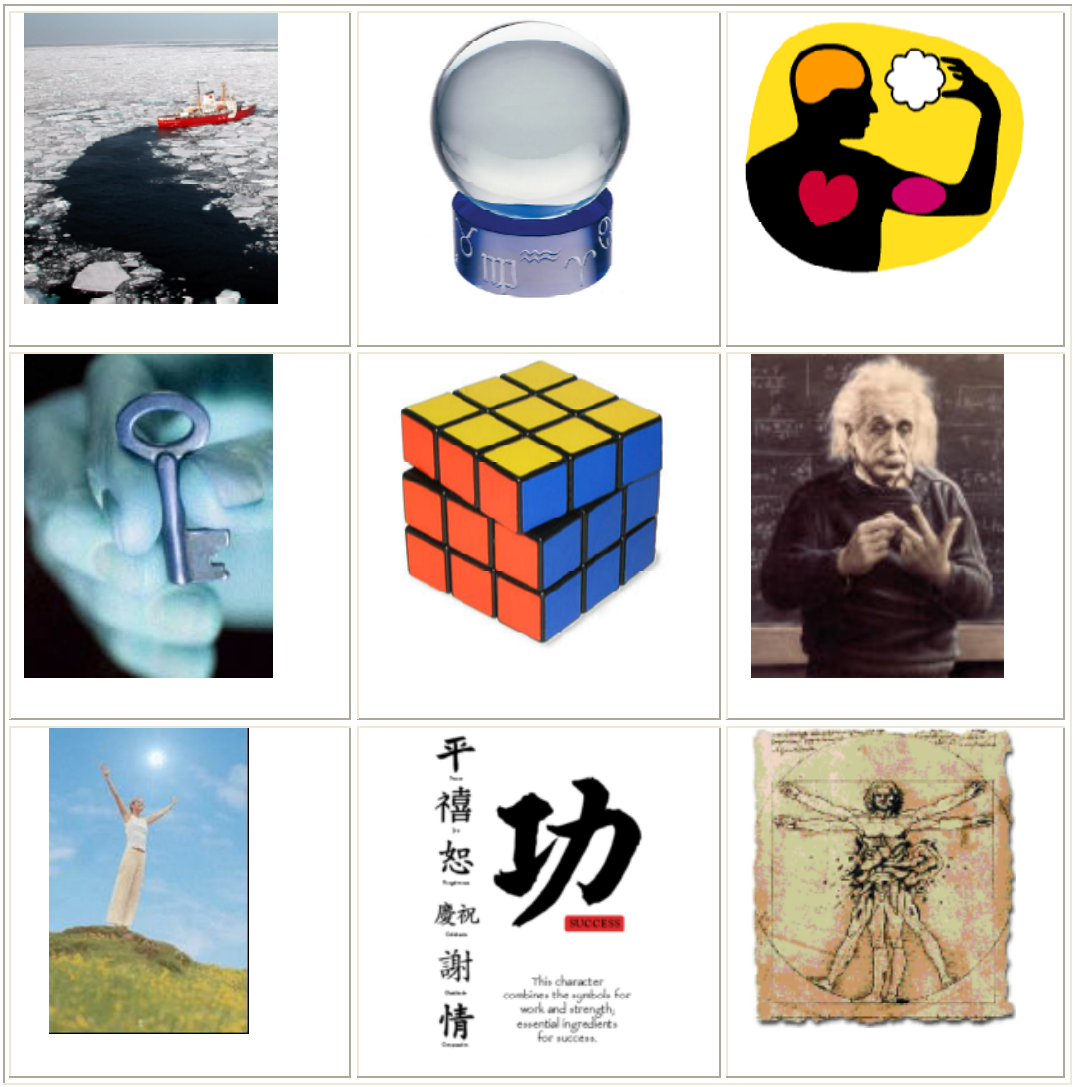

A Study of Innovation:

Anatomy of the Key Success Factors

by

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Preface

The title of this study has been carefully chosen. It is a subject that I have been passionate about for almost three decades. Not only does this report dissect the factors that drive successful innovation, but also it concludes with a new model to catch the mind with a central point of comparison between the drivers of innovation (wisdom, culture and reach) and their composite parts. Whilst the report has to follow the strict guidelines of a Henley MBA dissertation, every opportunity has been taken to lighten the load with illustrations and charts that represent the key points. There is a great deal of practicality lurking within the various sections.

There are many people who helped in the creation of this report. Thanks for your support, whether it was for returning my questionnaire, giving me a sofa for the night, or just wishing me luck. Special thanks to my wife Janet who helped to maintain my sanity and kept the coffee coming during the late nights, and to my tutors and fellow students who had to endure the occasional off-the-wall presentation on subjects related to innovation.

