | 61+ yrs |
|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | |
| 2 | | | | | | | | |
| 3 | | | | | | | | |
| 4 | | | | | | | | |
| 5 | | | | | | | | |
| 6 | | | | | | | | |
| 7 | | | | | | | | |
| 8 | | | | | | | | |
| 9 | | | | | | | | |

**2.6 Reward:** Are any of the following schemes used to reward director performance?

| | | | |
|---|---|---|---|
| a) | Share Purchase Scheme | Yes | No |
| b) | Profit Share based on Sales / Profit (or similar) | Yes | No |
| c) | Performance Bonus against specified goals | Yes | No |
| d) | Straight Salary increase negotiated with CEO/MD/Owner | Yes | No |
| e) | Other specify i.e. owner/ founder | Yes | No |

**2.7 Shareholders:** Please could you **indicate the type and number of shareholders** (PLCs excepted). *Tick ✓ those that sit on the board either in an executive or non-executive capacity*

| **Total number of shareholders ( excluding PLC's)** | | | |
|---|---|---|---|
| | Exec | Non Exec | Director Numbers |
| Founder | | | |
| Family Member | | | |
| Corporate / Trade Partner | | | |
| Financial Institution | | | |
| Individual Private Investor | | | |
| Director | | | |
| Other specify | | | |
| **Total** | | | |

**2.8 Number of Company Employees**

| Yr. End | 95/96 | 96/97 | 97/98 | 98/99 |
|---|---|---|---|---|
| Full time | | | | |
| Part Time | | | | |

**Company Profile**

**2.9 Company Details**

| | | | |
|---|---|---|---|
| a) | When was the company established? Approximately if precise date not known | | |
| b) | Is the company independent? | Yes | No |
| c) | Does the company solely produce products for in-house consumption | Yes | No |

**2.10 General Communication.** Please circle on a scale of 1 to 5 the degree to which you agree or disagree with the statement as far as your company is concerned

| | | Strongly Disagree | | Neither Agree or Disagree | | Agree Strongly |
|---|---|---|---|---|---|---|
| a) | Some managers are particularly good at working with others managers to get work done. | 1 | 2 | 3 | 4 | 5 |
| b) | Information is frequently exchanged in written form | 1 | 2 | 3 | 4 | 5 |
| c) | Different management areas come together for development work | 1 | 2 | 3 | 4 | 5 |
| d) | There are communication gaps between directors and/or managers | 1 | 2 | 3 | 4 | 5 |
| e) | Much information is exchanged informally during the day between employees and managers | 1 | 2 | 3 | 4 | 5 |
| f) | Management communication occurs at formal meetings | 1 | 2 | 3 | 4 | 5 |
| g) | E-mail is a useful means of internal communication | 1 | 2 | 3 | 4 | 5 |
| h) | Directors communicate informally with managers / supervisors on a daily basis | 1 | 2 | 3 | 4 | 5 |
| i) | The different management functions should work independently. | 1 | 2 | 3 | 4 | 5 |
| j) | E-mail / Internet are very useful for contacting people and organisations outside the company | 1 | 2 | 3 | 4 | 5 |

**2.11 Company Results:**

These figures are needed to complete the research, will be treated with the utmost confidentiality and used solely to relate innovation activity and management practices to company growth in % terms

| Yr End | 1995/96 | 1996/97 | 1997/98 | 1998/99 |
|---|---|---|---|---|
| | £ 000's | £ 000's | £ 000's | £ 000's |
| Sales | | | | |
| Gross Profit (Optional) | | | | |

## SECTION 3: INNOVATION ACTIVITY

### 3.1 New Products for New Markets:

**Product Innovation:** Introduction of a new product, with which customers are not familiar, meets new, previously unmet or unrecognised needs. This creates a new market for products that did not previously exist. E.g. DVD,s, Car Airbags etc.

| | | |
|---|---|---|
| a) Has the company developed and introduced any **products that were totally new and did not previously exist** for customers since 1996? | **Yes** | **No** |
| b) If Yes, how many? | | |
| c) What % of current products are under 3 years old? | % | |
| d) Approximate % share of total company turnover represented by these over the last 3 years | | |
| Last Year % | Previous Year % | Year before last % |

### 3.2 New Machine or Process Innovation:

**Process Innovation**: Introduction of totally new machine & production processes. E.g. Conical twin extruder, rapid prototyping and servo electric machines.

| | | |
|---|---|---|
| k) Has the company introduced any significant and totally new **machines and / or production processes** that are new to both to the industry and your markets since 1996? | **Yes** | **No** |
| l) If Yes, How many ? | | |
| m) Approximate % share of total company turnover contributed by these over the last 3 years? | | |
| Last Year % | Previous Year % | Year before last % |

### 3.3 Innovative Product Improvement:

Use of new materials, producing significantly improved quality, utility and / or cost of an existing product. E.g. Biodegradable polymers for disposable nappies, CoralFoam

| | | |
|---|---|---|
| e) Has the company introduced any significant improvements to products with **New Materials** since 1996? | **Yes** | **No** |
| f) If Yes, How many? | | |
| g) Approximate % share of total company turnover contributed by these over the last 3 years? | | |
| Last Year % | Previous Year % | Year before last % |

### 3.4 Innovative Machine & Process Improvements:

Significant but minor **improvement** such as use of Polymer Insights Intelligent Process Monitoring for improved product quality and performance.

| | | |
|---|---|---|
| n) Has the company introduced any significant improvements to **machines** and / or **processes** since 1996? | **Yes** | **No** |
| o) If Yes, How many? | | |
| p) q) Approximate % share of total company turnover represented by these over the last 3 years | | |
| Last Year % | Previous Year % | Year before last % |

### 3.5 Existing Products / Processes applied to New Customers and Markets:

Introduction of existing products / processes to a new market. E.g. injection moulding for small-scale clarinets for children and plastic jug kettles.

| | | |
|---|---|---|
| h) Has the company introduced and applied **existing products/processes to new markets** between 1996 and 1999? | **Yes** | **No** |
| i) If Yes, How many? | | |
| j) Approximate % share of total company turnover represented by these over the last 3 years | | |
| Last Year % | Previous Year % | Year before last % |

### 3.6 Innovation through Business Acquisition:

Has the company acquired another business in the last three years for these reasons?

| | | |
|---|---|---|
| q) Either to acquire innovative products range | **Yes** | **No** |
| r) Or Acquire process technology and know- how? | **Yes** | **No** |
| s) Unrelated to innovation needs | **Yes** | **No** |
| t) Give broad reason for Acquisition(s) | | |
| u) Approximate % share of total company turnover represented by the acquisition(s) in q and r above | | |
| Last Year % | Previous Year % | Year before last % |

## SECTION 4: MANAGEMENT PRACTICES

**PRACTICES TO ASSIST IN INNOVATION:** Established SME's generally do not have the same level of resources to do their own R&D for innovation as in larger companies. This section is designed to identify the ways in which you find information, access resources (finance, equipment, people, time) and share these with others to achieve product and process innovation.

**4.1 External sensing and environment scanning:** How often do employees including directors do any of the following during a year? Give an average annual figure.

| | | |
|---|---|---|
| a) | Attend external training and development programmes | |
| b) | Visit organisations involved in Industry relevant research (PIRA / RAPRA) | |
| c) | Attend external meetings of a Trade Body or Association (BPF) | |
| d) | Travel to meet suppliers on their premises | |
| f) | Attend trade shows, conferences and exhibitions | |
| g) | Associate with other employers in the local community | |
| h) | Travel to meet customers on their premises | |
| i) | Request Technical details from outside sources | |

**4.2 External Contact.** How often does the company consult any of the following for purposes related to innovation? Give an average annual figure.

| | | |
|---|---|---|
| a) | Academics / Universities | |
| b) | Customers | |
| c) | Raw Material Suppliers | |
| d) | Machine and Tool Makers | |
| e) | Agencies such as TEC's and Business Links | |
| f) | PIRA, RAPRA or Commercial Research organisation | |
| e) | External Market Research Sources | |
| f) | Production Subcontractors | |
| g) | Recruitment and selection consultants | |
| h) | Potential further Sources of Finance | |
| I) | Training and Development Organisations | |
| j) | Other specify | |

**4.3 Reasons** for consulting any of these may have been some of the factors below. Please rate the importance of these to the company by circling a number closest to your opinion

| *External Contact Motivation* | | Not at all Important | | Neutral | | Very Important |
|---|---|---|---|---|---|---|
| a) | Looking for ideas and opportunities | 1 | 2 | 3 | 4 | 5 |
| b) | Lack of own dedicated R & D resources | 1 | 2 | 3 | 4 | 5 |
| c) | Trying to save time | 1 | 2 | 3 | 4 | 5 |
| d) | Solving a problem | 1 | 2 | 3 | 4 | 5 |
| e) | Trying to find new resources (people, money, equipment) | 1 | 2 | 3 | 4 | 5 |
| f) | Minimise risk | 1 | 2 | 3 | 4 | 5 |
| g) | Cost reduction | 1 | 2 | 3 | 4 | 5 |
| h) | Response to competitor action | 1 | 2 | 3 | 4 | 5 |
| i) | Specific information gathering | 1 | 2 | 3 | 4 | 5 |
| j) | Lack of internal resources for a task | 1 | 2 | 3 | 4 | 5 |
| k) | Other (specify) | 1 | 2 | 3 | 4 | 5 |

**4.4 Planning and Control:** Please circle on a scale of 1 to 5 the extent to which you agree or disagree with these statements as far as your company is concerned

| | | Strongly Disagree | | Neither Agree or Disagree | | Agree Strongly |
|---|---|---|---|---|---|---|
| a) | Directors meet informally to discuss and plan future strategy | 1 | 2 | 3 | 4 | 5 |
| b) | Strategy discussion tends to take place only at board meetings | 1 | 2 | 3 | 4 | 5 |
| c) | It is sometimes difficult to find time to work out and set long term objectives for the business | 1 | 2 | 3 | 4 | 5 |
| d) | A formal strategy set out in a written business plan is essential | 1 | 2 | 3 | 4 | 5 |
| e) | Strategy is informally amended according to circumstances during the year. | 1 | 2 | 3 | 4 | 5 |
| f) | Production and day to day decisions often push strategic planning and review into second place | 1 | 2 | 3 | 4 | 5 |
| g) | Getting information on material usage and labour is difficult | 1 | 2 | 3 | 4 | 5 |
| h) | Three year financial forecasts should be made every year (Cash Flow, Profit and Loss, Balance Sheets) | 1 | 2 | 3 | 4 | 5 |
| i) | A Business Plan is only necessary for the bank and other sources of funds | 1 | 2 | 3 | 4 | 5 |
| j) | Sales and Production levels and efficiency are regularly reviewed against plans. | 1 | 2 | 3 | 4 | 5 |
| k) | A set annual routine for strategic planning for setting long term business objectives and performance is necessary | 1 | 2 | 3 | 4 | 5 |
| l) | Progress on achieving current business strategic objectives is regularly reviewed at board meetings. | 1 | 2 | 3 | 4 | 5 |
| m) | The Company reviews its activities continuously at management meetings and has no set planning routine | 1 | 2 | 3 | 4 | 5 |
| n) | An internal business plan covering products and markets, production and finance is carried out each year | 1 | 2 | 3 | 4 | 5 |

**4.5 Development Work:** Please circle on a scale of 1 to 5 the extent to which you agree or disagree with statement as far as your company is concerned

| | | Strongly Disagree | | Neither Agree or Disagree | | Agree Strongly |
|---|---|---|---|---|---|---|
| a) | A Research and Development department is needed to develop new products and processes. | 1 | 2 | 3 | 4 | 5 |
| b) | Suggestions about how to do things better are always examined | 1 | 2 | 3 | 4 | 5 |
| c) | We encourage and reward individuals who put forward and pursue innovative ideas for products or processes | 1 | 2 | 3 | 4 | 5 |
| d) | Everyone in the business tends to work together to develop new opportunities | 1 | 2 | 3 | 4 | 5 |
| e) | Directors are responsible for pursuing new ideas and opportunities | 1 | 2 | 3 | 4 | 5 |
| f) | Day to day work gets in the way of development work | 1 | 2 | 3 | 4 | 5 |

## APPENDIX 2 SPSS VARIABLE CALCULATION

### 2.1 Entrepreneurial component Information Seeking and Sharing

| | Transformation / Calculation | Score Max | Min | Score Min & Max + Mean |
|---|---|---|---|---|
| **Entrepreneurial Component ISS** | Total Summated Scales for Communication Climate (totcom)+ Development Work (totdev)<br>**Total** | 10<br>6<br>**16** | 50<br>30<br>**80** | **34 - 69**<br>**55.3** Mean |
| **Entrepreneurial Component RA** | Sum of :-<br>1) External Sensing count per annum (exsens) divided by firm size<br>2) Innovation contact count per annum (innocon) divided by firm size<br>3) Summated Scale - Reasons for contacting (reas)<br>**Total** | na<br><br>na<br><br>55 | na<br><br>na<br><br>11· | **1 – 113**<br>**42.7** Mean |
| **Entrepreneurial Component RR** | Sum of Scores allocated as follows:-<br>**1) Board Score**<br>Executive Director = 10 each<br>Non Executive Director = 20 each<br>**2) Score for Directorial Shareholding** composition (shadirsc) = Number of Executive Directors holding shares x 20 each + number of non executive directors x 10 each<br>**3) Shareholder Types additions**<br>Family = 0 each<br>Founder = 0 since may already be counted in executive / non executive score<br>Corporate = 20 each<br>Financial Institution = 20 each<br>Individual Private Investor = 20 each<br>Miscellaneous = 0<br>**4) Director Incentive Scheme**<br>Share Purchase Scheme = 20 each<br>Profit Share = 10 each<br>Incentive bonus based on profit share = 5 each<br>Straight negotiated salary increase = less 20<br><br>**Total** | | | **(10) – 265**<br>**93** Mean |
| **Entrepreneurial Component Decision Making** | Sum of :-<br>**1) Planning Scale** (totplanc)<br>**2) Board Meeting Score** (bdscore) 4 x each board meeting<br>**Total** | | | **22 – 242**<br>**73.3** Mean |
| **Entrepreneurial Capability Score Method One** | Sum of the above entrepreneurial components | | | **128 – 443**<br>**265** Mean |

**2.2. Innovation** totino, radino, incino.

The innovation data is a straight count as reported by the directors in the Schumpterian categories and classified as incremental or radical as shown in the table below.

| Innovation Category | Incremental | Major / Radical |
|---|---|---|
| Questionnaire Item Number | 3.2 Minor Innovative Product Improvement<br>3.5 Minor Innovative Process Improvement | 3.1 New Product / New Market<br>3.4 New Processes / New Customers or Markets<br>3.3 New applications of product or process to customer / market |

**2.3 Firm Performance**

**Sales Growth:**

Sales figures were collected for four years from 1996 through to 1999. Sales growth for three years was calculated and divided by three to obtain and average sales growth figure.

**Employment Growth:**

Employment figures for full and part time employees were collected for four years from 1996 through to 1999. Part timers were converted into the full time equivalents by dividing the figure in two for each year. This was then added to the full time figure for the year and all years summed. The total employment was divided by three to obtain an average sales growth figure.

**2.4 Moderators**

**Firm Size:** totemp99

Firm size was taken from the 1999 total employment figure.

**Board Size:** totnodir

Board size was taken from the total number of directors, executive and non executive reported.

## APPENDIX 3: DATA DESCRIPTION FIRM PROFILE

## Introduction

Exploratory descriptive detail of the firm profile data and the variables are created for use in the analysis are not set out in the appendicess 3 to 7; Firm Profile , Human Capital , Innovation , Entrepreneurial Capability Score and Firm Performance.

### 3. Firm Profile

Of the 96 responding firms 84 completed the employment size detail. In 1999 the largest firm employed 493 and the smallest 5. The firms in the sample changed in employment size quite markedly with some becoming much larger and others shrinking considerably. Firms that started out meeting the criteria but did not finish doing so were included along with some firms that had achieved employment over 50 in 1999. The histograms in figures 1 & 3 show the profile change between 1996 and 1999

### 3.1 Firm Size

**Table 1: Firm Descriptive Statistics**

Total employment F/T + P/T for 1999

| | | |
|---|---|---|
| N | Valid | 85 |
| | Missing | 8 |
| Mean | | 73.14 |
| Median | | 43.50 |
| Mode | | 34[a] |
| Std. Deviation | | 91.091 |
| Range | | 493 |
| Minimum | | 15 |
| Maximum | | 498 |
| Sum | | 6217 |

a. Multiple modes exist. The smallest value is shown

**Figure 1: Firm Size Profile**

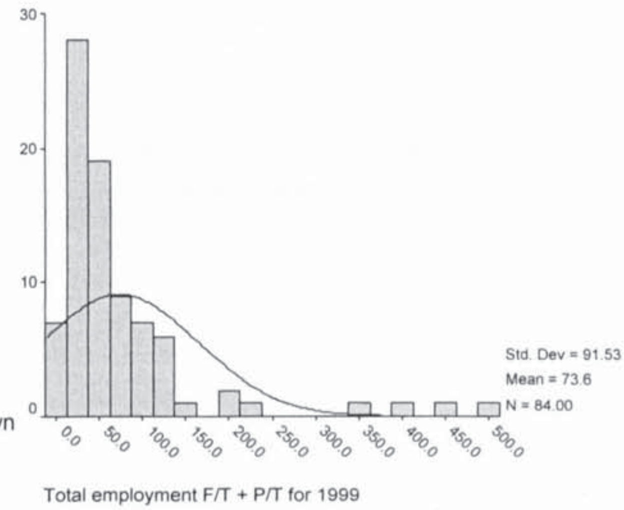
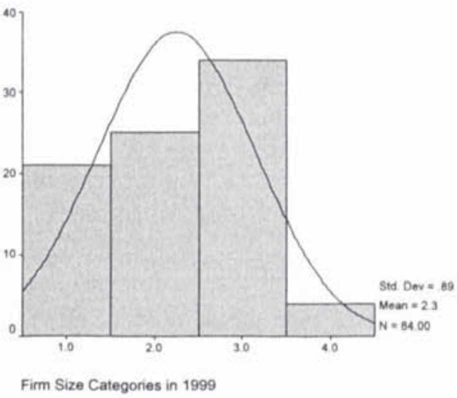
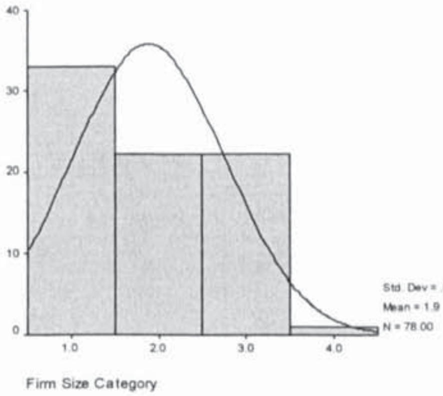



**Figure 2: Firm Size Category in 1999**




Key 1 = 1-24 employees, 2 = 25 – 49 3 = 50 - 259 4 = 250 – 500

**Figure 3: Firm Size Categories in 1996**



## 3.2 Firm Age Profile

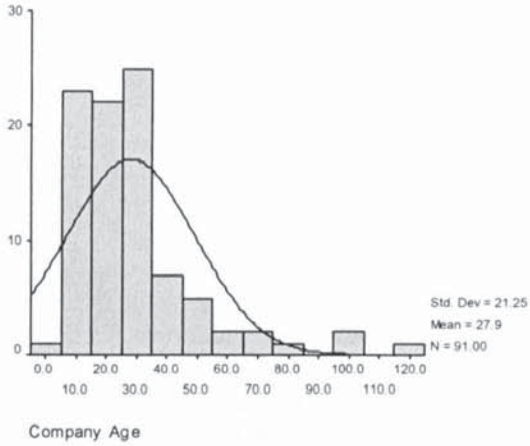
The oldest firm in the sample was established in 1879, 117 yrs old. The mean age of firms in the sample was 27.93 years with a median of 24 and the most common occurring firm age is 10 years.