Mike Warren

October 2004

To Janet, Jessica, Nina and Hollie

1. Abstract

Innovation is at the heart of long-term growth, shareholder returns, and the ability to remain at the leading edge of the market. There is a vast amount of literature on subjects relating to innovation and its importance to the growth and prosperity of organisations has raised a number of questions about what actually drives success. Whilst many companies appear to be creative and resourceful, they do not always achieve success. According to the Harvard Business Review (2004) only 1 out of 10 new product introductions succeed in the market[1], thus provoking numerous attempts to identify the key factors in an effort to improve the outcome. Almost twenty years ago, Tushman and Nadler (1986)[2] predicted that managing innovation would become the most important organisational task of the future, however there is very little quantitative research reported in the literature to support this view.

This study takes a sample of 65 people working in various international organisations involved with innovation. It uses their perception of key success drivers in an empirical investigation of the factors that produced both positive and negative outcomes. From a theoretical total of nine factors indicated by the literature, there are only two conditions that have a significant impact on the outcome of the innovation process. The conclusions show how the percentage of new products that are successful in the market may be improved by taking a closer look at these conditions. Moreover, organisations that are aware of the key drivers are able to achieve faster growth, superior economic value added, and an increase in intellectual capital.

What are the absolute fundamentals of innovation? - Those things that if not done, or not in place, then innovation would have little possibility of succeeding? Using multiple regression analysis on the sample data, it appears that there are two components that make a statistically significant, unique contribution to successful outcome:

1. **Clear Product Definition**
2. **A Market Orientated Team**

The main limitation of the study is the small sample size and methodological constraints, which to some extent limit the confidence with which these conclusions can be drawn. However, the potential value of further research to explore the key success drivers in more detail would appear to be indicated by this study.

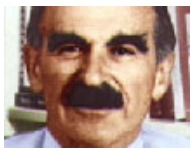
[1] Hamel, G. (2004) *"Innovate-Inexpensively"*, Harvard Business Review, July 38 pp.
[2] Tushman, A. and Nadler, B.C. (1986), "Organization for innovation", California Management Review

2. Introduction

This report offers a critical review of the literature relating to the success factors that drive innovation, and attempts to crystallise some common themes into *"Schools of Thought"* which characterise the views of different authors and can be used as a theoretical framework. The literature is vague on specifying performance measures for innovation, but the author suggests commonly used measures that can be applied to this type of study, i.e. "innovations that are categorised as products or services giving value to external customers". In a knowledge-based society, Intellectual Capital constitutes a large part of a company's value as well as its wealth; therefore this report looks at both financial and non-financial measures. Companies can be successful in any industry, but only if they use their intellectual capital to find sources of competitive advantage. Being individually creative is not enough. Innovation is a team enterprise.

CREATIVITY is thinking up new things. INNOVATION is doing new things

Theodore Levitt



The assumption that there might be a single universal factor driving success has been considered naïve by some authors, so studies have therefore tried to uncover an appropriate set of factors. Successful innovating companies often show an interesting blend of soft and hard approaches - sometimes relying on intuition rather than in-depth analysis and shifting their focus from creating "better and more" to "new and different". The type of climate within a business is one of the strongest drivers of successful innovation The development process, and its context, together with the way people are challenged to perform and supported while they do so, can inspire people to pursue innovation with passion, energy and commitment. In the conclusion to the report, the author proposes a new model that uses a metaphor to summarise contemporary thought on the key factors that influence the success of an innovation This suggests that a combination of ***wisdom, culture*** and ***reach*** is inherent in each of the "schools of thought" described.

2.1 Definitions

One of the key challenges of analysing innovation is the lack of consensus about what the term means. What are creativity and innovation? Often they are not distinguished and are simply seen as part of the process by which knowledge is developed and transformed into business value. But like the failure to differentiate between information and knowledge – it is not very useful for practical purposes. A more useful approach is to view creativity as the process of generating ideas whilst seeing innovation as the sifting, refining and more critically – the implementation of those ideas. Creativity is about divergent thinking. Innovation is about convergent thinking. Creativity is about the generation of ideas and innovation is about putting them into action. The academic literature contains a number of definitions of innovation, each revealing important aspects of it. Several authors emphasize newness, including anything perceived to be new by the people doing it (Rogers and Kim, 1985) or innovation as something different for each organization into which it is introduced (Downs and Mohr, 1976). The standard definition of innovation is **"the adoption of an existing idea, practice or object that is perceived as new by an individual or other unit of adoption"** (Rogers, 1995).

Whilst Roger's definition of innovation is precise and academic, it is not very descriptive of what is involved. Contemporary thought tends to view innovation more as a blend of people and processes, which is captured well in Joyce Wycoff's definition of innovation:

Innovation is about people using new knowledge and understanding to experiment with new possibilities in order to implement new concepts that create new value

Joyce Wycoff, Global Innovation Study Group

2.2 Aim of study

This report has three objectives: first, to offer a critical review of the literature relating to the success factors of innovation and to crystallise some common themes, second, to test the results empirically by researching the attitudes of people involved with innovation and new product development, thereby contributing to knowledge of the subject; and finally, to offer management effective recommendations that allow them to increase the likelihood of success of their innovation processes. The aim of the study is to provide a set of interrelated variables, definitions, and propositions that present a systematic view of the outcome of innovation by specifying relationships between the variables.

2.3 Scope of the Study

This is a broad-based study of the perceptions of people who have worked on innovative projects in the UK and internationally. Innovation can apply to a product, service or process of an organisation, and the benefits could be for either external or internal customers. In reviewing the literature, and selecting a target population for research, the author has focused mainly on areas where the benefit of the innovation is a product or service of value to external customers. This allows the outcome of the innovation to be more easily measured. The main limitation of the study is the small sample size and methodological constraints, which to some extent limit the confidence with which conclusions can be drawn. However, the potential value of further research to explore the key success drivers in more detail would appear to be indicated.

2.4 Structure of the Study

The report has been structured into four sections:

- A critical review of the main contributions on innovation and new product development found in the literature, together with a hypothesis derived from those views.
- The methodology used in the research.
- An analysis of the results.
- Conclusions of the study, together with a series of practical recommendations on how the key drivers of innovation can be used to improve the success rate.

2.5. Organising the Literature

The literature on innovation is expansive, necessitating a very selective treatment of the subject. There is also a great deal of conceptual ambiguity associated with the term "innovation", and therefore, a classification system has been developed for this study to move the discussion from an "author-centric" to a "concept-centric" structure by categorising author concepts into one of the following four ***"schools of thought":***

- ***The Development School***
  - Success is driven by the creativity, quality and definition of the product idea itself.
- ***The Process School***
  - Success is based on the implementation of the plan and bringing the idea to market.
- ***The Context School***
  - Success is driven by the favourability of the environment and the skill of the team.
- ***The Configuration School***
  - Success factors come from a combination of all of the three other schools.

2.6 Definition of Success

The process of innovation usually starts with a pool of knowledge. The innovator manipulates the information in a novel way to produce a new and potentially useful result (Radhakrishna, 1991)[3], but how is a "useful result" defined? According to Nick Bontis (1999) there are four measurement systems that could be considered: human resource accounting, economic value added, the balanced scorecard and intellectual capital, however, few of these measures have been used in the literature to any practical degree to measure the outcome of the innovation process. The following list is a typical selection of success measures frequently used or implied by various authors:

- **Sales impact:** How strong an impact the innovation had on the organisation's sales revenues.
- **Profit impact:** How strong an impact the project had on the organisation's annual profits.
- **Net Present Value:** The future impact of the project on the value of the firm. Projects with a positive NPV are expected to increase the value of the firm.
- **Profitability relative to spending:** How profitable the organisation's total new product efforts were, relative to the amount spent on them.
- **Success rate:** The proportion of development projects that become commercial successes.
- **Percentage of sales by new products:** The percentage of the organisation's sales accounted for by new products introduced within the last "x" years.
- **Technical success rating:** How successful the innovation was from a technical / technological perspective.
- **Meeting sales objectives:** The extent to which the innovation met the organisation's sales objectives for new products.
- **Profitability versus competitors:** How profitable the new product development project was relative to competitors' efforts.
- **Overall success:** Everything considered, how successful the organisation's innovation efforts were when compared to competitors.

Different measures are used by different industries. Venture capitalists, for example, tend to focus on sales and profit measures, whereas portfolio managers often choose non-financial measures such as technical success and competitive benchmarking. To date, few authors have used intellectual capital as a specific output measure for successful innovation, and therefore the concept will be touched upon in the following section.

[3] Radhakrishna, A V.& Varadarajan, A (1991) "Maximising Innovation in Industry and adapting to change" Industrial Management, Vol. 33 Issue 6, pp 19-22

2.7 The Role of Intellectual Capital

Traditional accounting methods, which are based on tangible assets and historical, transaction-based information, is not the only way to measure a successful innovation. Edvinsson (1997) defines Intellectual Capital (IC) as two major elements: human capital and structural capital. According to Edvinsson's view of IC (shown in Figure 1), human capital refers to the value of knowledge, skills and experiences held by individual employees in a firm; structural capital is the "embodiment, empowerment, and supportive infrastructure of human capital." As such, it includes all the things that support human capital in a firm, but which are left behind when employees go home at the end of the day. Lastly, customer capital is the value of customer relationships. Not every innovation needs to be directly measured by a financial return on investment. Incremental changes in quality and process improvement often yield important results such as improving workflow, efficiency and quality. That said, most of the focus in the literature remains on "breakthrough" change.