**Table 2: Descriptive Statistics Company Age**

Company Age

| | | |
|---|---|---|
| N | Valid | 91 |
| | Missing | 2 |
| Mean | | 27.93 |
| Median | | 24.00 |
| Mode | | 10 |
| Std. Deviation | | 21.247 |
| Range | | 117 |
| Minimum | | 5 |
| Maximum | | 121 |
| Sum | | 2542 |

**Figure 4 Firm Age Profile**

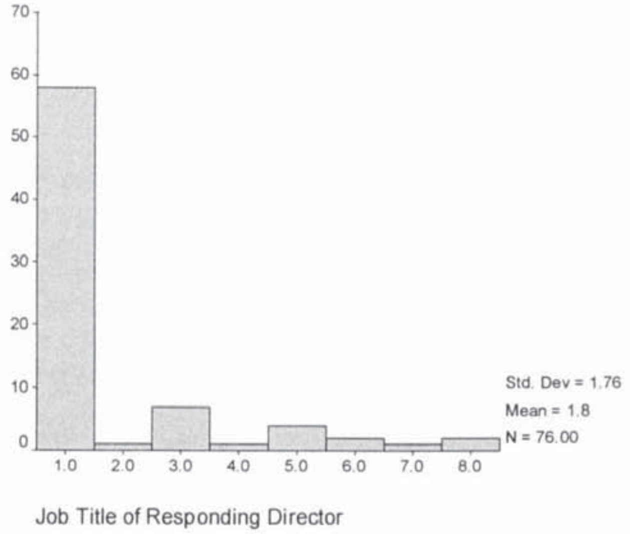



**Status:** Of the 96 firms who responded, 91 were independent firms with 5 subsidiaries replying to the injection moulding industry questionnaire were they could not be distinguished between independent and subsidiary.

## APPENDIX 4: HUMAN CAPITAL - BOARD OF DIRECTORS DATA DESCRIPTION

**4.1 Respondent Director Job Title:** Of the 76 respondents who gave job titles the largest responding category were the Managing Directors (1) at 57 (59.4%) of the total with the next largest category of 7 (3) Operations directors. The questionnaire asked for title of Director completing the questionnaire rather than job title, which might have obtained more correct responses.

**Figure 5: Respondent Director by Job Title**




Key: 1 = Managing Director, 2 = Chairman, 3 = Operations Director, 4 = Technical Director, 5 = Marketing Director, 6 = Technical Director 7 = Financial Director, 8 = Company Secretary.

## 4.2 Director Numbers

The firm sample represented 354 directors across both executive and non executive roles with an average of 3.81, median of 4 and mode of 3 directors. The largest board was composed of ten members with three firms claiming an 'illegal' single director for limited liability companies when two are required.

**Table 3: Total Director Profile**

**Statistics**

Total Number of Directors

| | | |
|---|---|---|
| N | Valid | 93 |
| | Missing | 0 |
| Mean | | 3.81 |
| Median | | 4.00 |
| Mode | | 3 |
| Range | | 9 |
| Minimum | | 1 |
| Maximum | | 10 |
| Sum | | 354 |

**Figure 6 Board Size Distribution**

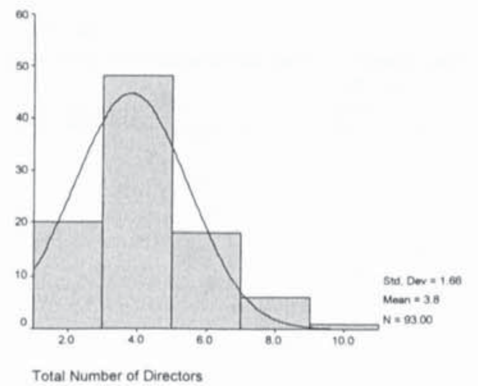


**Table 4: Frequency of Board Size / All Directors including executive and non executive.**

**Total Number of Directors**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | 1 | 3 | 3.2 | 3.2 | 3.2 |
| | 2 | 17 | 18.3 | 18.3 | 21.5 |
| | 3 | 25 | 26.9 | 26.9 | 48.4 |
| | 4 | 23 | 24.7 | 24.7 | 73.1 |
| | 5 | 11 | 11.8 | 11.8 | 84.9 |
| | 6 | 7 | 7.5 | 7.5 | 92.5 |
| | 7 | 5 | 5.4 | 5.4 | 97.8 |
| | 8 | 1 | 1.1 | 1.1 | 98.9 |
| | 10 | 1 | 1.1 | 1.1 | 100.0 |
| | Total | 93 | 100.0 | 100.0 | |

Of the Directors present in the sample firms, 271 (77%) are executive directors and 83 ( 23%) non executive directors. The most frequently encountered board size is three and four directors respectively at 26.9% and 24.7% of the total respectively. 18% of firms only possessed two directors. 49.5% of Boards in the sample had no non executive board members. Of the balance 26.9% had only one non executive director 15.1% 2 non executive directors. There were 83 non executive directors in 47 firms in the sample.

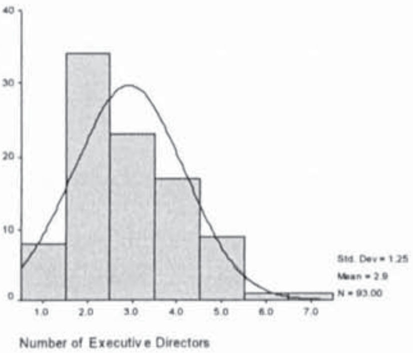
**Table 5 Executive Directors**

**Statistics**

Number of Executive Directors

| | | |
|---|---|---|
| N | Valid | 93 |
| | Missing | 0 |
| Mean | | 2.91 |
| Median | | 3.00 |
| Mode | | 2 |
| Range | | 6 |
| Minimum | | 1 |
| Maximum | | 7 |
| Sum | | 271 |

**Figure 7 Distribution Executive Directors**




## 4.3 Frequency of Executive Board Size:

**Table 6: Executive Directors**

**Number of Executive Directors**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | 1 | 8 | 8.6 | 8.6 | 8.6 |
| | 2 | 34 | 36.6 | 36.6 | 45.2 |
| | 3 | 23 | 24.7 | 24.7 | 69.9 |
| | 4 | 17 | 18.3 | 18.3 | 88.2 |
| | 5 | 9 | 9.7 | 9.7 | 97.8 |
| | 6 | 1 | 1.1 | 1.1 | 98.9 |
| | 7 | 1 | 1.1 | 1.1 | 100.0 |
| | Total | 93 | 100.0 | 100.0 | |

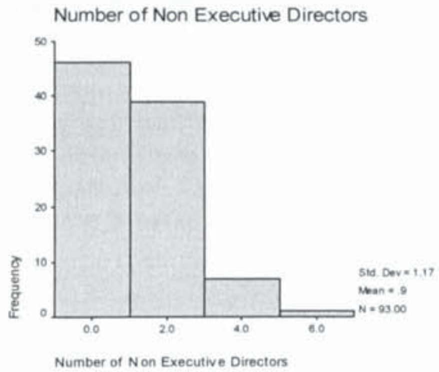
**Table 7 Non Executive Directors**

**Statistics**

Number of Non Executive Directors

| | | |
|---|---|---|
| N | Valid | 93 |
| | Missing | 0 |
| Mean | | .89 |
| Median | | 1.00 |
| Mode | | 0 |
| Range | | 6 |
| Minimum | | 0 |
| Maximum | | 6 |

**Figure 8 Distribution of Non executive Directors**




## Table 8: Frequency of Non Executive Directors on Firm Boards

**Number of Non Executive Directors**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | 0 | 46 | 49.5 | 49.5 | 49.5 |
| | 1 | 25 | 26.9 | 26.9 | 76.3 |
| | 2 | 14 | 15.1 | 15.1 | 91.4 |
| | 3 | 4 | 4.3 | 4.3 | 95.7 |
| | 4 | 3 | 3.2 | 3.2 | 98.9 |
| | 6 | 1 | 1.1 | 1.1 | 100.0 |
| | Total | 93 | 100.0 | 100.0 | |

## 4. 6 Director Age

### 4.6.1 Table 9: Summary Total Number Directors by Age Category across all firms

| Director Age Category | 25/35 | 36/45 | 46/50 | 51/55 | 56/60 | 60+ | Total Directors |
|---|---|---|---|---|---|---|---|
| *Executive* | 23 | 50 | 48 | 76 | 46 | 28 | 271 |
| **Non Executive Directors** | 5 | 11 | 12 | 18 | 17 | 20 | 83 |
| **Total** | **28** | **61** | **60** | **94** | **63** | **48** | **354** |
| **Percentage of Total** | 7.9 | 17.2 | 16.9 | 26.6 | 17.8 | 13.6 | 100 |

Director age over all firms peaks in the 51/55 age category and is distributed normally over all the ages when taken together. The age spread for the non executive directors is perhaps unexpectedly evenly spread. The youngest category nor surprisingly has the least board representation. Some of this number may also be accounted for by the inclusion of family board members. However when mean non executive board age is considered the presence of non executive directors causes the mean age distribution to shift upwards.

### 4.6.2 Mean Board Age

The descriptive statistics and histograms below show the mean age distribution for each board of directors: executive and non executive. The board age profile for executive directors has an approximately normal distribution with two age peaks. The non executive board membership age when taken together shows the sample to contain some firms with considerably older mean non executive board member age. This could be selection of older individuals for their experience and wisdom or alternatively it seems likely that for this sample of independent firms founders have remained with the board after a late retirement, causing the mean figure to rise. The suggestion of late retirement stems from the marked absence of numbers in the previous age category. Mean Board Age for all Boards has been used for the multivariate analysis since it better meets the underlying assumptions due to the normal distribution.

**Table 10: Mean Executive Board Age**

**Statistics**

Executive Director Mean cAge

| | | |
|---|---|---|
| N | Valid | 91 |
| | Missing | 2 |
| Mean | | 50.2665 |
| Median | | 50.0000 |
| Mode | | 55.00 |
| Range | | 32.50 |
| Minimum | | 35.00 |
| Maximum | | 67.50 |

**Figure 9 Distribution Executive Board Age**

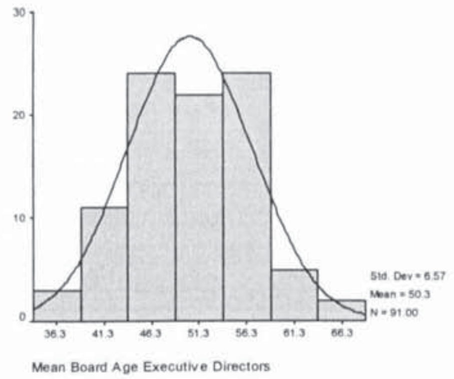



**Table 11: Mean Non Executive Board Age**

**Statistics**

Non Executive Director Mean cAge

| | | |
|---|---|---|
| N | Valid | 43 |
| | Missing | 50 |
| Mean | | 54.5010 |
| Median | | 52.5000 |
| Mode | | 67.50 |
| Range | | 32.50 |
| Minimum | | 35.00 |
| Maximum | | 67.50 |

**Figure 10: Distribution Mean Non Executive Board Age**

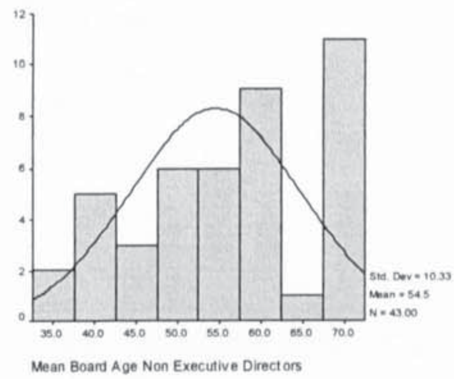


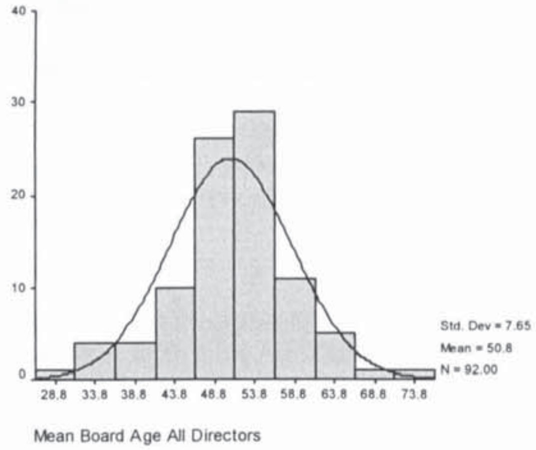
**Table 12 Mean Board Age: Executive and Non Executive Directors**

**Statistics**

Mean of all Director cAges

| | | |
|---|---|---|
| N | Valid | 92 |
| | Missing | 1 |
| Mean | | 50.76 |
| Median | | 51.25 |
| Mode | | 55 |
| Range | | 47 |
| Minimum | | 27 |
| Maximum | | 74 |

**Figure 11: Distribution of Mean Board Age All Directors**




## 4.7. Director and Board Service Length

**Table 13: Director Service Length Profile / all Directors**

| Director | Less than 2 Years | 2/5 Years | 6/10 Years | 11/15 Years | 16/20 Years | 21+ Years | Total |
|---|---|---|---|---|---|---|---|
| **Total** | 18 | 42 | 84 | 70 | 37 | 93 | 344 |
| **%** | 5.2 | 12.2 | 24.4 | 20.3 | 10.8 | 27.1 | 100 |

The time served by all directors, executive and non executive, shows a peak in the over 21 year category. This reflects the age profile of the non executive directors, highlighting potential multicollinearity with age.

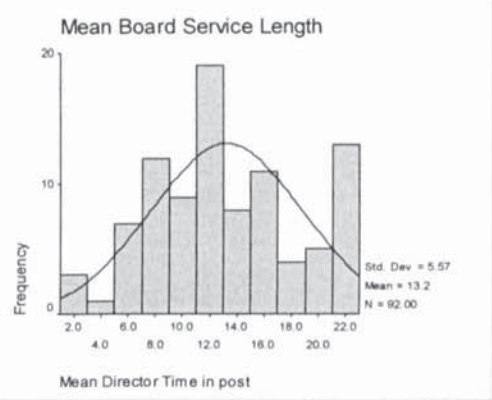
**Table 14: Mean Board / Director Service Length: All Directors**

**Statistics**

Mean Director cTime in post

| | | |
|---|---|---|
| N | Valid | 92 |
| | Missing | 1 |
| Mean | | 13.21 |
| Median | | 12.50 |
| Mode | | 23 |
| Range | | 22 |

**Figure 12 Distribution of mean board service length**




## 4.8. Board Education Level

The educational level scores using a score of 1 for each year of education towards and exam qualification as previously described shows that the attainment levels are relatively low at a mean of 6.98. The most commonly occurring level of education is 6. This represents the total education score for all board members divided by the number of directors on the board. The distribution is skewed towards a significant percentage of boards 23% possessing little or no educational qualifications at all with the highest score at 20 where a board of two directors possessed both accounting qualifications and undergraduate degrees. The frequency table 2 shows the exact detail.

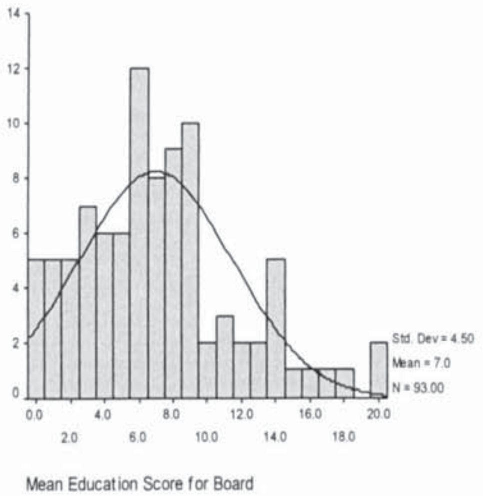
A score of 4 or below means that the board members have a maximum educational qualifications than the equivalent of GSCE's / GCE's at O and A Level. A score of 7 can mean that the board is educated up to first degree level. 50% of the sample boards had score below this. A score of seven and beyond indicates the presence of additional qualifications either at Masters or doctoral level but mot commonly an accounting qualification.