This study uses an increase in a firm's Intellectual Capital as one of the primary outcome measures of successful innovation. It takes into account the value of relationships between people within an organisation, and people external to the organisation. Trust, reciprocity, shared values, networking, and standards are all things that can also add value by increasing the spread of knowledge and incrementally improving the innovation process:

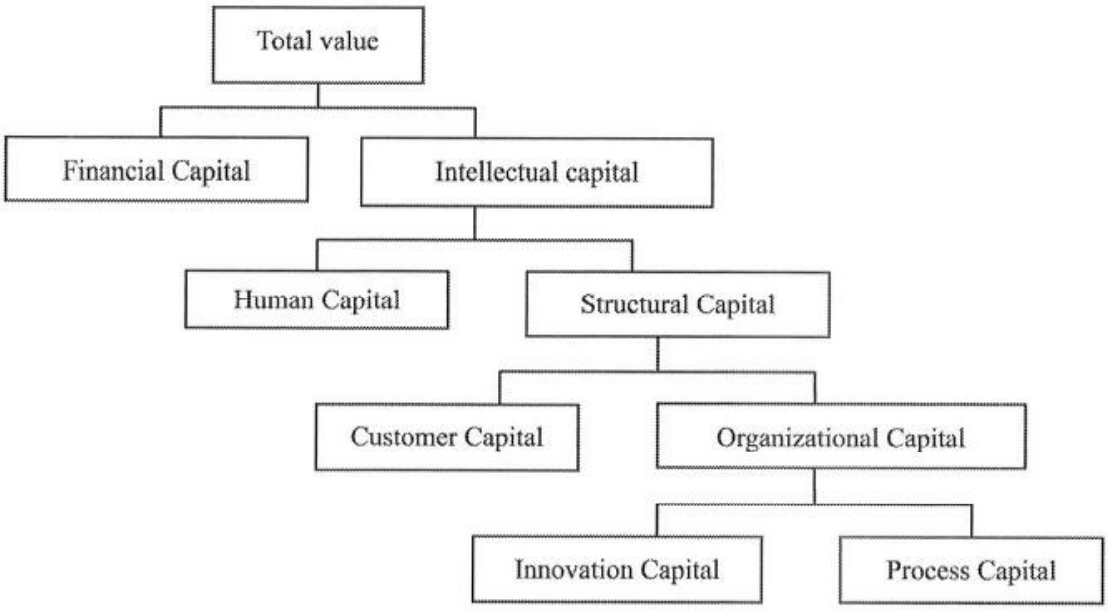


Fig.1 Edvinsson's IC Model

Chen et al (2004) updated Edvinsson's model and added that successful innovation is driven by an operational mechanism, a cooperation mechanism, and a motivation mechanism. Chen also covers the requirement for investment in human and material resources and a strong strategic vision from senior management, with good cooperation between R&D, marketing and operations.

2.8. The Factors Behind Success

Researchers have been analysing the various factors involved in successful product innovation for over 40 years. In recent times the focus has concentrated more on the process rather than the idea itself, but the assumption that there might be a single universal factor driving success was considered naïve by Souder (1986), so studies therefore tried to uncover the appropriate set of factors. Also Balachandra (2000)[4] concluded that there was no universal set of parameters and that furthermore some factors have been shown to produce contradictory effects on a project's success.

Van der Panne et al has examined 43 recent papers about the factors behind success and failure of innovative projects. Nine out of the 43 papers reported a set of possible causes for success or failure and provided some rank ordering, however, the various studies were seen to be inconsistent or inconclusive with respect to factors such as strength of competition, R&D intensity, the degree to which a project was "innovative" or "technologically advanced" and the level of top management support. Agreement does exist, however, about the positive impact on innovation of factors such as organisational culture, experience with innovation, and the multidisciplinary character of the management team. The importance given to different sets of factors vary widely with most studies. It is noteworthy that there were over 70 factors considered important in the Van der Panne studies, but each study listed only a few of these (ranging between 3 and 12) factors. Van der Panne's conclusion was that there were no common factors within the studies. Thomas Edison would probably object to any view that imposes a rigid structure on the process of innovation:

"Hell, there are no rules here -- we're trying to accomplish something."

[4] Balachandra, R. (2000) *"An expert system for new product development projects",* Industrial Management, Vol. 100, Iss. 7; pg. 317.