**Table 15: Mean Board Education Score for All Directors**

Mean Education Score for Board

| | | |
|---|---|---|
| N | Valid | 93 |
| | Missing | 0 |
| Mean | | 6.98 |
| Median | | 6.50 |
| Mode | | 6 |
| Std. Deviation | | 4.503 |
| Range | | 20 |
| Minimum | | 0 |
| Maximum | | 20 |

**Figure 13: Distribution Mean Board Education Score for All Directors**



## Table 16: Education Score Frequency

**Table 3: Frequency Table Mean Education Score for Board**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | 0 | 5 | 5 4 | 5.4 | 5.4 |
| | 1 | 1 | 1.1 | 1.1 | 6 5 |
| | 1 | 1 | 1.1 | 1.1 | 7.5 |
| | 1 | 3 | 3.2 | 3.2 | 10.8 |
| | 2 | 1 | 1.1 | 1.1 | 11.8 |
| | 2 | 1 | 1.1 | 1.1 | 12.9 |
| | 2 | 3 | 3.2 | 3.2 | 16.1 |
| | 3 | 2 | 2.2 | 2.2 | 18.3 |
| | 3 | 2 | 2.2 | 2.2 | 20.4 |
| | 3 | 2 | 2.2 | 2.2 | 22.6 |
| | 3 | 1 | 1.1 | 1.1 | 23.7 |
| | 4 | 2 | 2.2 | 2.2 | 25.8 |
| | 4 | 2 | 2.2 | 2.2 | 28.0 |
| | 4 | 1 | 1.1 | 1.1 | 29.0 |
| | 4 | 1 | 1.1 | 1.1 | 30.1 |
| | 5 | 1 | 1.1 | 1.1 | 31.2 |
| | 5 | 1 | 1.1 | 1.1 | 32.3 |
| | 5 | 2 | 2.2 | 2.2 | 34.4 |
| | 5 | 1 | 1.1 | 1.1 | 35.5 |
| | 5 | 1 | 1.1 | 1.1 | 36 6 |
| | 6 | 1 | 1.1 | 1.1 | 37.6 |
| | 6 | 6 | 6.5 | 6 5 | 44.1 |
| | 6 | 1 | 1.1 | 1.1 | 45.2 |
| | 6 | 1 | 1.1 | 1.1 | 46.2 |
| | 6 | 1 | 1.1 | 1.1 | 47.3 |
| | 6 | 2 | 2.2 | 2.2 | 49.5 |
| | 7 | 1 | 1.1 | 1.1 | 50.5 |
| | 7 | 1 | 1.1 | 1.1 | 51.6 |
| | 7 | 1 | 1.1 | 1.1 | 52.7 |
| | 7 | 3 | 3.2 | 3.2 | 55.9 |
| | 7 | 2 | 2.2 | 2.2 | 58.1 |
| | 8 | 2 | 2.2 | 2 2 | 60.2 |
| | 8 | 2 | 2.2 | 2.2 | 62.4 |
| | 8 | 1 | 1.1 | 1.1 | 63.4 |
| | 8 | 1 | 1.1 | 1.1 | 64.5 |
| | 8 | 1 | 1.1 | 1.1 | 65.6 |
| | 8 | 2 | 2.2 | 2.2 | 67.7 |
| | 9 | 1 | 1.1 | 1.1 | 68.8 |
| | 9 | 4 | 4.3 | 4.3 | 73.1 |
| | 9 | 1 | 1.1 | 1.1 | 74.2 |
| | 9 | 1 | 1.1 | 1.1 | 75.3 |
| | 9 | 2 | 2 2 | 2.2 | 77.4 |
| | 9 | 1 | 1.1 | 1.1 | 78 5 |
| | 10 | 1 | 1.1 | 1.1 | 79.6 |
| | 10 | 1 | 1.1 | 1.1 | 80.6 |
| | 11 | 1 | 1.1 | 1.1 | 81.7 |
| | 11 | 1 | 1.1 | 1.1 | 82.8 |
| | 11 | 1 | 1.1 | 1.1 | 83 9 |
| | 12 | 1 | 1.1 | 1.1 | 84.9 |
| | 12 | 1 | 1.1 | 1.1 | 86.0 |
| | 13 | 1 | 1.1 | 1.1 | 87.1 |
| | 13 | 1 | 1.1 | 1.1 | 88.2 |
| | 14 | 1 | 1.1 | 1.1 | 89.2 |
| | 14 | 1 | 1.1 | 1.1 | 90.3 |
| | 14 | 1 | 1.1 | 1.1 | 91.4 |
| | 14 | 1 | 1.1 | 1.1 | 92.5 |
| | 14 | 1 | 1.1 | 1.1 | 93.5 |
| | 15 | 1 | 1.1 | 1.1 | 94.6 |
| | 16 | 1 | 1.1 | 1.1 | 95.7 |
| | 17 | 1 | 1.1 | 1.1 | 96.8 |
| | 18 | 1 | 1.1 | 1.1 | 97.8 |
| | 20 | 2 | 2.2 | 2.2 | 100.0 |
| | Total | 93 | 100 0 | 100 0 | |

## APPENDIX 5: INNOVATION DATA DESCRIPTION

**Table 17: Innovation type present in sample Firms**

| Innovation category | Number of Firms Zero Innovation | % | Number of Firms Innovation Present | % | Total Case s |
|---|---|---|---|---|---|
| | | | | | |
| New Product New Mkt | 34 | 37 | 59 | | 93 |
| New Process Innovation | 61 | 57 | 32 | | 93 |
| Innovative Product Imp. | 55 | 51 | 38 | | 93 |
| Innovative Process Imp. | 52 | 48 | 41 | | 93 |
| Existing product new Mkt | 49 | 46 | 44 | | 93 |
| Incremental Innovation | 24 | 22 | 58 | | 93 |
| Radical Innovation | 24 | 22 | 58 | | 93 |
| Zero Innovation | 11 | 10 | 82 | | 93 |

Consideration of the type of innovation present in the sample firms reveals that new product innovation to new markets as the most popular form of innovation. The small percentage of radical process innovation at 32% is perhaps surprising since there is considerable scope for the introduction of new technology across the industry. See Chapter 3. Caution is required since it is not possible to gauge the impact of such innovation from a simple count. It is possible that a single innovation in this category may have a proportionally greater. It may also be possible that this form of innovation is more difficult for established independent small and medium sized enterprises during times of poor economics performance as seems to be the case for many of the firms in the sample.

The Incremental and Radical innovation counts are split evenly with only 11 firms undertaking no innovation at all.

**Table 18: Descriptive Statistics Firm Innovation New products to New Markets**

**Statistics**

New Product Innovations to New Markets

| | | |
|---|---|---|
| N | Valid | 93 |
| | Missing | 0 |
| Mean | | 4.88 |
| Median | | 2.00 |
| Mode | | 0 |
| Std. Deviation | | 7.695 |
| Range | | 30 |
| Minimum | | 0 |
| Maximum | | 30 |
| Sum | | 454 |

**Figure 14: Distribution of Firm Innovation New Products to New Markets**

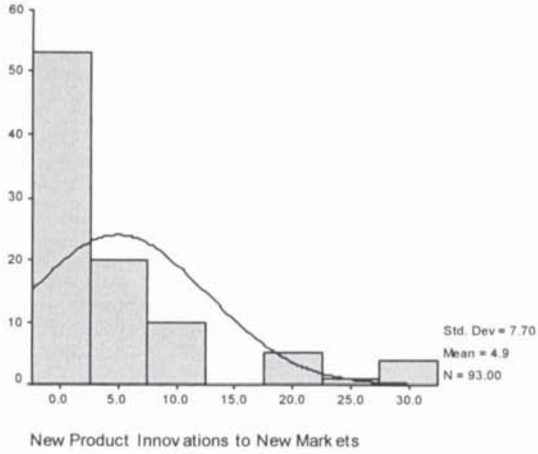



**Table 19: Descriptive Statistics Firm Innovation New Process Intro.**

**Statistics**

New Process Innovations

| | | |
|---|---|---|
| N | Valid | 93 |
| | Missing | 0 |
| Mean | | 1.14 |
| Median | | .00 |
| Mode | | 0 |
| Std. Deviation | | 2.980 |
| Range | | 20 |
| Minimum | | 0 |
| Maximum | | 20 |
| Sum | | 106 |

**Figure 15: Distribution of Firm Innovation New Process Introduction**

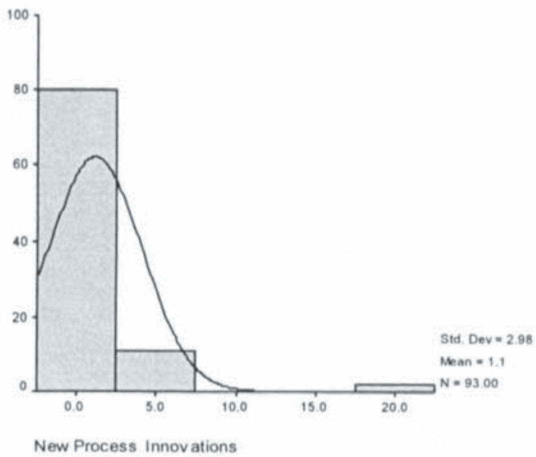



**Table 20: Total Radical Innovation / New Products +Process Innovation**

Total Number of Radical Innovations

| | | |
|---|---|---|
| N | Valid | 93 |
| | Missing | 0 |
| Mean | | 6.02 |
| Median | | 2.00 |
| Mode | | 0 |
| Std. Deviation | | 8.382 |
| Range | | 30 |
| Minimum | | 0 |
| Maximum | | 30 |
| Sum | | 560 |

**Figure 16: Distribution of Firm Total Radical Innovations New Product and Process Innovation**

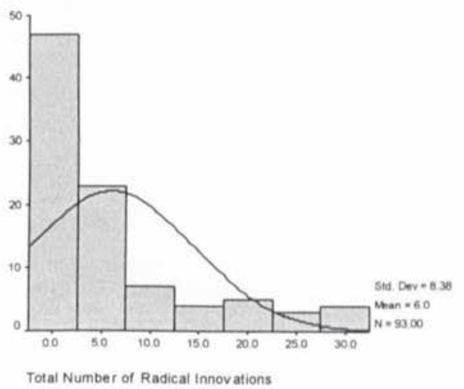


**Table 21: Firm Innovative Product Improvement**

Innovative Product Improvements

| | | |
|---|---|---|
| N | Valid | 93 |
| | Missing | 0 |
| Mean | | 1.44 |
| Median | | .00 |
| Mode | | 0 |
| Std. Deviation | | 2.849 |
| Range | | 19 |
| Minimum | | 0 |
| Maximum | | 19 |
| Sum | | 134 |

**Figure 17: Distribution Firm Innovative Product Improvement**

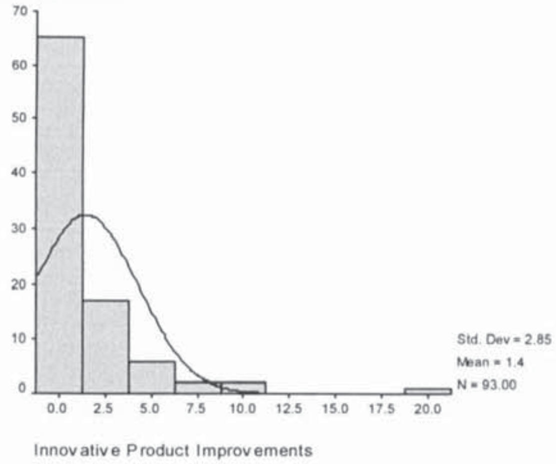



**Table 22: Descriptive Statistics Firm Innovative Process Improvements**

Innovative Process Improvments

| | | |
|---|---|---|
| N | Valid | 93 |
| | Missing | 0 |
| Mean | | 1.56 |
| Median | | .00 |
| Mode | | 0 |
| Std. Deviation | | 2.648 |
| Range | | 10 |
| Minimum | | 0 |
| Maximum | | 10 |
| Sum | | 145 |

**Figure 18: Distribution Firm Innovative Process Improvements**

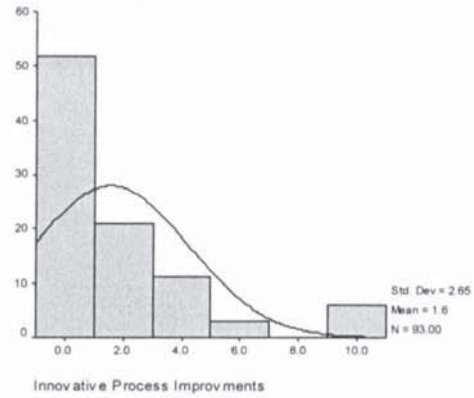



**Table 23: Descriptive Statistics Innovation Applications of Existing products to New Markets**

Innovative Applications of Existing Products to New

| | | |
|---|---|---|
| N | Valid | 92 |
| | Missing | 1 |
| Mean | | 1.51 |
| Median | | .00 |
| Mode | | 0 |
| Std. Deviation | | 2.830 |
| Range | | 20 |
| Minimum | | 0 |
| Maximum | | 20 |
| Sum | | 139 |

**Figure 19: Distribution Innovation Applications of Existing products to New Markets**

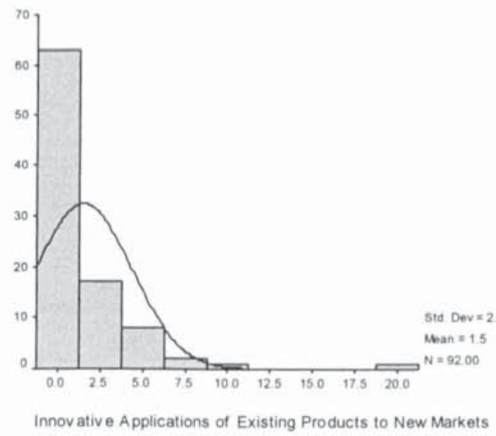


**Table 24: Descriptive Statistics Total Incremental Innovation (Product/, Process Improvements/ New Mkt**

Total Number of Incremental Innovations

| | | |
|---|---|---|
| N | Valid | 92 |
| | Missing | 1 |
| Mean | | 4.52 |
| Median | | 3.00 |
| Mode | | 0 |
| Std. Deviation | | 5.292 |
| Range | | 22 |
| Minimum | | 0 |
| Maximum | | 22 |
| Sum | | 416 |

**Figure 20: Distribution Total Incremental Innovation ( Product, Process Improvements + new market applications)**

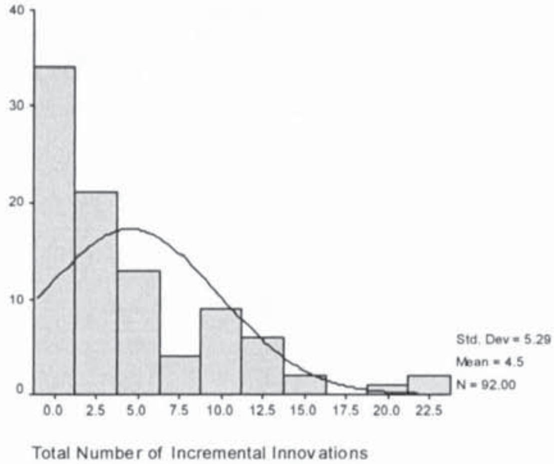



**Table 25 : Descriptive Statistics Total Innovation / Incremental and Radical innovation combined**

Total Number of Product and Process Innovati

| | | |
|---|---|---|
| N | Valid | 92 |
| | Missing | 1 |
| Mean | | 10.58 |
| Median | | 7.50 |
| Mode | | 0[a] |
| Std. Deviation | | 10.920 |
| Range | | 47 |
| Minimum | | 0 |
| Maximum | | 47 |
| Sum | | 973 |

a. Multiple modes exist. The smallest value is showı

**Figure 21: Distribution Total Innovation / Incremental and Radical innovation combined**

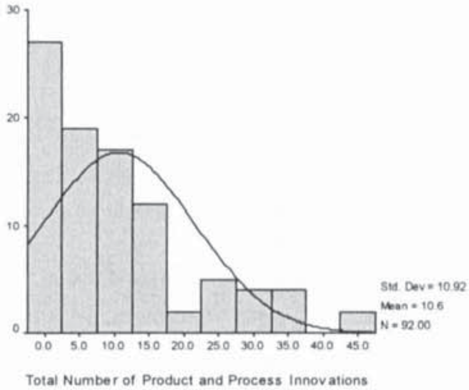


**Table 26: Frequency Table Total Innovation / Incremental and Radical Innovation combined**

**Total Number of Product and Process Innovations**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | 0 | 11 | 11.8 | 12.0 | 12.0 |
| | 1 | 5 | 5.4 | 5.4 | 17.4 |
| | 2 | 11 | 11.8 | 12.0 | 29.3 |
| | 3 | 5 | 5.4 | 5.4 | 34.8 |
| | 4 | 4 | 4.3 | 4.3 | 39.1 |
| | 5 | 3 | 3.2 | 3.3 | 42.4 |
| | 6 | 5 | 5.4 | 5.4 | 47.8 |
| | 7 | 2 | 2.2 | 2.2 | 50.0 |
| | 8 | 4 | 4.3 | 4.3 | 54.3 |
| | 9 | 2 | 2.2 | 2.2 | 56.5 |
| | 10 | 4 | 4.3 | 4.3 | 60.9 |
| | 11 | 3 | 3.2 | 3.3 | 64.1 |
| | 12 | 4 | 4.3 | 4.3 | 68.5 |
| | 13 | 6 | 6.5 | 6.5 | 75.0 |
| | 14 | 1 | 1.1 | 1.1 | 76.1 |
| | 15 | 3 | 3.2 | 3.3 | 79.3 |
| | 16 | 1 | 1.1 | 1.1 | 80.4 |
| | 17 | 1 | 1.1 | 1.1 | 81.5 |
| | 22 | 2 | 2.2 | 2.2 | 83.7 |
| | 24 | 3 | 3.2 | 3.3 | 87.0 |
| | 25 | 2 | 2.2 | 2.2 | 89.1 |
| | 28 | 1 | 1.1 | 1.1 | 90.2 |
| | 30 | 1 | 1.1 | 1.1 | 91.3 |
| | 31 | 1 | 1.1 | 1.1 | 92.4 |
| | 32 | 1 | 1.1 | 1.1 | 93.5 |
| | 33 | 1 | 1.1 | 1.1 | 94.6 |
| | 34 | 2 | 2.2 | 2.2 | 96.7 |
| | 37 | 1 | 1.1 | 1.1 | 97.8 |
| | 43 | 1 | 1.1 | 1.1 | 98.9 |
| | 47 | 1 | 1.1 | 1.1 | 100.0 |
| | Total | 92 | 98.9 | 100.0 | |
| Missing | System | 1 | 1.1 | | |
| Total | | 93 | 100.0 | | |

## 1 Innovation Count

All 93 cases used possessed innovation data even if there was a nil return. The actual counts are shown in the table below.
The most frequent type of innovation in which the sample firms engaged was new product innovation to new markets followed by innovative process improvements. This may be a reflection of the continuing introduction of new polymers that have applications in new areas where previous materials were used. This particularly applies to areas where heat resistance is required.

**Table 27: Innovation Count by Category ( 93 observations)**

| Innovation Type | New Product New Market | New Process | Product Improv'mt | Process Improv'mt | Existing Product New Market | Firm Acquisit'n | Total Number Innovation |
|---|---|---|---|---|---|---|---|
| Actual Number | 454 | 106 | 134 | 145 | 139 | 6 | 978 |
| % Of Total | 46.5% | 10.8% | 13.7% | 14.8% | 14.2% | | 100% |
| | Radical Innovation 560 | | Incremental Innovation 418 | | | Acq' 6 | 984 |

## APPENDIX 6: DATA DESCRIPTION ENTREPRENEURIAL CAPABILITY SCORE

The entrepreneurial capability composite score is the sum of the individual entrepreneurial components for information seeking and sharing, resource access, risk and reward profile and decision making.

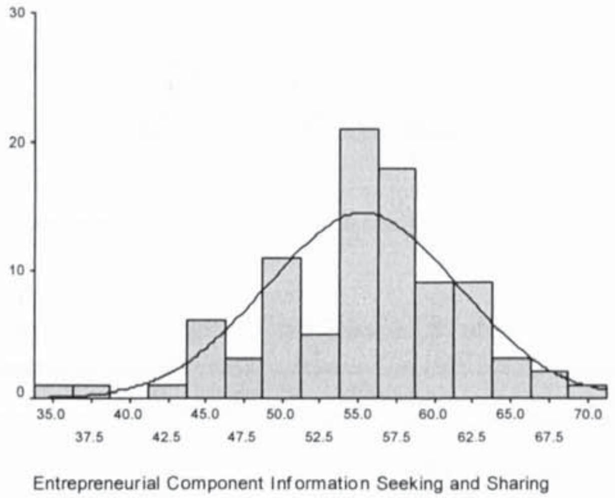
### ENTREPRENEURIAL CAPABILITY SCORE METHOD 1

**a) INFORMATION SEEKING AND SHARING**

**Table 28: Descriptive Statistics Entrepreneurial Component Information Seeking and Sharing**

| | N | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|---|
| Entrepreneurial Component Information Seeking and Sharing Score | 91 | 34 | 69 | 55.27 | 6.259 |
| Valid N (listwise) | 91 | | | | |

**Figure 22: Distribution of Entrepreneurial Component Information Seeking and Sharing**

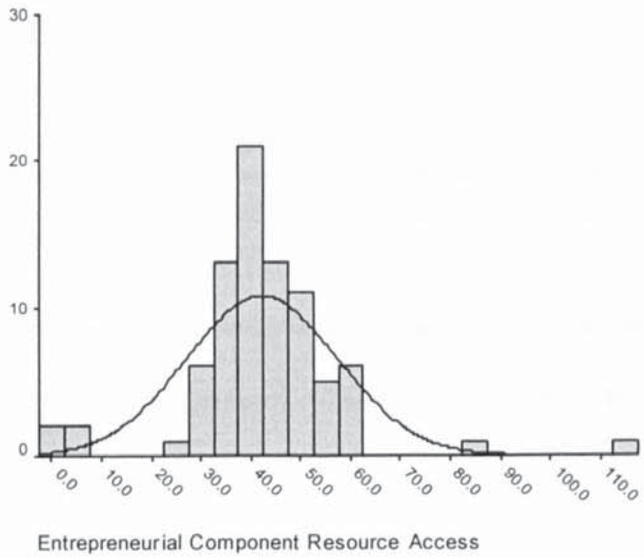


**b) RESOURCE ACCESS: Descriptive Statistics Entrepreneurial Component Resource Access**

**Table 29: Entrepreneurial Component Resource Access**

| | N | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|---|
| Entrepreneurial Component Resource Access | 82 | 1 | 113 | 42.27 | 15.154 |
| Valid N (listwise) | 82 | | | | |

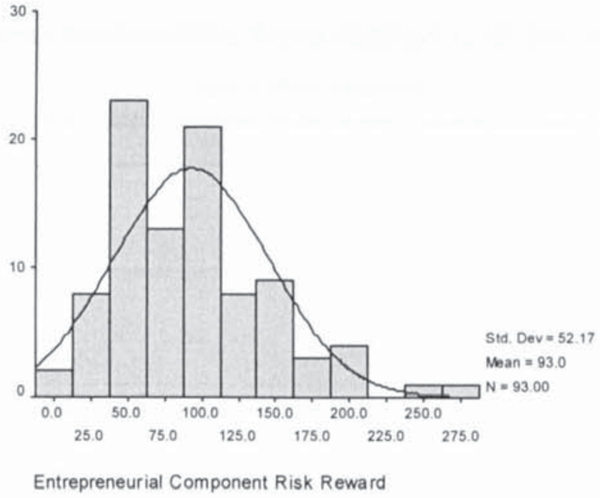
**Figure 23: Entrepreneurial Component Resource Access**




**c) RISK AND REWARD**
**Table 30: Entrepreneurial Component Risk Reward Profile**

| | N | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|---|
| Entrepreneurial Component Risk Reward | 92 | -10 | 265 | 93.32 | 52.342 |
| Valid N (listwise) | 92 | | | | |

**Figure 24: Distribution Entrepreneurial Component Risk Reward Profile**




## d) DECISION MAKING

**Table 31: Entrepreneurial Component Decision Making:**

**Descriptive Statistics**

| | N | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|---|
| Entrepreneurial Decision Making | 87 | 22 | 242 | 73.33 | 31.089 |
| Valid N (listwise) | 87 | | | | |

**Figure 25: Distribution Entrepreneurial Component Decision Making**

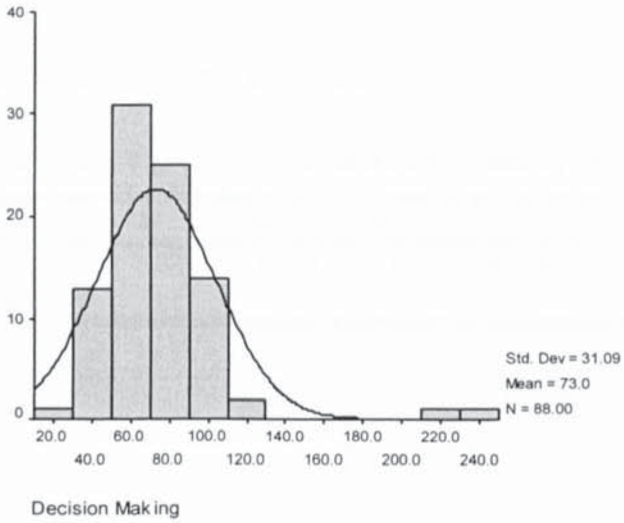
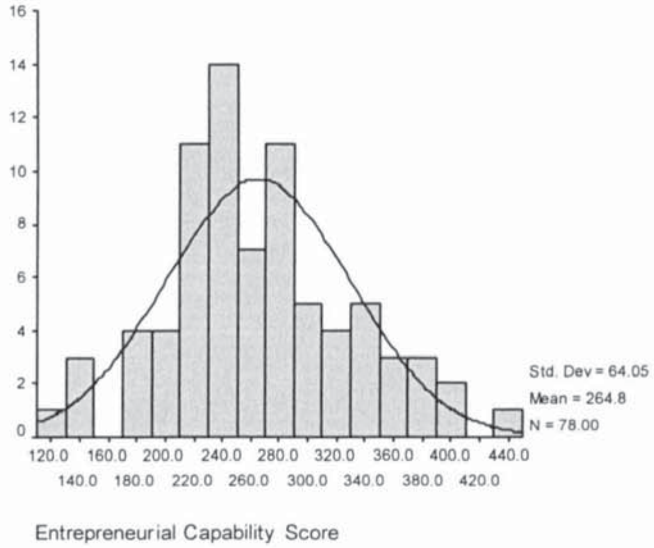


**Table 32: Entrepreneurial Capability Score (Method 1) All Components**

**Descriptive Statistics**

| | N | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|---|
| Entrepreneurial Capability Score | 78 | 128 | 443 | 264.80 | 64.054 |
| Valid N (listwise) | 78 | | | | |

**Figure 26 Distribution Entrepreneurial Capability Score: Method 1**

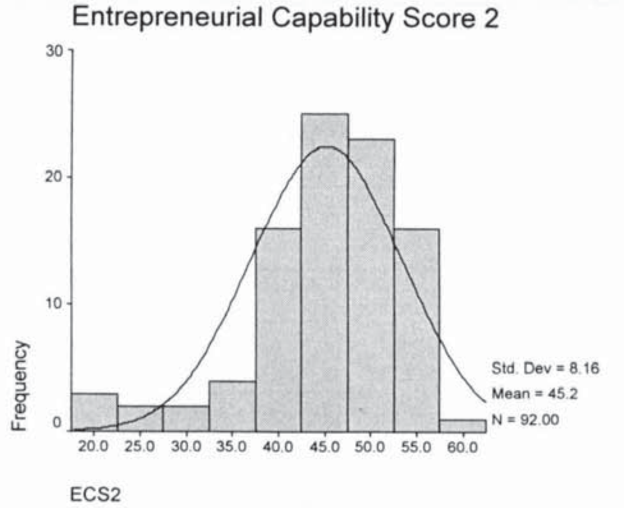



**2) Entrepreneurial Capability Score Method 2**
**Table 33**

**Descriptive Statistics Entrepreneurial Capability Score 2**

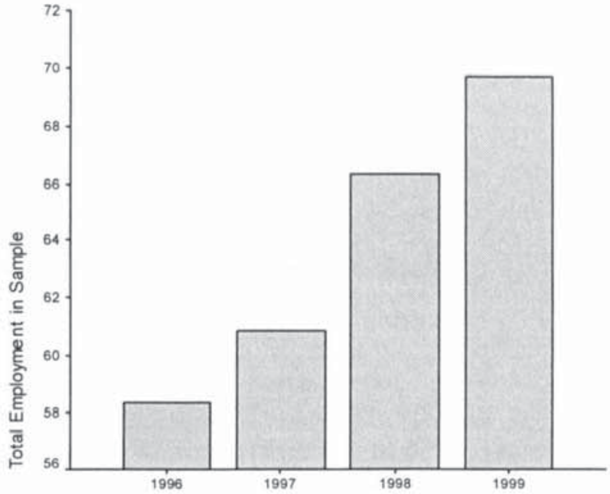
| | N | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|---|
| ECS2 | 92 | 19.00 | 60.00 | 45.1957 | 8.15811 |
| Valid N (listwise) | 92 | | | | |

**Figure 27 Histogram Entrepreneurial Capability Score 2**



### 1) Firm Employment

**Figure 28: Growth in Total Employment across all sample firms 1996 - 99**




Total employment has increased substantially across the sample firms when taken as a whole but if viewed as total employment growth over the years covered 1996 -99 another data feature emerges. There is declining employment for a substantial number of firms within the sample as can be seen in the histogram below counterbalanced by high growth in others. In order to determine whether this is related to declining sales or increased productivity perhaps consequent on new process introduction a Scatterplot showing total employment growth against total sales for the period is shown next. This shows that employment growth is positively associated with sales growth although there is a marked clustering around the zero employment growth point and the slope is undoubtedly influenced by the presence of outliers. This points to a static or declining sales profile for many firms in the sample accompanied by employment decline.

**Table 34: Descriptive Statistics Total Employment Growth**

Total Employment Growth for 1996 -1999

| | | |
|---|---|---|
| N | Valid | 81 |
| | Missing | 12 |
| Mean | | 11.3333 |
| Median | | 8.0000 |
| Mode | | 8.00 |
| Std. Deviation | | 31.31274 |
| Range | | 217.00 |
| Minimum | | -100.00 |
| Maximum | | 117.00 |

**Figure 29: Distribution of total employment growth for the period 1996 - 1999**

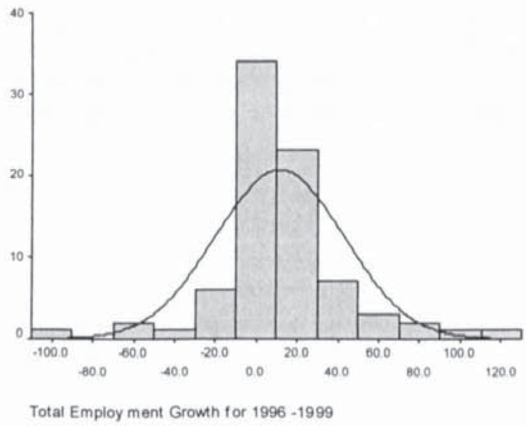
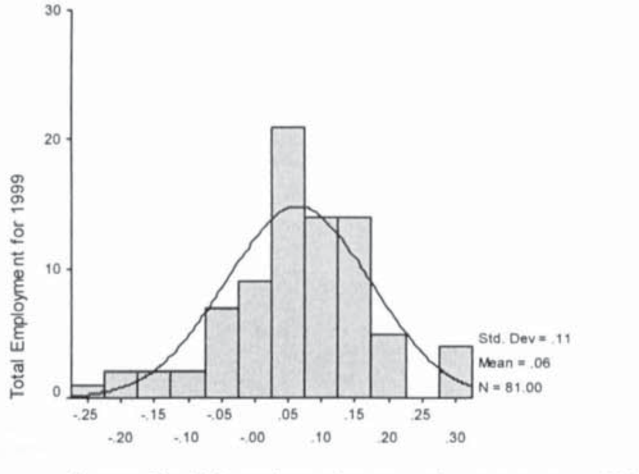


**Table 35: Descriptive Statistics Average Employment Growth as % of 1999 Employment**

Average Growth in employment expressed as a percentage 1999 Employment

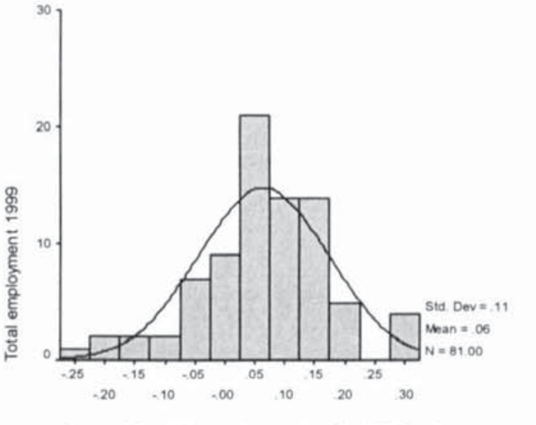
| | | |
|---|---|---|
| N | Valid | 81 |
| | Missing | 12 |
| Mean | | .0644 |
| Median | | .0702 |
| Std. Deviation | | .10885 |
| Range | | .58 |
| Minimum | | -.27 |
| Maximum | | .32 |

**Figure 30: Distribution Average Employment Growth as % of 1999 Employment**




The mean average employment growth for sample firms is a modest 6.4% with a maximum of 32% and minimum of 32%. Average employment growth is simplified and re-expressed in categories in the histogram below.

**Figure 31: Distribution Average Employment Growth expressed in categories**




**Key**

**1 =** **-.30 - -.21 %**
**2 =** **-.20 - -.11%**
**3 =** **-.10 - 0%**
**4 =** **.01 - .09%**
**5 =** **.10 - .19%**
**6 =** **.20 - 29%**
**7 =** **.30 - .40%**

**2) Sales Growth:** Sales growth for all firms between 1996 and 1999 shows growth with a marked slowing between 1998 and 1999. As highlighted above this data has within it a significant underlying trend of declining sales and employment. The distribution for total firm sales growth is significantly skewed with 50% of firms exhibiting zero or close to zero sales growth for the period. The frequency table that follows on the next page shows the detail of sales decline and growth by firm.