3. Literature Review

The following sections form a structured critique of academic and practitioner approaches to the factors that drive successful innovation. This leads to the framework of the research and formulation of the hypothesis. Since there are multiple 'schools of thought' on the subject, they have been classified into four categories that represent the key arguments. This structure highlights the differences in approach by each author, the weaknesses of some arguments and the criticism that they have received. A conclusion is given at the end of each school prospectus. All references are noted in the Bibliography using the Harvard system.

3.1. The Development School

The Development School is based on creativity, quality and definition of the idea. One of the strongest supporters of the development school is David Henard. From his review of the empirical literature he provides insights into a variety of evidence and multitude of factors that have been reported in the quest to identify the key drivers of new product success. Of the 24 predictors of new product performance investigated, he suggests that product advantage, meeting customer needs, and dedicated resources to implement the task, have the most significant impact on new product performance.

The Development School recognises that once an innovator has formulated ideas, a number of critical success factors have to be achieved before any results are realised (Henard, 2001). Rubenstein (1964) defined an idea as, "a potential proposal for undertaking new work which will require the commitment of significant organisation resources such as time, money and energy" The phrase "potential proposal" indicates that the idea must move into the next school, the process school before it is allocated necessary resources. However, the quality and quantity of ideas which exist within an organisation are directly dependent on the creative behaviour of the innovators and are not under the direct control of managers. Escher's views would be well accepted in the Development School:

"Only those who attempt the absurd will achieve the impossible."

The Development School is concerned with the "front-end" of the innovation process. Reinertsen (1999) coined the term "Fuzzy Front End" to describe methodologies for screening ideas, and indicates that fast idea screening systems make more economic sense than improving screening efficiency. The front end of innovation is defined as those activities that come before the formal and well structured New Product Development (NPD) stage of innovation. Even though there is a continuum between the front-end of Innovation and NPD, the activities of this preliminary stage are often chaotic, unpredictable and unstructured. In comparison, NPD is typically structured, which assumes formalism with a prescribed set of activities and questions to be answered. In contrast, perhaps the most comprehensive study to date from the Development School was published by Khurana and Rosenthal (1998) who defined the front-end as being complete when a business unit commits to funding and launch of a new-product development project or decides to redirect or stop the project (i.e., the go/no-go decision). Specifically, they indicate that successful organisations follow a holistic approach to the front end, giving an important insight into the necessary conditions for success when the front-end is complete.

Moenart & DeMeyer (1995), in one of the first studies that specifically evaluated front-end activities, investigated the integration of marketing and R&D activities and how information exchange affects a successful outcome. Moreover, the practice of reaching a sharp definition early in the new product development NPD process may not be desirable or even feasible in certain dynamic situations. Under high uncertainty, forcing early finalisation of specifications may result in a firm getting locked into an incorrect definition. Bhattacharya & Krishnan (1998) have proposed a system in which a firm adapts its product definition process to the market and competitive environment. Uncertainty in the product definition is resolved through "frequent, repeated interactions with customers and using a flexible development process. To maximise its anticipated profits, a firm should tune its innovation process to the prevailing level of market uncertainty, the marginal value of information obtained from the customer during the NPD process, and its own risk-profile and internal development capabilities".

3.1.1 Summary of the Development School

Quality and definition of the innovative idea is the key criteria for success. The Development School is concerned with the "front-end" of the innovation process – even in a turbulent environment a firm can adapt its product definition process to the market and competitive environment. Uncertainty in the product definition is resolved through frequent, repeated interactions with customers using a flexible development process.

3.2. The Process School

Students of the Process School like to debate the subject of creativity versus systems and processes. They believe that there is a direct trade-off between being well organised and being creative and that successful innovation must be reflected in human performance, systems, processes and technology.
Their simple definition of the invention and innovation process is:

Innovation = Invention + Exploitation

This definition has been widely attributed to Ed Roberts of MIT.
The innovation process starts with scanning the environment to find something new and something different. The Process School would then argue that further exploitation involves directing human and capital resources towards the creation of new knowledge, generating technical ideas, developing prototypes, and then transferring the ideas into manufacturing, distribution, and use. This *"strategy building"* involves the planning, implementation and effective integration of people, organisational processes, and action into a cohesive plan. Strategy building identifies the resources that enable staff to work on the innovation. For the process to be effective, management must recruit suitably creative people to generate ideas, and action must be taken to support their productivity. Some authors have advocated that the presence of a product champion (or the entrepreneur him/herself) is one of the necessary conditions for success. The Process School suggests that the three stages in the process of innovation are: "invention, translation and commercialisation" (Merrifield, B.D. 1986).
Bowers and Peterson (1965) observed that innovations require some kind of protective nurturing before they become viable. This point was initially made by Quinn and Mueller (1963) who suggested:

"A new product is like a baby, you can't just bring it into the world and expect it to grow up and be a success. It needs a mother (enthusiasm) to love and keep it going when things get tough. It needs a paediatrician (expert information and technical skills) to solve problems that the mother can't cope with alone, and it needs a father (authority with resources) to feed it and house it. Without any of these the baby may still turn out alright, but its chances of survival are a lot lower"

3.2.1 Summary of the Process School

Human performance, systems, processes and technology drive successful innovation. This implies building a strategy, appointing a product champion, and identifying the resources that enable staff to work on the innovation.