**Figure 32: Total Sales Growth across all Firms 1996 - 99**

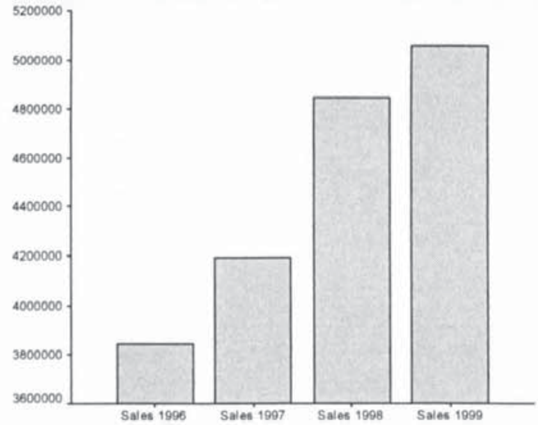


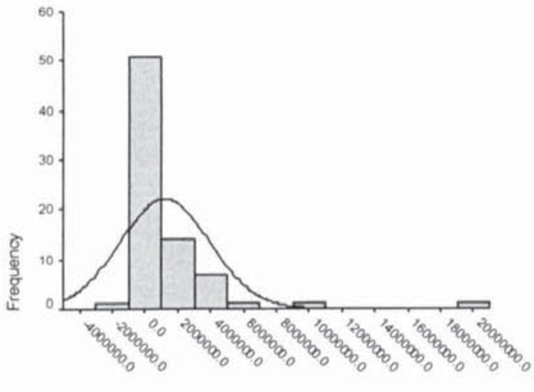

**Table 36: Descriptive Statistics Total Sales Growth 1996 - 99**

Total Sales Growth for 1996 -99

| | | |
|---|---|---|
| N | Valid | 76 |
| | Missing | 17 |
| Mean | | 1204211.4 |
| Median | | 553500.00 |
| Mode | | .00[a] |
| Std. Deviation | | 2732779.7 |
| Range | | 23000000 |
| Minimum | | -3000000 |
| Maximum | | 20000000 |

a. Multiple modes exist. The smallest value is shown

**Figure 33: Distribution Total Sales Growth 1996-99**



## Table 37: Frequency Table Sales Growth and Decline 1996 99

**Total Sales Growth for 1996 -99**

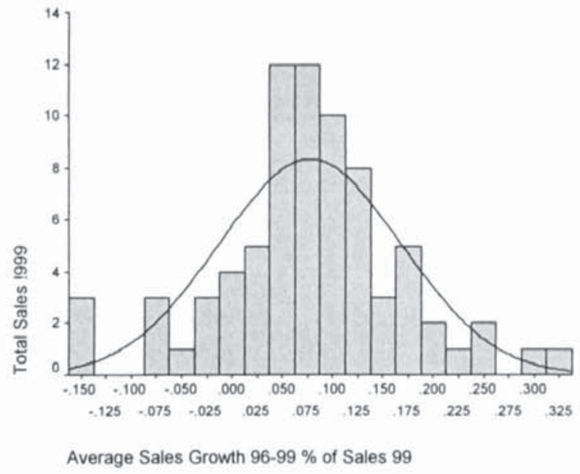
| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | -3000000.00 | 1 | 1.1 | 1.3 | 1.3 |
| | -800000.00 | 1 | 1.1 | 1.3 | 2.6 |
| | -600000.00 | 1 | 1.1 | 1.3 | 3.9 |
| | -500000.00 | 1 | 1.1 | 1.3 | 5.3 |
| | -200000.00 | 1 | 1.1 | 1.3 | 6.6 |
| | -142000.00 | 1 | 1.1 | 1.3 | 7.9 |
| | -115000.00 | 1 | 1.1 | 1.3 | 9.2 |
| | -100000.00 | 1 | 1.1 | 1.3 | 10 5 |
| | -84000.00 | 1 | 1.1 | 1.3 | 11.8 |
| | -70000.00 | 1 | 1.1 | 1.3 | 13.2 |
| | .00 | 3 | 3.2 | 3.9 | 17.1 |
| | 18000.00 | 1 | 1.1 | 1.3 | 18.4 |
| | 47768.00 | 1 | 1.1 | 1.3 | 19.7 |
| | 50000.00 | 1 | 1.1 | 1.3 | 21.1 |
| | 60000.00 | 1 | 1.1 | 1.3 | 22.4 |
| | 100000.00 | 1 | 1.1 | 1.3 | 23.7 |
| | 102000.00 | 1 | 1.1 | 1.3 | 25.0 |
| | 120000.00 | 1 | 1.1 | 1.3 | 26.3 |
| | 152000 00 | 1 | 1.1 | 1.3 | 27.6 |
| | 180000.00 | 1 | 1.1 | 1.3 | 28.9 |
| | 195000.00 | 1 | 1.1 | 1.3 | 30.3 |
| | 197000.00 | 1 | 1.1 | 1.3 | 31.6 |
| | 200000 00 | 1 | 1.1 | 1.3 | 32.9 |
| | 209000 00 | 1 | 1.1 | 1.3 | 34.2 |
| | 225000.00 | 2 | 2.2 | 2.6 | 36.8 |
| | 228000.00 | 1 | 1.1 | 1.3 | 38.2 |
| | 229100.00 | 1 | 1.1 | 1.3 | 39.5 |
| | 230000.00 | 1 | 1.1 | 1.3 | 40.8 |
| | 250000.00 | 1 | 1.1 | 1.3 | 42.1 |
| | 276000.00 | 1 | 1.1 | 1.3 | 43.4 |
| | 300000.00 | 1 | 1.1 | 1.3 | 44.7 |
| | 360000.00 | 1 | 1.1 | 1.3 | 46.1 |
| | 380000.00 | 1 | 1.1 | 1.3 | 47 4 |
| | 500000.00 | 1 | 1.1 | 1.3 | 48.7 |
| | 550000.00 | 1 | 1.1 | 1.3 | 50.0 |
| | 557000.00 | 1 | 1.1 | 1.3 | 51.3 |
| | 560000.00 | 1 | 1.1 | 1.3 | 52 6 |
| | 588000.00 | 1 | 1.1 | 1.3 | 53.9 |
| | 600000.00 | 3 | 3.2 | 3.9 | 57.9 |
| | 690000.00 | 1 | 1.1 | 1.3 | 59.2 |
| | 700000.00 | 3 | 3.2 | 3.9 | 63.2 |
| | 764860.00 | 1 | 1.1 | 1.3 | 64.5 |
| | 884340.00 | 1 | 1.1 | 1.3 | 65.8 |
| | 900000.00 | 1 | 1.1 | 1.3 | 67.1 |
| | 930000.00 | 1 | 1.1 | 1.3 | 68 4 |
| | 1000000.00 | 1 | 1.1 | 1.3 | 69.7 |
| | 1100000.00 | 1 | 1.1 | 1.3 | 71.1 |
| | 1164000.00 | 1 | 1.1 | 1.3 | 72 4 |
| | 1200000.00 | 1 | 1.1 | 1.3 | 73.7 |
| | 1293000 00 | 1 | 1.1 | 1.3 | 75.0 |
| | 1350000.00 | 1 | 1.1 | 1.3 | 76.3 |
| | 1400000.00 | 1 | 1.1 | 1.3 | 77.6 |
| | 1500000.00 | 2 | 2.2 | 2 6 | 80.3 |
| | 1550000.00 | 1 | 1.1 | 1.3 | 81.6 |
| | 1600000 00 | 1 | 1.1 | 1.3 | 82 9 |
| | 1670000 00 | 1 | 1.1 | 1.3 | 84.2 |
| | 2000000.00 | 1 | 1.1 | 1.3 | 85.5 |
| | 2500000.00 | 1 | 1.1 | 1.3 | 86.8 |
| | 3000000 00 | 1 | 1.1 | 1.3 | 88.2 |
| | 3500000.00 | 2 | 2.2 | 2.6 | 90 8 |
| | 3900000.00 | 1 | 1.1 | 1.3 | 92.1 |
| | 3946000.00 | 1 | 1.1 | 1.3 | 93 4 |
| | 4000000.00 | 1 | 1.1 | 1.3 | 94.7 |
| | 4500000.00 | 1 | 1.1 | 1.3 | 96.1 |
| | 5000000.00 | 1 | 1.1 | 1.3 | 97.4 |
| | 9600000.00 | 1 | 1.1 | 1.3 | 98.7 |
| | 20000000.00 | 1 | 1.1 | 1.3 | 100.0 |
| | Total | 76 | 81.7 | 100.0 | |
| Missing | System | 17 | 18.3 | | |
| Total | | 93 | 100 0 | | |

**Table 38: Average Sales Growth over 3 yrs as % of Total Sales 1999**

Average Sales Growth 96-99 % of Sales 99

| | | |
|---|---|---|
| N | Valid | 76 |
| | Missing | 17 |
| Mean | | .0772 |
| Median | | .0770 |
| Std. Deviation | | .09067 |
| Variance | | .00822 |
| Range | | .47 |
| Minimum | | -.15 |
| Maximum | | .33 |

**Figure 34: Distribution Average Sales Growth as % over Total Sales 99**




The average sales growth over three years expressed as a percentage of total sales for 1999 reveals generally low growth rates with a mean of 7.7% with the lowest figure at a negative 15% with the highest at 33%. The distribution is approximately normal but exhibits some outliers.

## APPENDIX 8: MISSING VALUE ANALYSIS 1

**Univariate Statistics**

| | N | Mean | Std. Deviation | Missing | | No. of Extremes[a] | |
|---|---|---|---|---|---|---|---|
| | | | | Count | Percent | Low | High |
| MAGEADIR | 91 | 50.41 | 8.34 | 1 | 1.1 | 4 | 2 |
| MEANCEX | 91 | 13.35 | 5.45 | 1 | 1.1 | 0 | 0 |
| MEDUSCR | 92 | 7.03 | 4.50 | 0 | .0 | 0 | 3 |
| ECOMPISS | 90 | 55.33 | 6.27 | 2 | 2.2 | 2 | 0 |
| ECOMPRA | 81 | 42.75 | 14.59 | 11 | 12.0 | 3 | 2 |
| ECOMPRR | 92 | 93.32 | 52.34 | 0 | .0 | 0 | 4 |
| ECOMPDM | 87 | 73.33 | 31.09 | 5 | 5.4 | 0 | 2 |
| ECS | 78 | 264.80 | 64.05 | 14 | 15.2 | 0 | 3 |
| RADINNO | 92 | 6.09 | 8.40 | 0 | .0 | 0 | 12 |
| INCINNO | 92 | 4.52 | 5.29 | 0 | .0 | 0 | 3 |
| TOTINNO | 92 | 10.60 | 10.90 | 0 | .0 | 0 | 7 |
| TOTNODIR | 92 | 3.83 | 1.65 | 0 | .0 | 0 | 2 |
| GRWPER | 83 | -1.1942 | 14.3258 | 9 | 9.8 | 6 | 5 |
| TOTEMPER | 81 | .1283 | .6011 | 11 | 12.0 | 3 | 1 |
| AVSALEMP | 67 | 41359.2420 | 179924.1756 | 25 | 27.2 | 3 | 4 |
| TOTEMP99 | 84 | 73.61 | 91.53 | 8 | 8.7 | 0 | 7 |

a. Number of cases outside the range (Q1 - 1.5*IQR, Q3 + 1.5*IQR).

**Table 39**

**Missing Patterns (cases with missing values)**

| Case | # Missing | % Missing | MEDUSCR | ECOMPRR | RADINNO | INCINNO | TOTINNO | TOTNODIR | MAGEADIR | MEANCEX | ECOMPISS | ECOMPDM | ECS | ECOMPRA | TOTEMP99 | TOTEMPER | GRWPER | AVSALEMP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Missing and Extreme Value Patterns[a] | | | | | | | | | | | | | | | |
| 5 | 1 | 6.3 | | | | | | | | | | | | | | | | S |
| 17 | 1 | 6.3 | | | | | | | | | | + | + | | | | + | S |
| 19 | 1 | 6.3 | | | | | | | | | | | | | | | | S |
| 29 | 1 | 6.3 | | | | | | | | | | | | | | | | S |
| 33 | 1 | 6.3 | | | | | | | - | | | | | | | | | S |
| 42 | 1 | 6.3 | | | | | | | | | | | | | | | | S |
| 67 | 1 | 6.3 | | | | | | | | | | | | | | | | S |
| 68 | 1 | 6.3 | | | | | | | | | | | | + | | | - | S |
| 75 | 1 | 6.3 | | | | | | | | | | | | | | | + | S |
| 31 | 2 | 12.5 | | | | | | | | | | | | | | | S | S |
| 39 | 2 | 12.5 | | | | | | | | | | | | | | | S | S |
| 51 | 2 | 12.5 | | | | | | | | | | | | - | | | S | S |
| 15 | 2 | 12.5 | | | | | | | | | | | | | | | S | S |
| 30 | 2 | 12.5 | | | + | | | | | | | | | | | | S | S |
| 61 | 3 | 18.8 | | | | | | | | | | | | | | S | S | S |
| 88 | 2 | 12.5 | | | | | | | | | | | | - | + | S | | S |
| 8 | 4 | 25.0 | | | | | | | | | | A | A | | | S | | S |
| 34 | 2 | 12.5 | | | + | | | | | | | A | A | | | | | |
| 56 | 2 | 12.5 | | | | | | | | | | A | S | | | | | |
| 44 | 2 | 12.5 | | | | | | | | | - | | A | A | | | | |
| 58 | 4 | 25.0 | | | | | | | | | A | A | S | A | | | - | |
| 92 | 4 | 25.0 | | | | | | | | | A | A | S | A | | | - | |
| 37 | 5 | 31.3 | | | | | | | | | | | A | A | A | S | | S |
| 81 | 5 | 31.3 | | | | | | | | | | | A | A | A | S | | S |
| 82 | 5 | 31.3 | | | | | | | | | | | A | A | A | S | | S |
| 13 | 5 | 31.3 | | | | | | | | | | | A | A | A | S | | S |
| 28 | 5 | 31.3 | | | + | | + | | | | | | A | A | A | S | | S |
| 71 | 6 | 37.5 | | | | | | | | | | | A | A | A | S | S | S |
| 76 | 6 | 37.5 | | + | + | | | | | | | | A | A | A | S | S | S |
| 77 | 6 | 37.5 | | | | | | | | | | | A | A | A | S | S | S |
| 49 | 2 | 12.5 | + | | | | | | A | A | | | | | | | | |

- indicates an extreme low value, while + indicates an extreme high value. The range used is (Q1 - 1.5*IQR, Q3 + 1.5*IQR).

a. Cases and variables are sorted on missing patterns.

**Missing Value Analysis 2 Table 40**

**Table 41**

**Tabulated Patterns**

| Number of Cases | Missing Patterns[a] | | | | | | | | | | | | | | | | Complete if ...[b] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MEDUSCR | ECOMPRR | RADINNO | INCINNO | TOTINNO | TOTNODIR | MAGEADIR | MEANCEX | ECOMPISS | ECOMPDM | ECS | ECOMPRA | TOTEMP99 | TOTEMPER | GRWPER | AVSALEMP | |
| 61 | | | | | | | | | | | | | | | | | 61 |
| 9 | | | | | | | | | | | | | | | | X | 70 |
| 5 | | | | | | | | | | | | | | | X | X | 75 |
| 1 | | | | | | | | | | | | | | X | X | X | 77 |
| 1 | | | | | | | | | | | | | | X | | X | 71 |
| 1 | | | | | | | | | | X | X | | | X | | X | 74 |
| 2 | | | | | | | | | | X | X | | | | | | 63 |
| 1 | | | | | | | | | | | X | X | | | | | 62 |
| 2 | | | | | | | | | X | X | X | X | | | | | 66 |
| 5 | | | | | | | | | | | X | X | X | X | | X | 77 |
| 3 | | | | | | | | | | | X | X | X | X | X | X | 86 |
| 1 | | | | | | | X | X | | | | | | | | | 62 |

Patterns with less than 1% cases (0 or fewer) are not displayed.

a. Variables are sorted on missing patterns.

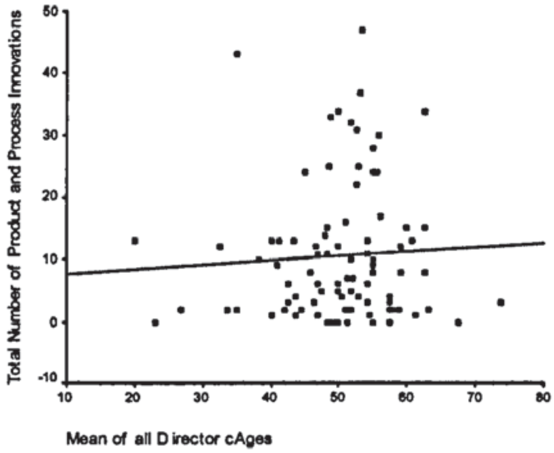
b. Number of complete cases if variables missing in that pattern (marked with X) are not used.

## APPENDIX 9: SCATTERPLOTS / VARIABLE RELATIONSHIPS

**Hypothesis 1: Human Capital attributes and Innovation**

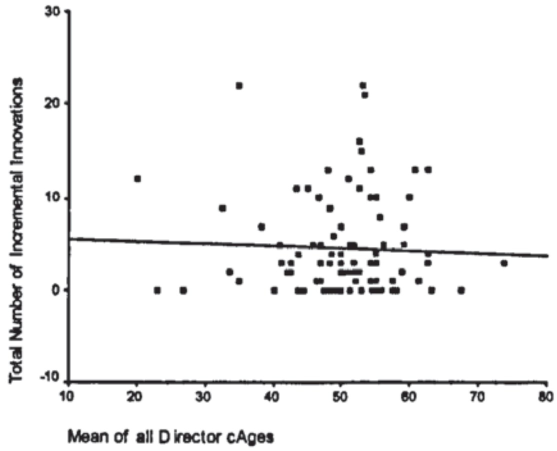
**Figure 35: Scatterplots 1 - 6**

**Scatterplot 1: Board Mean Age and Total Number of Innovations** (constant included)



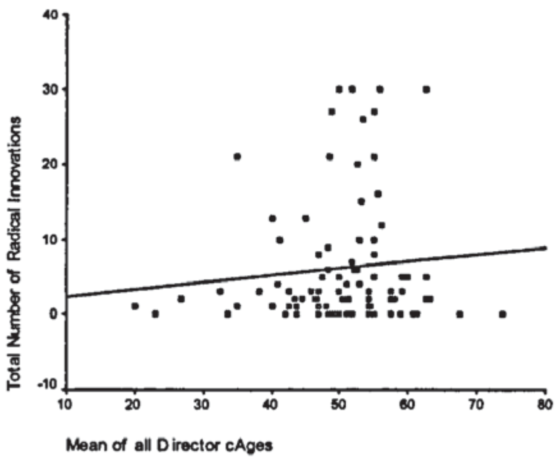

The innovation count falls into a poisson distribution therefore needs to be treated with caution. The number of total innovations appears to rise slightly with age when incremental innovation and radical innovation are taken together. The relationship changes however when they are disaggregated. Incremental innovation appears to decline with higher board mean age but radical innovation intriguingly increases with age.

**Scatterplot 2: Mean Board Age and Incremental Innovation** (constant included)

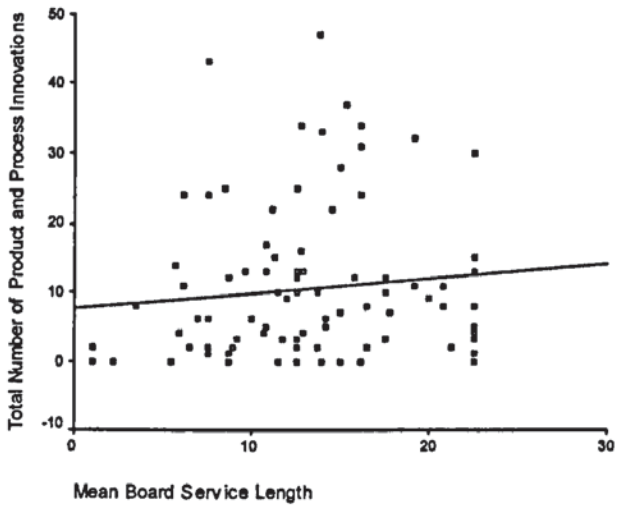


Radical innovation increases with mean board age in an unexpected manner.

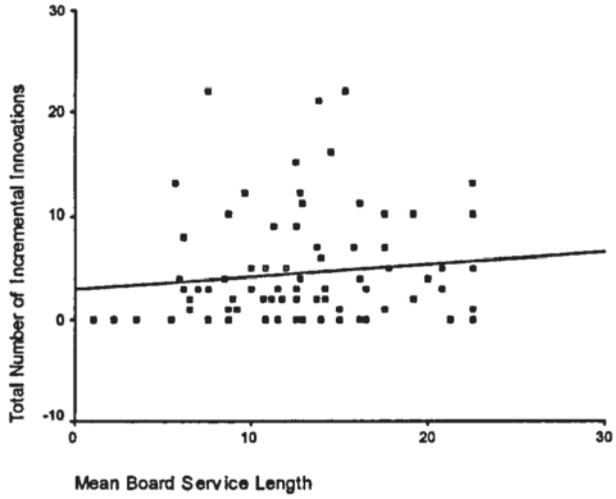
**Scatterplot 3: Mean Board Age and Radical Innovation** (constant included)



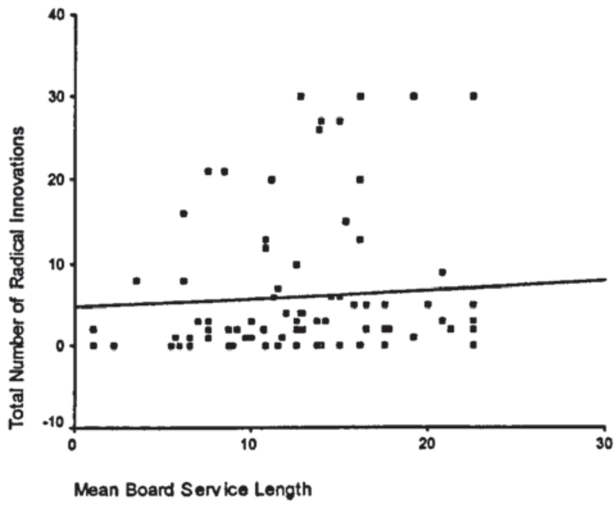

**Scatterplot 4: Mean Board Service Length and total innovation** (constant included)



**Scatterplot 5: Mean Board Service Length and Incremental Innovation** (constant included)




**Scatterplot 6: Mean Board Service Length and Radical Innovation** (constant included)



## APPENDIX 10: ENTREPRENEURIAL CAPABILITY CONSTRUCT DEVELOPMENT

The process used to create the scales, contributing to the entrepreneurial capability construct variable is outlined in this appendix along with the considerations of dimensionality, validity and reliability for the use of summated scales. The two methods used to calculate the entrepreneurial capability score are shown in separate appendices.

**Item Pool Generation:** The process adopted to create the measurement scales involved firstly the generation of an item pool based on the concepts and theoretical frameworks of previous research across the four dimensions of management practice, information seeking and sharing, risk and reward profile, resource access and decision making. These were then reviewed and further refined and reduced during the initial study with the managing directors to ensure face validity in terms of being understood in practical terms and that there was indeed a correspondence between their understanding and the theoretical concepts. At this stage the scale items for risk and reward were converted into a question and answer format since this method of data collection for this subject did not produce the required response and was deemed as unlikely to be completed by the respondent. A simple tick collected the response to a yes and no question. See item 2.6 Reward Appendix 5:1 The Injection Moulding questionnaire.

The pilot study to 142 further directors resulted in further refinement and reduction of the scale items. At this point data collection using two scales were dropped in favour of other methods that incorporated firm size in order to ensure that this factor was included in the analysis. The measurement scales stayed the same from this point although their positions within the questionnaire changed between the surveys for the pilot, full survey, remail to improve response rates and the additional mailing to an additional database of injection moulders that followed.

The item pool for each multi item scale for the entrepreneurial components are designed with sets of questions relating to the same management practice in order to ensure that the underlying attitude will be common to all items within the scale. Scales representing decision-making, (labelled planning and control in the questionnaire), resource access, (external contact) information seeking and sharing (general communication and development work) were created. The scale questions have been constructed to ask similar related questions in different ways. This includes negative questions that have been reversed scored during the data transformation into variables. The negative and positive items are balanced in pairs for each item set to maintain internal consistency.

Asking a question more than once increases the relative consistency but can also lead to a high level of item redundancy (Boyle, 1994). Repeating a question in another form ensures that overall response is stable and not subject to a momentary determinant. (Oppenheim, 1992).

The initial studies led to the elimination of some repeat items due to perceived potential non-response due to a low tolerance of repetition on the part of respondents. The scales across the dimensions measured for the entrepreneurial components (or sub constructs) information seeking and sharing, decision making, and resource consisted initially of total of 56 items and were finally reduced to 40 in the survey instrument across four separate Likert scales. These were further reduced as part of the data reduction procedure undertaken within the factor analysis. Details on the data reduction process are shown in appendix 5:4.

**Item Scaling:** Five point Likert scales categories used were strongly disagreeing, neither agrees nor disagrees to strongly agree for three out of the four scales. The fourth scale for reasons for innovation contact used not at all important, neutral and very important. Five point Likert scales are commonly used in the corporate entrepreneurship entrepreneurial orientation scales. Adopting a similar research instrument therefore provides some elements of comparability. The tolerance and willingness of the respondents to complete the scales was also considered. It was thought that seven point scales would be too elaborate for the very straightforward nature of the directors in the sample who would see little point in such fine distinctions.

**Scale Considerations: Dimensionality, Reliability and Validity.**

The dimensionality, validity and reliability of the scales used for the entrepreneurial capability score(s) are important in order to demonstrate that the research instrument reliably measures the concept or construct that it sets out to and that the data structure is representative of the general population. The degree of reliability sets limits to the degree of validity possible. (Oppenheim, 1992). (Hinkin, 1998, Kerlinger, 1986, Bagozzi and Foxall, 1996).

**Dimensionality:** Items in a scale should all relate to a single concept and be unidimensional. (Gerbing and Anderson, 1988) Factor analysis of the four scales together should show the separate items for information seeking and sharing, resource access and decision making loading onto a single factor or component if the items representing each proposed dimension of entrepreneurial management practice are indeed unidimensional. The first pass of principle component analysis revealed that this was largely the case with the exception of the development work scale items. These loaded at a very low and unsatisfactory level for the sample size and achieved a poor Cronbach's alpha. These items were dropped from the calculation of new regression variables. Other items for each scale did not load at a sufficiently high level for the sample size onto the required dimensions and were eliminated during the data reduction process. This process reduced 40 items on the questionnaire to a final 24 for the new regression variables. This data reduction and summary process is detailed in appendix 5:3 and will be discussed further in the next chapter.

**Content Validity**: Validity of a scale is assessed is several ways. Firstly face or content validity must be established. Face validity requires that the operationalised variable have a reasonable correspondence to the theoretical concept. The construct must be defined in a theoretically relevant manner and actually captures what was intended. Items that are not related to the theoretical construct should not be included.(Chandler and Lyon, 2001, Churchill, 1979, Peter, 1981). For example that the decision making entrepreneurial component scale must measure the board level decision making style and that the information seeking and sharing entrepreneurial component does indeed measure the board's propensity to seek information internally and externally and share information across the firm. The framework and conceptual links to theory have been demonstrated in Chapter 4.

**Scale Reliability:** Reliability in the context of scales means that the research instrument will behave in a fashion that is consistent with itself, that it has internal consistency and is free from measurement error. Reliability can be measured in several ways. Firstly the consistency of individual responses over time can be assessed through a test retest technique or an independent Levenes t test to ensure that responses at different points of time are consistent. Alternatively and most commonly used is the diagnostic measure for internal consistency, the Cronbach's alpha providing a reliability coefficient for the entire scale. (Cronbach, 1951). (Churchill, 1979, Peter, 1979, Peter, 1981, Chandler and Lyon, 2001). The overall objective of both measure types is to check the confidence levels that different readings taken on different occasions and times and with other respondents, produces genuine readings for any variation in the management practice under consideration and that this measurement is free from measurement error. In other words that the measurement scale is repeatable and has a probability of obtaining the same results again if the measure were duplicated.

The response bias for all the observations for the scale were tested within SPSS with an independent Levenes t test: The observations were entered into the database in the order they were received and divided into early or late categories. A significance level of above .05% was achieved indicating that there was no bias to the responses over time.
The application of Cronbach's Alpha to the scales separately and taken together, (40 items before reduction) as an entrepreneurial capability score showed satisfactory alphas around or above .70 for two of the scales (Decision Making and Resource Access) without item elimination for all the scales except development work. Information seeking and sharing required elimination of four items. The Development Work scale was removed from the information seeking and sharing component. The results of the Cronbach's Alpha test are shown in appendix 5:4. The refinement of the scales through item elimination therefore increased the alphas to well above an acceptable level for a new scale to .823. Cronbach's Alpha establishes evidence that the construct actually measures what was intended. The scales created are therefore shown to be internally consistent and consistent over time and therefore reliable.
Reliability is expressed in the form of a correlation coefficient. For social sciences, figures above .90% are not usually achieved. An alpha of .70 is considered a generally acceptable level for the social sciences but for exploratory factor analysis 65% may be acceptable. The squared correlation coefficient expresses the percentage of the shared true variance and the error component. The degree to which a common variance is shared between measures or overlaps is then known. A reliability coefficient of 90% means that for two measures of .81 there is an overlap or common variance of four fifths. If after repeated iterations this becomes less the scales will need to be reconsidered (Nunnally, 1979). As sample size increases alphas will increase in size so that the identification of the cut-off level for factor loading can be reviewed downwards. Full details of the Alpha's for each scale shown separately in the questionnaire and the total of all items used to obtain new regression variables are shown in Appendix 5:4.

**Validity of the Entrepreneurial Capability Construct and Measurement**

Once the reliability of the scale has been established through reliability analysis it is appropriate to precede to the assessment of validity. In addition to face validity, the entrepreneurial capability construct and its measurement scale must show that it validly and accurately measures something useful in terms of capturing the entrepreneurial management practices of the board. It is possible to assess reliability in several ways; commonly used measures are convergent, discriminant and nomological validity.

**Convergent validity** assesses the degree of correlation or overlap between alternative measures of the concept or construct.(Peter, 1981, Ford et al., 1986) (Knight, 1997). Within this research convergent validity for the entrepreneurial capability construct will be demonstrated if the two calculation methods for entrepreneurial capability construct show the same significant relationships or correlations with the independent and dependent variables of the regression model.

**Discriminant validity** indicates that the degree to which the measurement correlates with similar but conceptually distinct measures. (Gerbing and Anderson, 1988)(Hair et al., 1998). Low correlations are sought here, showing little common or shared variance. Assessment of discriminant validity in terms of inter factor correlations for the entrepreneurial capability score was considered inappropriate for the nature of the relationships to be tested with the multiple regression techniques where the entrepreneurial capability score as used as an independent variable (Anderson and Gerbing, 1988). Validity of the regression techniques employed is discussed later.

**Nomological validity**, the demonstration of whether the empirical relationships observed within both the entrepreneurial capability construct and the nomological net of the overall research model are is correct addressed in Chapter 6.

## APPENDIX 11: DATA REDUCTION AND SUMMARY PROCESS USING FACTOR ANALYSIS FOR THE ENTREPRENEURIAL CAPABILITY CONSTRUCT.

This appendix details the data reduction and summary process used on the data collected through the Likert scales.

**1. Objective of the Reduction Process:** Factor Analysis, in the form of Principal Component Analysis has been used to refine and reduce a large set of variables collected using Likert scales to develop and evaluate a scale to measure entrepreneurial capability at board level in established independent medium sized enterprises. The entrepreneurial capability score was first calculated producing a composite score as detailed in appendix 6. This is called ecs in the analysis. After consideration of the method and sample size achieved, a further measure, considered more robust was calculated. This score is called ecsbis in the analysis. The data reduction has occurred in two stages for the two different methods of calculating entrepreneurial capability.

**Entrepreneurial Capability Score Method 1 (ecs):** The initial data reduction process was used simply to produce summed scales, reliable and valid, that could be used in conjunction with scoring of other management practices to create a large numeric and continuous variable to represent board entrepreneurial capability score for use as an independent variable in regression analysis. This is detailed in separate appendix 16. The preliminary reduction of items was used to ensure that both the separate subscales and the summated scale used, as a component in the first entrepreneurial capability score calculation method were internally consistent, reliable and valid for such a use. The summated totals from the 30 items were as used in conjunction with a scoring system of question and answer (see appendix 10) to produce a score capable of representing a variation of resource profile.

**Entrepreneurial Capability Score Method 2 (ecsbis):** Principle component analysis was used to further reduce the number of items for those components that loaded most highly and were considered to be meaningfully representative of the entrepreneurial components within entrepreneurial capability. The entrepreneurial components that emerged were labelled resource access, decision making and information seeking and sharing. The measurement scales were reduced to the most representative items that explained most of the variance by loading most highly. It is important to note that the risk and reward component did not employ Likert scales to gather data so is not included in this second entrepreneurial capability variable. The second measurement construct is therefore not totally comparable with the first method of deriving an entrepreneurial capability score. The final remaining items best describe the underlying structure of an entrepreneurial capability based on these three dimensions of managerial practice and organisational process. This summated score has also been used to determine the relationship with the other variable sets within the hypotheses in the same manner as the first entrepreneurial capability score. Since the scores have different bases, the results form both sets of analyses could only loosely be considered to contribute to convergent validity of the research.

The components identified were not converted to regression scores as the components identified were correlated with each other through use of the oblique rotation method. They would by definition of the process used to determine them be multicollinear.

**2. The Process**

**Factor Analysis Technique:** Both Factor Analysis and Principle component analysis are used to produce a smaller number of linear combinations of variables, identifying an underlying structure through accounting for most of the variability in the pattern of variation. Principle component analysis has been used in an exploratory method rather than confirmation by factor analysis since it is considered to give a better empirical summary of the data set (Gorsuch, 1990) and is commonly used in the development and evaluation of new scales. Principle components analysis is combined with oblique rotation to determine which items best represent components of an entrepreneurial capability in a meaningful but intercorrelated manner.

**Sample Size:** Considerations of sample size were also influential as well as the requirement for a simple solution for best describing the variable relationships. The sample size, smaller than originally hoped for, required the scale to be reduced to essentials for calculating the second method of entrepreneurial capability score using the scales to ensure future generalisability. Smaller samples have less reliable correlation coefficients among the variables. If, however, there are strong, reliable correlations and very distinct factors emerging it is possible to use a small sample (Stevens, 1996). The data reduction process for ecs2 therefore aimed at producing a simple solution with a few items, strongly representing the entrepreneurial components and explaining as much of the original variance in the data as possible, appropriate for application to a small sample. The ideal ratio between items and cases is 10 to 1 but 5 is often considered adequate for in most cases (Nunnally, 1978, Tabachnick and Fidell, 1996). This means that with between 82 and 88 sets of completed cases for the subscales a final scale composed of

12 to 16 items representing the three subscales information seeking and sharing, resource access and decision making were required to produce a measure of entrepreneurial capability.

**Entrepreneurial capability score 1 (ecs1)**

Originally there were 40 items in four scales. Preliminary principle component analysis reduced these to 30 items for use in the ecs1 with the development work scale, contributing to the information seeking and sharing entrepreneurial component, being discarded as not fit for the purpose intended. These initial items were deleted because they did not meet the necessary criteria for retention. Items for elimination were selected using principle component analysis with rotated and unrotated solutions giving the KMO and Bartletts Sphericity tests, the communalities table, the total variance, scree plot and component matrix. These were used in conjunction with reliability analysis using Cronbach's Alpha to assist in the item elimination process as described briefly below.

Factor analysis was run as a first step with all items earmarking those that did not load onto the factors at a sufficiently high level using the component matrix. The bulk of items from the separate subscales loaded onto separate factors as anticipated with most values between 75.4% to 62.1%. Some items loaded onto more than one whatever rotation method used. Both rotated and unrotated solutions were used to assess items. The objective of factor rotation is to achieve the simplest, most theoretically meaningful factor pattern by reducing some of the ambiguities accompanying the original analysis (Thurstone, 1947, Hair et al., 1998). Varimax and Direct Oblim rotation within SPSS, orthogonal and oblique rotation methods were initially used. Oblique rotation is the more flexible technique and does not require the factors to be unrelated to each other. The management practices that comprise entrepreneurial capability are interlocked and clearly related to each other. The oblique rotation method, Direct Oblim, produced the best loading of the items onto the identified three factors explaining the most variance consistent with the hypothesised internal entrepreneurial capability relationships.

The KMO and Bartletts Sphericity tests were used alongside the scree test (Cattell, 1966) and the correlation coefficient matrix to identify which items loaded onto the identified factors in the most meaningful way, helping with the elimination of items. The KMO Test of sampling adequacy for the ecs1 30 items indicated a score of .701, a sufficiently high proportion of the common variance in the variables. A score below 0.5 would indicate that factor analysis is not suitable for the data. The Bartletts test of Sphericity shows a significance of .000 indicating that there are significant relationships between the items.

The Cronbach's alpha reliability test for the thirty items shown in appendix 5:4 achieves a satisfactory score of 82.29%. Item to total correlations of above .5 were retained as were inter item correlations of above .30 or above. The communality table showed sufficiently high levels of common variance above .5 as well.

The thirty items in the reduced scales identified distinct dimensions that were deemed to represent the theorised entrepreneurial components within the theorised concept of entrepreneurial capability. These were used to create the first entrepreneurial capability score along with other scoring methods for factual data, not collected with Likert scales.

**Entrepreneurial capability score 2 (ecs2)**

The thirty items were reduced further in the following manner. Each subscale was subjected firstly to principle component and reliability analysis and the results examined to reduce the item pool to those that loaded onto factors most strongly and in an internally consistent manner. It was possible to reduce the items to four each for each subscale of resource access, decision making and information seeking and sharing in a meaningful manner. Each scale item was carefully scrutinised to ensure that these items were consistent with theory and original intention in identifying dimensions of an entrepreneurial capability within the firm at board level. In other words the observed factor structure is consistent with the hypothesised structure. The four items within each dimension did indeed represent different aspects of the management practice identified as associated with entrepreneurial capability as outlined in Chapters 2 and 4. Appendix 5:3A shows the items of the final selection in both orthogonal and oblique rotation matrices. The loadings shown are at a satisfactory high level, accompanied by a KMO score of .763 and Bartlett Sphericity test significance at .000. The Cronbach's alpha achieved was .807, slightly less than that for the greater number of items of the preliminary stage. The reliability analysis for these reduced items is shown in appendix 12 The factor loadings are shown in Appendix 13

The scales were summed and the summated total from the reduced item scale called ecsbis was used in the multiple regression models to test the relationships. The research model tested with ecsbis as an independent variable is a slightly modified one without the risk and reward element of entrepreneurial capability. The results of this analysis and that for ecs1 are discussed in chapter 6.