3.3. The Context School

This is a very popular school. Its philosophy embodies the bulk of contemporary thinking on what drives successful innovation. Peter Drucker is Principal of the Context School. His view is that success is more likely to result from the "systematic pursuit of opportunities than from a flash of genius (Drucker 2002)". His philosophy is that most innovative business ideas arise through the methodical analysis of seven areas of opportunity within the environment:

1. Unexpected occurrences,
2. Incongruities,
3. Process needs,
4. Industry and market changes,
5. Demographic changes,
6. Changes in perception, and
7. New knowledge.

According to Drucker (1984), "knowledge is the only meaningful resource today". Hence, access to relevant information plays a leading role in the development of ideas. The drive to seek new and up-to-date knowledge (the concept of the "learning organisation") is the only means of sustaining the value of the firm's knowledge resource. Drucker goes on to say that innovators need to look for simple, focused solutions to real problems and that grandiose ideas designed to revolutionise an industry rarely work. Innovation, like any other endeavour, takes *talent, ingenuity, and knowledge.*

Balachandra & Friar (1999) have looked at innovation projects based on their contextual nature, and Radnor & Noke (2002) have attempted to produce a "compass" (Figure 2) that attempts to move away from the process school and its traditional models (such as Cooper's stage / gate systems[5]), which dictate a particular course of action regardless of an organisation's strengths and weaknesses. The advantage of the compass is that it takes into consideration the 'context' of the innovation process.

[5] Cooper, R.G. and Kleinschmidt, E.J. (1993c), "Stage Gate Systems for New Product Success", Marketing Management, Vol. 1 No. 4, pp. 20-9.

The innovation compass has five core themes; structure, leadership, outputs, teams and context, which represent core elements that are often referenced in the literature.

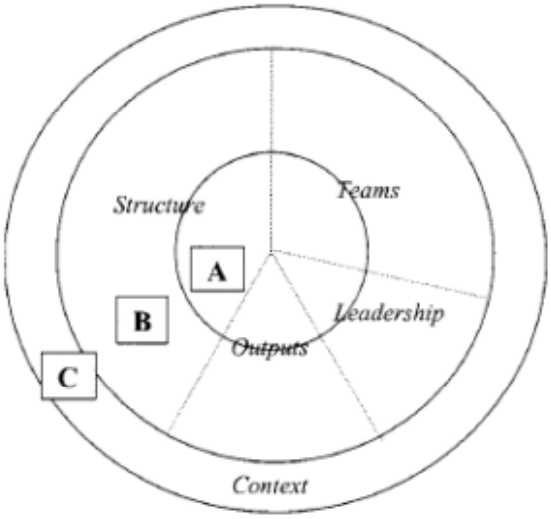


Fig. 2, The Innovation Compass, Radnor and Noke (2002)

Several authors have researched the individual elements of the Context School. For example, Bryman (1992) summarises leadership with an emphasis on motivation, empowerment and change. Other authors (McGill and Slocum, 1998; de Vries, 1996; Heifetz and Laurie, 1997; Kotter, 1996; Dougherty and Hardy, 1996; Brown and Eisenhardt, 1995; Bennis and Nanus, 1985; Burgelman, 1983; Tannenbaum et al., 1961) tend to agree that the most critical tasks of a leader are:

- Setting a clear vision and direction
- Directing the desired behaviour
- Creating an environment and climate that encourages people's abilities
- Deploying their own skills to maximum effect (not hands-on or hands-off but "hands-ready")
- Being seen to take responsibility at critical stages of the project.

However, Gee and Tyler in their study found several leadership weaknesses that were counter-productive to innovation, significant ones were:

- Poor interpersonal relationships
- Autocratic attitude
- Lack of profit orientation
- Lack of market orientation
- Lack of harmony with company objectives

The Context school tends to disagree with the philosophy of the Process school in that when providing a rigid or semi-rigid process to generate and evaluate ideas, the process itself may limit innovation in a number of ways. Requiring the idea to go through multiple "screens" before being funded can limit the scope of the original idea and potentially impact on the final product. For example, Context scholars would simply ask for cross-functionality within the team, and suggest that marketability is decided by a "leap of faith" rather than formal market research.

An organisation's culture is critical in fostering innovation. An organisation's leaders play a key role in setting the climate and exemplifying the attitude and ways of working they would expect from others. A culture supportive of innovation is characterised by openness. Information should be freely available to those that need it and communication, generally face-to-face, is encouraged. People need to feel that they are trusted and supported and, as a result, that there is a freedom to challenge, act and comment. In this context people will follow the courage of their convictions and the views of the 'non-conformist' will emerge:

"I believe in the idea of a 'restless company' where existing technologies are constantly challenged in a search for products that work better."

James Dyson, Inventor.

Innovative cultures like Dyson are supportive and fun to work in but these organisations demand and expect high performance. Mediocrity is not tolerated, but management go to great lengths to encourage their staff. They create 'no blame' cultures that allow people to take risks, to persevere and to overcome obstacles when giving up would have been easier. Management can influence and improve the number and usefulness of ideas by its behaviour and creation of the right environment. Generally, within the context school, there is a significant devolution of responsibility down the management chain, opening up opportunities for individuality. This type of school tends to develop staff by mentoring and supporting them through the development process. Connell et al (2001) suggest that optimal new product development requires a carefully managed balance of the five critical success factors:

(1) Executive direction
(2) Project team
(3) Innovation strategy
(4) Internal factors
(5) External factors

The hierarchy of these factors is shown in figure 3:

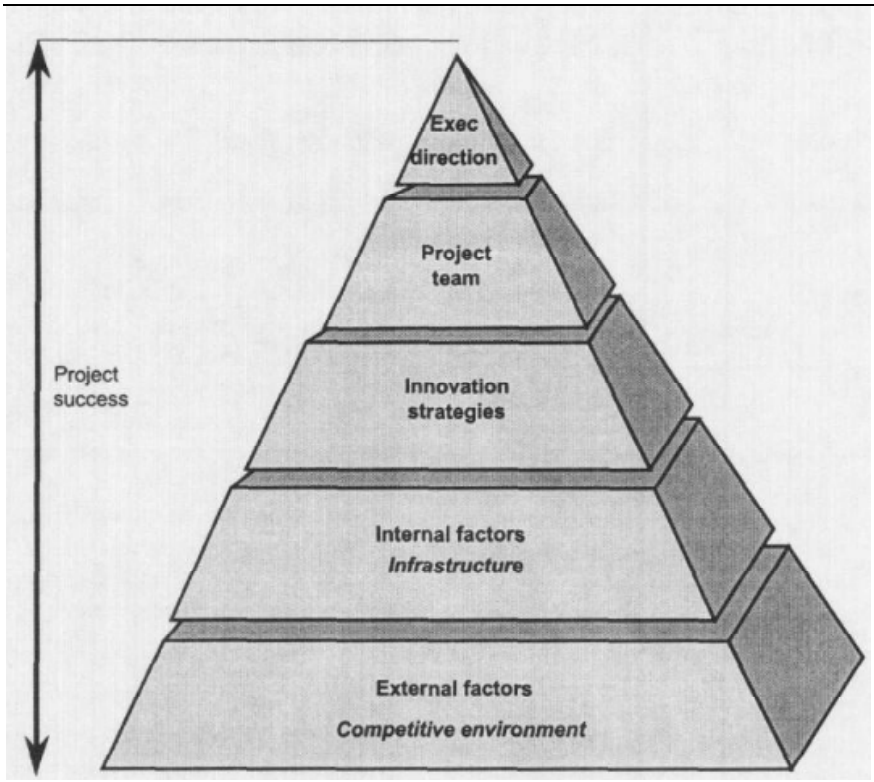


Fig 3. Connell Pyramid (2001)

Teams

One of the success drivers from the context school is recognition that people are the only real source of long-term competitive advantage. Companies from this school go to great lengths to support, encourage, thank and reward their team and to celebrate success. In these organisations, recruiting - and keeping - the right people is crucial. Successful teams generally include the functions that are directly or indirectly related to the design, engineering, manufacturing and marketing of the product for which they are responsible (Henke et al., 1993). In this way, cross-functional teams are formed by members from different specialities and with complementary skills. Each member has an equal stake in the project and, as a team, is accountable for the entire process, from beginning to end, not just one phase (Cooper, 1999).