The items retained in the final five point Likert scale were as follows:-

**Table 39Final Item Selection after Reduction**

| Likert Scale Statement | Item | Name |
|---|---|---|
| **Decision Making ( Planning and Control)** | | |
| A formal strategy set out in a written business plan is essential | Item d | Written strategic plan |
| Sales and Production are regularly reviewed against plans | Item j | Regular performance review |
| A annual set routine for strategic planning for setting long term objectives is necessary | Item k | Long term board direction |
| Three year financial forecasts should be made every year | Item h | Financial planning |
| **Resource Access (Reason for seeking contact)** | | |
| Solving a problem | Item d | Problem solving |
| Trying to save time | Item c | Time saving |
| Specific information gathering | Item i | Knowledge acquisition |
| Cost Reduction | Item g | Cost reduction |
| **Information seeking and sharing ( Communication)** | | |
| Some managers are particularly good at working with other managers to get things done | Item a | Boundary spanning |
| Different Management areas come together for development work | Item c | Management development co-operation |
| Much information is exchanged informally during the day between employees and managers | Item e | Cross functional Working |
| Directors communicate informally with managers / supervisors on a daily basis | Item h | Informal Communication Climate |

## APPENDIX 12: SCALE RELIABILITY - CRONBACH'S ALPHAS ECS 1

The reliability analysis Cronbach's Alpha 's shown are for the thirty items used in the entrepreneurial capability score calculation method 1

### Entrepreneurial Capability Score 1 - 30 items across : Individual Component Scales

**Table 40**

a) **Reliability Analysis Scale / Alpha : 30 items**

N of Cases = 84.0

| Item Means | Mean | Minimum | Maximum | Range | Max/Min | Variance |
|---|---|---|---|---|---|---|
| | 3.5671 | 2.3095 | 4.3333 | 2.0238 | 1.8763 | .2256 |

| | Scale Mean if Item Deleted | Scale Variance if Item Deleted | Corrected Item-Total Correlation | Squared Multiple Correlation | Alpha if Item Deleted |
|---|---|---|---|---|---|
| PLANCPA | 102.8214 | 190.3894 | .4069 | .6070 | .8160 |
| PLANCBSC | 103.2143 | 204.5077 | -.1191 | .3564 | .8349 |
| PLANCCSC | 104.0952 | 191.9185 | .2226 | .5197 | .8224 |
| PLANCPD | 103.3929 | 180.0968 | .5651 | .6890 | .8084 |
| PLANCESC | 104.7024 | 206.0911 | -.1727 | .3485 | .8346 |
| PLANCFSC | 104.3452 | 188.0360 | .3840 | .5780 | .8160 |
| PLANCGSC | 103.3929 | 191.7595 | .2278 | .5536 | .8222 |
| PLANCPH | 103.7500 | 190.2620 | .2573 | .4584 | .8212 |
| PLANCISC | 103.0357 | 189.2879 | .3416 | .4482 | .8176 |
| PLANCPJ | 103.0357 | 183.0469 | .5842 | .5566 | .8092 |
| PLANCPK | 103.5000 | 185.0000 | .4813 | .6342 | .8125 |
| PLANCPL | 103.4048 | 187.6414 | .4255 | .5086 | .8147 |
| PLANCMSC | 104.0714 | 201.8985 | -.0483 | .3857 | .8326 |
| PLANCPN | 103.5714 | 176.7298 | .6034 | .7562 | .8059 |
| REASCONA | 103.0714 | 186.0671 | .4022 | .6435 | .8152 |
| REASCONB | 103.7976 | 193.5128 | .1748 | .6274 | .8244 |
| REASCONC | 103.3690 | 187.2959 | .4791 | .6754 | .8133 |
| REASCOND | 102.7738 | 187.4783 | .4789 | .6628 | .8134 |
| REASCONE | 103.4286 | 180.1033 | .5729 | .6775 | .8081 |
| REASCONF | 103.5833 | 183.3303 | .5425 | .7178 | .8103 |
| REASCONG | 103.1190 | 185.2146 | .5268 | .7800 | .8114 |
| REASCONH | 103.7143 | 186.7849 | .3901 | .7209 | .8157 |
| REASCONI | 103.3452 | 183.3613 | .5909 | .7185 | .8092 |
| REASCONJ | 103.6310 | 192.4284 | .2583 | .5737 | .8205 |
| COMPA | 103.2857 | 192.7367 | .3047 | .5820 | .8189 |
| COMNB | 104.0595 | 186.5386 | .4387 | .5739 | .8141 |
| COMPC | 103.1667 | 192.5502 | .3325 | .6565 | .8182 |
| COMPE | 102.9524 | 194.2869 | .2304 | .5317 | .8212 |
| COMPH | 102.6786 | 191.1846 | .3645 | .6130 | .8172 |
| COMPJ | 103.0357 | 201.9867 | -.0463 | .5120 | .8309 |

Reliability Coefficients 30 items

Alpha = .8229 Standardized item alpha = .8284

The Alpha results that follow are for the further reduced and refined items used for a more parsimonious approach to creating a new measurement variable.

## b) Entrepreneurial capability Score 2 (ecsbis): Cronbach's Alpha

N of Cases = 88.0

| Statistics for | Mean | Variance | Std Dev | Variables |
|---|---|---|---|---|
| Scale | 45.8523 | 57.2768 | 7.5681 | 12 |

Item-total Statistics

| | Scale Mean if Item Deleted | Scale Variance if Item Deleted | Corrected Item-Total Correlation | Squared Multiple Correlation | Alpha if Item Deleted |
|---|---|---|---|---|---|
| REASCOND | 41.6705 | 48.2925 | .5091 | .6294 | .7828 |
| REASCONC | 42.2273 | 49.1891 | .4534 | .5187 | .7879 |
| REASCONI | 42.2045 | 47.4519 | .5459 | .5668 | .7790 |
| REASCONG | 42.0227 | 47.2179 | .5547 | .5876 | .7781 |
| PLANCPN | 42.3864 | 45.5731 | .5084 | .5466 | .7829 |
| PLANCPD | 42.2841 | 45.8609 | .5363 | .4923 | .7793 |
| PLANCPJ | 41.8977 | 48.2308 | .4871 | .4654 | .7847 |
| PLANCPK | 42.3409 | 48.3422 | .4524 | .4185 | .7881 |
| COMPH | 41.4886 | 51.2872 | .3744 | .4785 | .7947 |
| COMPE | 41.7727 | 52.6834 | .2488 | .4326 | .8047 |
| COMPC | 41.9886 | 51.6206 | .3681 | .4199 | .7952 |
| COMPA | 42.0909 | 52.1526 | .3036 | .3503 | .8002 |

Reliability Coefficients 12 items
Alpha = .8027 Standardized item alpha = .8000

**Component Matrix: Unrotated Solution**[a]

| | Component 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| Reasons for Seeking Contact g Cost Reduction | .741 | | | |
| Reasons for Seeking Contact e Accessing resources | .725 | | | |
| Reasons for Seeking Contact f Risk Minimisation | .710 | | | |
| Reasons for Seeking Contact i Information gathering | .701 | | | |
| Reasons for Seeking Contact d Solving a problem | .670 | -.308 | | |
| Reasons for Seeking Contact c Saving Time | .651 | -.390 | | |
| Planning and Control Scale Item n | .633 | | .495 | |
| Planning and Control Scale Item j | .577 | .336 | .318 | |
| Reasons for Seeking Contact h Response to Competitor action | .567 | | | -.483 |
| Planning and Control Scale Item d | .553 | .307 | .433 | .317 |
| Planning and Control Scale Item k | .533 | | .413 | .359 |
| Reasons for Seeking Contact a Looking for Ideas | .524 | | | |
| Planning and Control Scale Item a | .502 | | -.430 | |
| Planning and Control Scale Item l | .495 | | | .320 |
| Communication Climate b | .449 | .351 | | |
| Communication Climate c | .314 | .591 | -.406 | |
| Communication Climate h | .322 | .538 | -.433 | |
| Communication Climate j | | .506 | | |
| Reasons for Seeking Contact j Lack of internal resources | .423 | -.494 | | |
| Reasons for Seeking Contact b Lack of own R&D dept | .316 | -.487 | | |
| Planning and Control Reverse Scored LikertScale conversion l | | .443 | | |
| Planning and Control Reverse score item m | | .345 | .316 | |
| Communication Climate e | | .465 | -.506 | |
| Communication Climate a | .315 | .393 | -.492 | |
| Planning and Control Reverse score item g | | .477 | | -.519 |
| Planning and Control Reverse score item c | | .386 | | -.496 |
| Planning and Control Scale Item h | .309 | | .395 | .426 |
| Planning and Control Reverse score item f | .344 | .383 | .375 | -.382 |
| Planning and Control Reverse scored item e | | | | -.375 |
| Planning and Control Reverse Scored LikertScale conversion b | | | | .339 |

Extraction Method. Principal Component Analysis.

a. 4 components extracted.

**Varimax Rotated Component Matrix**[a]

| | Component 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| Reasons for Seeking Contact g Cost Reduction | .789 | | | |
| Reasons for Seeking Contact f Risk Minimisation | .779 | | | |
| Reasons for Seeking Contact h Response to Competitor action | .761 | | | |
| Reasons for Seeking Contact d Solving a problem | .742 | | | |
| Reasons for Seeking Contact c Saving Time | .725 | | | |
| Reasons for Seeking Contact i Information gathering | .710 | | | |
| Reasons for Seeking Contact e Accessing resources | .663 | .339 | | |
| Reasons for Seeking Contact a Looking for Ideas | .588 | | | |
| Reasons for Seeking Contact j Lack of internal resources | .474 | | | -.405 |
| Planning and Control Reverse score item m | -.365 | | | |
| Planning and Control Scale Item d | | .810 | | |
| Planning and Control Scale Item k | | .754 | | |
| Planning and Control Scale Item n | | .686 | | .359 |
| Planning and Control Scale Item h | | .630 | | |
| Planning and Control Scale Item l | | .628 | | |
| Planning and Control Scale Item j | | .536 | | .443 |
| Communication Climate b | | .512 | | |
| Communication Climate h | | | .771 | |
| Communication Climate c | | | .745 | |
| Communication Climate e | | | .719 | |
| Communication Climate a | | | .713 | |
| Planning and Control Scale Item a | .405 | | .513 | |
| Communication Climate j | -.394 | | .447 | |
| Reasons for Seeking Contact b Lack of own R&D dept | .366 | | -.402 | |
| Planning and Control Reverse Scored LikertScale conversion l | | .334 | .342 | |
| Planning and Control Reverse score item g | | | | .701 |
| Planning and Control Reverse score item f | | .327 | | .647 |
| Planning and Control Reverse score item c | | | | .640 |
| Planning and Control Reverse scored item e | | | | .439 |
| Planning and Control Reverse Scored LikertScale conversion b | | | | -.402 |

Extraction Method. Principal Component Analysis.
Rotation Method. Varimax with Kaiser Normalization.

a. Rotation converged in 5 iterations.

**Pattern Matrix**[a]

| | Component 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| Reasons for Seeking Contact h Response to Competitor action | .808 | | | |
| Reasons for Seeking Contact f Risk Minimisation | .793 | | | |
| Reasons for Seeking Contact g Cost Reduction | .786 | | | |
| Reasons for Seeking Contact d Solving a problem | .733 | | | |
| Reasons for Seeking Contact c Saving Time | .703 | | | |
| Reasons for Seeking Contact i Information gathering | .697 | | | |
| Reasons for Seeking Contact e Accessing resources | .629 | | | |
| Reasons for Seeking Contact a Looking for Ideas | .588 | | | |
| Reasons for Seeking Contact j Lack of internal resources | .424 | | | .405 |
| Planning and Control Reverse score item m | -.388 | | | |
| Communication Climate h | | .767 | | |
| Communication Climate c | | .739 | | |
| Communication Climate e | | .724 | | |
| Communication Climate a | | .716 | | |
| Planning and Control Scale Item a | .378 | .510 | | |
| Communication Climate j | -.421 | .449 | | |
| Reasons for Seeking Contact b Lack of own R&D dept | .321 | -.418 | | |
| Planning and Control Scale Item d | | | .814 | |
| Planning and Control Scale Item k | | | .763 | |
| Planning and Control Scale Item n | | | .664 | -.339 |
| Planning and Control Scale Item h | | | .661 | |
| Planning and Control Scale Item l | | | .625 | |
| Planning and Control Scale Item j | | | .498 | -.422 |
| Communication Climate b | | | .495 | |
| Planning and Control Reverse Scored LikertScale conversion l | | .319 | .320 | |
| Planning and Control Reverse score item g | | | | -.697 |
| Planning and Control Reverse score item c | | | | -.639 |
| Planning and Control Reverse score item f | | | | -.638 |
| Planning and Control Reverse scored item e | | | | -.448 |
| Planning and Control Reverse Scored LikertScale conversion b | | | | .409 |

Extraction Method: Principal Component Analysis.
Rotation Method: Oblimin with Kaiser Normalization.

a. Rotation converged in 11 iterations.

**Component Matrix Unrotated Solution**[a]

| | Component 1 | 2 | 3 |
|---|---|---|---|
| Reasons for Seeking Contact g Cost Reduction | .741 | | |
| Reasons for Seeking Contact e Accessing resources | .725 | | |
| Reasons for Seeking Contact f Risk Minimisation | .710 | | |
| Reasons for Seeking Contact i Information gathering | .701 | | |
| Reasons for Seeking Contact d Solving a problem | .670 | -.308 | |
| Reasons for Seeking Contact c Saving Time | .651 | -.390 | |
| Planning and Control Scale Item n | .633 | | .495 |
| Planning and Control Scale Item j | .577 | .336 | .316 |
| Reasons for Seeking Contact h Response to Competitor action | .567 | | |
| Planning and Control Scale Item d | .553 | .307 | .433 |
| Planning and Control Scale Item k | .533 | | .413 |
| Reasons for Seeking Contact a Looking for Ideas | .524 | | |
| Planning and Control Scale Item a | .502 | | -.430 |
| Planning and Control Scale Item l | .495 | | |
| Communication Climate b | .449 | .351 | |
| Planning and Control Reverse scored item e | | | |
| Communication Climate c | .314 | .591 | -.406 |
| Communication Climate h | .322 | .538 | -.433 |
| Communication Climate j | | .506 | |
| Reasons for Seeking Contact j Lack of internal resources | .423 | -.494 | |
| Reasons for Seeking Contact b Lack of own R&D dept | .316 | -.487 | |
| Planning and Control Reverse score item g | | .477 | |
| Planning and Control Reverse Scored LikertScale conversion l | | .443 | |
| Planning and Control Reverse score item c | | .386 | |
| Planning and Control Reverse score item m | | .345 | .316 |
| Communication Climate e | | .465 | -.506 |
| Communication Climate a | .315 | .393 | -.492 |
| Planning and Control Scale Item h | .309 | | .395 |
| Planning and Control Reverse score item f | .344 | .363 | .375 |
| Planning and Control Reverse Scored LikertScale conversion b | | | |

Extraction Method: Principal Component Analysis.

a. 3 components extracted.

**Varimax Rotated Component Matrix**[a]

| | Component 1 | 2 | 3 |
|---|---|---|---|
| Reasons for Seeking Contact g Cost Reduction | .768 | | |
| Reasons for Seeking Contact c Saving Time | .762 | | |
| Reasons for Seeking Contact d Solving a problem | .740 | | |
| Reasons for Seeking Contact i Information gathering | .734 | | |
| Reasons for Seeking Contact f Risk Minimisation | .720 | | |
| Reasons for Seeking Contact e Accessing resources | .675 | .320 | |
| Reasons for Seeking Contact h Response to Competitor action | .652 | | |
| Reasons for Seeking Contact j Lack of internal resources | .574 | | -.305 |
| Reasons for Seeking Contact a Looking for Ideas | .535 | | |
| Planning and Control Scale Item a | .495 | | .448 |
| Planning and Control Reverse score item m | -.389 | | |
| Planning and Control Reverse scored item e | -.342 | | |
| Planning and Control Scale Item n | | .784 | |
| Planning and Control Scale Item d | | .749 | |
| Planning and Control Scale Item j | | .692 | |
| Planning and Control Scale Item k | | .635 | |
| Planning and Control Reverse score item f | | .615 | |
| Planning and Control Scale Item l | | .527 | |
| Communication Climate b | | .511 | |
| Planning and Control Scale Item h | | .458 | |
| Planning and Control Reverse Scored LikertScale conversion l | | .381 | .346 |
| Planning and Control Reverse score item g | | .373 | .327 |
| Planning and Control Reverse score item c | | .342 | |
| Planning and Control Reverse Scored LikertScale conversion b | | | |
| Communication Climate c | | | .765 |
| Communication Climate h | | | .745 |
| Communication Climate e | | | .712 |
| Communication Climate a | | | .673 |
| Reasons for Seeking Contact b Lack of own R&D dept | .418 | | -.483 |
| Communication Climate j | -.328 | | .426 |

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 5 iterations.

**Direct Oblim Pattern Matrix**[a]

| | Component 1 | 2 | 3 |
|---|---|---|---|
| Reasons for Seeking Contact g Cost Reduction | .761 | | |
| Reasons for Seeking Contact c Saving Time | .759 | | |
| Reasons for Seeking Contact d Solving a problem | .735 | | |
| Reasons for Seeking Contact i Information gathering | .733 | | |
| Reasons for Seeking Contact f Risk Minimisation | .715 | | |
| Reasons for Seeking Contact e Accessing resources | .657 | | |
| Reasons for Seeking Contact h Response to Competitor action | .654 | | |
| Reasons for Seeking Contact j Lack of internal resources | .568 | -.310 | |
| Reasons for Seeking Contact a Looking for Ideas | .521 | | |
| Planning and Control Scale Item a | .504 | .447 | |
| Planning and Control Reverse score item m | -.411 | | .320 |
| Planning and Control Reverse scored item e | -.352 | | |
| Communication Climate c | | .759 | |
| Communication Climate h | | .741 | |
| Communication Climate e | | .718 | |
| Communication Climate a | | .677 | |
| Reasons for Seeking Contact b Lack of own R&D dept | .401 | -.475 | |
| Communication Climate j | -.327 | .425 | |
| Planning and Control Scale Item n | | | .781 |
| Planning and Control Scale Item d | | | .745 |
| Planning and Control Scale Item j | | | .680 |
| Planning and Control Scale Item k | | | .632 |
| Planning and Control Reverse score item f | | | .618 |
| Planning and Control Scale Item l | | | .515 |
| Communication Climate b | | | .496 |
| Planning and Control Scale Item h | | | .466 |
| Planning and Control Reverse Scored LikertScale conversion l | | .323 | .369 |
| Planning and Control Reverse score item g | | .304 | .368 |
| Planning and Control Reverse score item c | | | .336 |
| Planning and Control Reverse Scored LikertScale conversion b | | | |

Extraction Method: Principal Component Analysis.
Rotation Method: Oblimin with Kaiser Normalization.

a. Rotation converged in 12 iterations.

## Appendix 14 Rotated Component Matrices 12 Items

**Rotated Component Matrix[a]**

| | Component | | |
|---|---|---|---|
| | 1 | 2 | 3 |
| Reasons for Seeking Contact d Solving a problem | .858 | | |
| Reasons for Seeking Contact c Saving Time | .830 | | |
| Reasons for Seeking Contact i Information gathering | .809 | | |
| Reasons for Seeking Contact g Cost Reduction | .807 | | |
| Planning and Control Scale Item n | | .839 | |
| Planning and Control Scale Item d | | .786 | |
| Planning and Control Scale Item j | | .775 | |
| Planning and Control Scale Item k | | .761 | |
| Communication Climate h | | | .797 |
| Communication Climate e | | | .792 |
| Communication Climate c | | | .768 |
| Communication Climate a | | | .724 |

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 4 iterations.

**Pattern Matrix: Direct Oblim[a]**

| | Component | | |
|---|---|---|---|
| | 1 | 2 | 3 |
| Reasons for Seeking Contact d Solving a problem | .869 | | |
| Reasons for Seeking Contact c Saving Time | .850 | | |
| Reasons for Seeking Contact i Information gathering | .818 | | |
| Reasons for Seeking Contact g Cost Reduction | .801 | | |
| Communication Climate e | | .802 | |
| Communication Climate h | | .796 | |
| Communication Climate c | | .766 | |
| Communication Climate a | | .725 | |
| Planning and Control Scale Item n | | | .850 |
| Planning and Control Scale Item j | | | .789 |
| Planning and Control Scale Item d | | | .784 |
| Planning and Control Scale Item k | | | .771 |

Extraction Method: Principal Component Analysis.
Rotation Method: Oblimin with Kaiser Normalization.

a. Rotation converged in 5 iterations.

**Table 41: Rotated Solutions 12 items**

## APPENDIX 15: MULTICOLLINEARITY IN THE BOARD HUMAN CAPITAL VARIABLES

**Hypothesis 1: Board Human Capital explaining Innovation.**

The innovation count data has a poisson distribution so it is inappropriate to run the multiple regressions with SPSS software. Limdep does not have the same capacity to produce multicollinearity diagnostics. Multicollinearity has therefore been established for hypothesis 2 where OLS regression techniques have been used. The remedy for the multicollinearity has none the less been applied to hypothesis 1 in the same way as Hypothesis 2 in that the regression models have been run separately with both age and education and service length and education as independent variable to determine their contribution to the dependent variable. In this way the masking effect of the multicollinear variable is avoided and the contribution of the independent variables on their own are clear.

**Hypothesis 2: Board Human Capital explaining Entrepreneurial capability score**
The tables below give several tests of multicollinearity. Table 1 gives two of the most commonly used measures: the tolerance value and variance inflation factor (VIF).

**Table 42: Hypothesis 2 SSPS OLS Regression Tolerance / VIF Tests**

**Hypothesis 2 OLS Regression Multicollinearity Diagnostics**

| Model | | Unstandardized Coefficients | | Standardized Coefficients | | | Collinearity Statistics | |
|---|---|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | t | Sig. | Tolerance | VIF |
| 1 | (Constant) | 276.859 | 43.236 | | 6.403 | .000 | | |
| | Mean Board Age | -2.082E-03 | .913 | .000 | -.002 | .998 | .758 | 1.319 |
| | Mean Board Service | -2.425 | 1.685 | -.199 | -1.440 | .154 | .629 | 1.590 |
| | Mean Board Education Score | 3.101 | 1.782 | .213 | 1.740 | .086 | .807 | 1.240 |

a. Dependent Variable: Entrepreneurial Capability Score

Both the Tolerance and VIF figures should approach a value of 1 if there is no multicollinearity and the independent variables have no tendency to explain each other. A variable tolerance shows the amount of variability not explained by the other independent variables. The VIF is derived from the tolerance value VIF = 1/Tolerance so the tests are closely related. It is apparent that for hypothesis 2 with all the human capital variables included in the regression model there is a degree of multicollinearity between the human capital variables. The tolerance values are well below 1 for all.

**Table 43: Hypothesis 2 SSPS OLS Regression Collinearity Diagnostics**

**Collinearity Diagnostics**[a]

| Model | Dimension | Eigenvalue | Condition Index | Variance Proportions (Constant) | Mean Board Age | Mean Board Service | Mean Board Education Score |
|---|---|---|---|---|---|---|---|
| 1 | 1 | 3.633 | 1.000 | .00 | .00 | .01 | .01 |
| | 2 | .309 | 3.431 | .00 | .00 | .07 | .50 |
| | 3 | 4.500E-02 | 8.985 | .17 | .08 | .85 | .48 |
| | 4 | 1.350E-02 | 16.402 | .83 | .92 | .07 | .01 |

a. Dependent Variable: Entrepreneurial Capability Score

Table 2 gives additional information on possible multicollinearity that would make the regression model unstable. If several of the eigenvalues approach a zero value the variables are highly intercorrelated and these small data values can lead to large changes in the coefficient values. The condition index, another measure but derived from the eigenvalues, identifies the principal cause with a measure over 15 for Mean Board Age.

**Remedy for Identified Multicollinearity**

There are various remedies for identified multicollinearity but the simplest and most effective was to simply estimate separate regression models for age and service with education so the effect was avoided without sacrificing potentially interesting explanations on the relationships between the variables involved. The tables below show the same diagnostic measures as discussed above applied to such separated regression models indicating reduced Collinearity. These separate estimations reveal an interesting aspect to the board human capital analysis not least the relationship of age and service length to education level. It should be noted that education and service length still have tolerance and VIF figures indicating some form of relationship. The condition index is below 15 so that these independent variables have been used together in the regression model none the less. The background to the relationship between these variables is discussed in detail in Chapter 6.

**Table 1: Hypothesis 2 Mean Board Age and Education as independent variable Entrepreneurial capability score and dependent variable**

**Coefficients[a]**

| Model | | Unstandardized Coefficients B | Unstandardized Coefficients Std. Error | Standardized Coefficients Beta | t | Sig. | Collinearity Statistics Tolerance | Collinearity Statistics VIF |
|---|---|---|---|---|---|---|---|---|
| 1 | (Constant) | 268.640 | 43.167 | | 6.223 | .000 | | |
| | Mean Board Age | -.641 | .804 | -.088 | -.797 | .428 | .993 | 1.008 |
| | Mean Board Education Score | 4.212 | 1.618 | .289 | 2.602 | .011 | .993 | 1.008 |

a. Dependent Variable: Entrepreneurial Capability Score

**Collinearity Diagnostics[a]**

| Model | Dimension | Eigenvalue | Condition Index | Variance Proportions (Constant) | Variance Proportions Mean Board Age | Variance Proportions Mean Education Board |
|---|---|---|---|---|---|---|
| 1 | 1 | 2.777 | 1.000 | .00 | .00 | .03 |
| | 2 | .209 | 3.642 | .02 | .03 | .91 |
| | 3 | 1.417E-02 | 13.997 | .98 | .97 | .06 |

a. Dependent Variable: Entrepreneurial Capability Score

**Table 2: Hypothesis 2 Mean Board Service and Education as independent variable Entrepreneurial capability score and dependent variable**

**Coefficients[a]**

| Model | | Unstandardized Coefficients B | Unstandardized Coefficients Std. Error | Standardized Coefficients Beta | t | Sig. | Collinearity Statistics Tolerance | Collinearity Statistics VIF |
|---|---|---|---|---|---|---|---|---|
| 1 | (Constant) | 276.784 | 27.879 | | 9.928 | .000 | | |
| | Mean Board Education Score | 3.100 | 1.752 | .213 | 1.769 | .081 | .823 | 1.215 |
| | Mean Board Service | -2.427 | 1.463 | -.199 | -1.660 | .101 | .823 | 1.215 |

a. Dependent Variable: Entrepreneurial Capability Score

**Collinearity Diagnostics[a]**

| Model | Dimension | Eigenvalue | Condition Index | Variance Proportions (Constant) | Variance Proportions Mean Board Education | Variance Proportions Mean Board Service |
|---|---|---|---|---|---|---|
| 1 | 1 | 2.664 | 1.000 | .01 | .03 | .01 |
| | 2 | .298 | 2.990 | .00 | .47 | .13 |
| | 3 | 3.816E-02 | 8.356 | .99 | .50 | .85 |

a. Dependent Variable: Entrepreneurial Capability Score

## APPENDIX 16 : Total UK Enterprise Population Start of 1997

| Size Category | Empl'mt Cat % | Size | Business Numbers | Empl'mt 000's | Sales Turnover in £m. | Business % of total stock | Empl'mt % of total | % of Total Sales Turnover |
|---|---|---|---|---|---|---|---|---|
| Very Small | | 0-1 | 2,523,535 | 2,868 | 86,706 | 68.0 | 13.6 | 4.8 |
| | | 1-4 | 803,275 | 2,106 | 215,110 | 21.7 | 10.0 | 12 |
| | | 5-9 | 191,755 | 1,396 | 112,403 | 5.2 | 6.6 | 6.3 |
| Small | | 10-19 | 107,395 | 1,511 | 142,295 | 2.9 | 7.2 | 7.9 |
| | | 20-49 | 49,980 | 1,539 | 152,559 | 1.3 | 7.3 | 8.5 |
| **Total Small** | **99.1** | | **3,675,940** | | | **99.1** | **44.7** | **39.5** |
| | | 50-99 | 15,415 | 1,071 | 105,087 | 0.4 | 5.1 | 5.8 |
| Medium | | 100-199 | 8,135 | 1,121 | 112,913 | 0.2 | 5.3 | 6.3 |
| | | 200-249 | 1,580 | 352 | 38,550 | 0.0 | 1.7 | 2.1 |
| Total Medium | 0.6% | | 25,130 | | | 0.6 | 12.1 | 14.2 |
| **Total SME's** | **99.7%** | | | | | **99.7** | **56.8** | **53.7** |
| Large | | 250 -499 | 3,215 | 1,118 | 142,789 | 0.1 | 5.3 | 7.9 |
| | | 500+ | 3,410 | 7,993 | 688,751 | 0.1 | 37.9 | 38.3 |
| **Total Large** | **0.3%** | | **6,625** | | | **0.2** | **43.2** | **46.2** |
| **Total UK** | **100%** | **All** | **3,707,695** | **21,073** | **1,797,164** | **100** | **100** | **100** |

**Source:** Small and Medium Enterprises (SME) Statistics for the United Kingdom, 1997, SME Statistics Unit, Department of Trade and Industry, Sheffield July 1998 Table 1.1

### Table 2: Total UK Enterprise Population Start of 2002

| Size Category | Empl'mt Cat. % | Size | Business Numbers | Empl of'mt 000's | Sales Turnover in £m. | Business % of total stock | Empl'mt % of total | % of Total Sales Turnover |
|---|---|---|---|---|---|---|---|---|
| Very Small | | 0-1 | 2,634,395 | 2,937 | 155,566 | 68.3 | 10.7 | 6.8 |
| | | 1-4 | 796,880 | 2,332 | 203,837 | 20.6 | 8.4 | 8.9 |
| | | 5-9 | 215,855 | 1,537 | 133,276 | 5.6 | 5.6 | 5.8 |
| Small | | 10-19 | 119,145 | 1,660 | 161,615 | 3.1 | 6.0 | 7.1 |
| | | 20-49 | 56,515 | 1,746 | 175,000 | 1.5 | 6.3 | 7.6 |
| Total Small | 99.1% | | 3,822,790 | | | 99.1 | 37.0 | 36.2 |
| | | 50-99 | 19,255 | 1,340 | 151,155 | 0.5 | 4.8 | 6.6 |
| Medium | | 100-199 | 8,370 | 1,181 | 142,024 | 0.2 | 4.3 | 6.2 |
| | | 200-249 | 1,845 | 411 | 47,043 | 0.0 | 1.5 | 2.1 |
| Total Medium | 0.7% | | 29,470 | | | 0.7 | 10.6 | 14.9 |
| **Total SMEs** | **99.8** | | **3,852,260** | | | **99.8** | **47.6** | **51.1** |
| Large | | 250 - 499 | 3,740 | 1,340 | 170,063 | 0.1 | 4.7 | 7.4 |
| | | 500+ | 4,470 | 13,178 | 950,437 | 0.1 | 47.7 | 41.5 |
| Total Large | 0.2 | | 8,210 | | | 0.2 | 52.4 | 48.9 |
| Total UK | 100% | All | 3,860,470 | 27,662 | 2,290,016 | 100 | 100 | 100 |

**Source:** Source: Small Business Service Small and Medium Sized Enterprise (SME) Statistics for the UK 2002

## APPENDIX 17: THEORETICAL UNDERPINNING REFERENCE TABLE ENTREPRENEURIAL CAPABILITY CONSTRUCT

| General Area | Reference |
|---|---|
| **1) ORGANISATIONAL PROCESSES** | (Aldrich and Martinez, 2001, Aldrich, 1999, Burns and Stalker, 1961, Cyert and March, 1963, Eisenhardt and Tabrizi, 1995, Eisenhardt, 1989, Eisenhardt and Martin, 2000, Eisenhardt and Schoonhaven, 1990, Flamholtz, 1986, Freel, 1998, Ghoshal and Bartlett, 1995, Hite and Hesterly, 2001, Hite, 2005, Hofer and Charan, 1984, Lorenzoni and Lipparini, 1999, Nelson and Winter, 1982, Pavitt, 2003, Selznik, 1957, Senge, 1992, Teece, 1986, Teece, 1998, Teece and Pisano, 1994, Watson, 1995) |
| **2) MANAGEMENT PRACTICES** | |
| **Risk and Reward** | (Bennett and Robson, 2004) (Boyd and Salamin, 2001, Hambrick, 1987, Penrose, 1959) (Barnhart and Rosenstein, 1998, Barrett and Weinstein, 1998, Berry and Perren, 2001, Boyd and Salamin, 2001, Brockhaus, 1980, Busenitz, 1999, Chandler, 1996, Conyon et al., 2001, Daily and Dalton, 1992, Daily and Dalton, 1993, Daily et al., 2002, Douglas and Shepherd, 1999, Fama and Jensen, 1983, Forlani and Mullins, 2000, Gamble, 2000, Huse, 1998, Miner, 1990, Miner et al., 1989, Palich and Bagby, 1995, Shepherd et al., 2000, Stevenson and Gumpert, 1985, Zahra, 1996, Zahra et al., 2000) |
| **Finance / Equity in SMEs** | (Cooper and Smith, 1992, Cressy, 1996, Cressy and Storey, 1996, Murray, 1995, Scherer et al., 2000) |
| **Family Participation** | (Chua et al., 1999, Donckels and Frohlich, 1991, Goffee and Scase, 1985, Hofer and Charan, 1984, Lumpkin and Sloat, 2002, Murray, 2003, Salvato, 2002, Sharma et al., 1997, Sitorus, 2002, Ward, 1997, Westhead and Cowling, 1997, Westhead et al., 2002) |
| **Resource access / leveraging – Networks and Networking** | (Rothwell, 1991, Rothwell and Dodgson, 1991, Starr and Macmillan, 1990)<br>(Ahuja, 2000, Birley, 1986, Borch and Huse, 1993, Burt, 1992, Chell and Baines, 2000, Collinson, 2000, Conway, 2000, Curran et al., 1993, Dubini and Aldrich, 1991, Freel, 2000, Gilmore et al., 2000, Granovetter, 1973, Gulati, 1998, Gulati et al., 2000, Hansen, 1995, Hartman et al., 1994, Hite and Hesterly, 2001, Huggins, 2000, Jarillo, 1989, Jarillo, 1993, Johanisson and Monsted, 1997, Johannisson and Monsted, 1998, Larsen and Starr, 1993, Lee et al., 2001, Lee, 1993, Lipparini and Sobrero, 1994, Matlay and Fletcher, 2000, Mohan-Neill, 1995, Ostgaard and Birley, 1996, Rothwell, 1991, Rothwell and Dodgson, 1991) |
| **Internal Networking / Climate** | (Irwin et al., 1998) Burton, 1999, Chandler et al., 2000, Daellenbach et al., 1999, Gamble, 2000)(Cumming, 1998, Kanter, 1985, Link and Rees, 1991, Millar et al., 1997, Piergiovanni et al., 1997, Tushman and Nadler, 1986) |
| **Information seeking and sharing** | (Brush, 1992, Cooper et al., 1995, Cyert and March, 1963, Daft et al., 1988, Dollinger, 19, Dollinger, 1984, Mohan-Neil, 1993, Mohan-Neill, 1995, Thomas et al., 2004, Thomas et al., 1993, Thompson, 1967) |
| **Decision-making** | (Aitkins and Lowe, 1993, Aram and Cowan, 1990, Atkins and Lowe, 1996, Baker et al., 1993, Beaver and Jennings, 2000, Berry, 1998, Bracker et al., 1988, Busenitz, 1999, Gilmore and Kazanjian, 1989, Lyles et al., 1993, Papadakis et al., 1998, Robinson and Mcdougall, 1998, Robinson and Pearce, 1983, Robinson and Pearce, 1984, Robinson and Pearson, 1984, Schwenck and Schrader, 1993, Smith et al., 1988) |