According to Rickards & Moger the creative problem solving literature suggests that the creative performance of teams is enhanced by leadership interventions. This relates to the classical leadership dimensions of task orientation and relationship orientation. Jill Hender, a member of the Associate Faculty at Henley Management College and a researcher for Henley believes that the single most important factor in determining the success of innovation initiatives is having a leader and a team with the ability and passion to turn ideas into business reality[6]. How the project team is organized and functions has been found to strongly influence successful innovation in past studies[7]. The three main factors influencing successful team innovation are:

- The way teams are organized.
- The cross-functional nature of teams.
- Team accountability.

3.3.1 Summary of the Context School

The key driver of success is the ability to exploit the opportunities within the environment. The talent, ingenuity and knowledge of the team and its leadership should create a culture supportive of innovation that is open and cross-functional, with a passion to turn ideas into business reality.

3.4. The Configuration School

The philosophy of the Configuration School encompasses those of the other schools, and it is this encompassing which makes it special. The school believes that success is derived from an in-depth understanding of the dynamics of the markets in which the company operates and a real perception of the needs of customers.

Another factor for success is a deep understanding of how the product is positioned against the competition; for example, companies that compete on the basis of their own strengths and avoid head-on competition are more likely to realise success. In particular, they can compete on the basis of quality, design and service rather than cost.

[6] Hender, J. (2004) *"Innovation Leadership"* Henley Incubator - Grist
[7] Griffin, A. and Hauser, J.(1996) "Integrating R&D and Marketing: a review and analysis of the literature." Journal of Product Innovation Management, 13, pp. 191-215

The Configuration School has a strong emphasis on adding value, and their general philosophy is that an understanding of the external social, political and cultural forces will be the key drivers of successful innovation (Steele 1998). Once the environmental landscape has been mapped, authors such as Peter Drucker (from the Context School) recommend four different strategies that can turn opportunities into profitable action (edited by Heller, 2001):

- Being the first and strongest with an innovation, which if successful, will guarantee market dominance
- Outflank the entrenched opposition with a novel, powerful platform,
- Entering a market area or niche that can be claimed almost exclusively
- Change the rules by marketing the product or service in a different way.

Robert Cooper is also a great proponent of the Configuration School. He believes that a unique superior product with such elements as; value-for-money, relative product quality, and superior end-user benefits, are decisive factors in successful innovation. In previous studies; (Maidique & Zirger 1984; Cooper & Kleinschmidt 1987; Cooper & Kleinschmidt 1993a; Montoya-Weiss & Calantone 1994), successful innovation has been linked to quality of execution, and opportunities within the environment. As described by the Process School, product superiority is the result of a well-executed new product process, but within the context of the market and appropriate synergies (Cooper & Kleinschmidt 1993b). Successful innovating companies within the configuration school often have an interesting blend of formal and informal approaches - sometimes relying on intuition rather than in-depth analysis and shifting their focus from creating **"better and more" to "new and different".** This type of climate within a business is one of the strongest drivers of new product development performance, and an organisation's leadership, management, mission and values, together with the way people are both challenged to perform and supported while they do so, can inspire those people to pursue innovation with passion, energy and commitment. Cooper (1996) has also established from his benchmarking study[8] that there are three critical drivers of new product performance:

- **High quality new product process;** this process, whether explicit or implicit, includes activities taking the project from idea to launch. Success is driven by a high quality process.
- **Resource commitment;** adequate resources must be available for the process.
- **New product strategy;** a clear and well-communicated innovation strategy for the business unit.

[8] Cooper, R. G. (1996) "Overhauling the New Product Process" Industrial Marketing Management, 25, 465-482

If product innovation is to be a success, then a thorough understanding of certain macro-environmental factors would also be essential:

- **Customers' needs and wants.**
- **The competitive situation.**
- **The nature of the market.**

From a practical viewpoint this would involve market research, market assessment, customer tests, and market trials prior to launch.

Most innovative companies have learned the power of teams, but they go further, with team members extending outside of the organisation - to suppliers, collaborators, partners and, if appropriate, customers can also be part of the innovation team. The configuration school has networks, partnerships and alliances permeating the organisational structure. One of its key elements is trust between members of the network.

The configuration school encourages innovations that challenge and replace the established market formula with a new vision. For example, it may be necessary to change the route to market, perhaps by altering business processes or distribution. Moreover, for the implementation of radical innovations, it may be necessary for an organisation to change the way it is perceived by customers so that they can relate its brand image to products aimed at a completely different market. Since it is the implementation phase that is often the most crucial phase in the completion of a project, some authors have mapped the success and failure factors for this particular phase. Reports tend to be dominated by control aspects such as planning, budgeting and monitoring (Wijnen et al., 1997). Henley Incubator[9] has developed the innovation ecosystem (figure 4), which can be used as a framework to check an organisation's innovation environment and activities.

[9] Gaule, A (2004) "Innovation Measurement", Corporate Venturing; Issue 5.

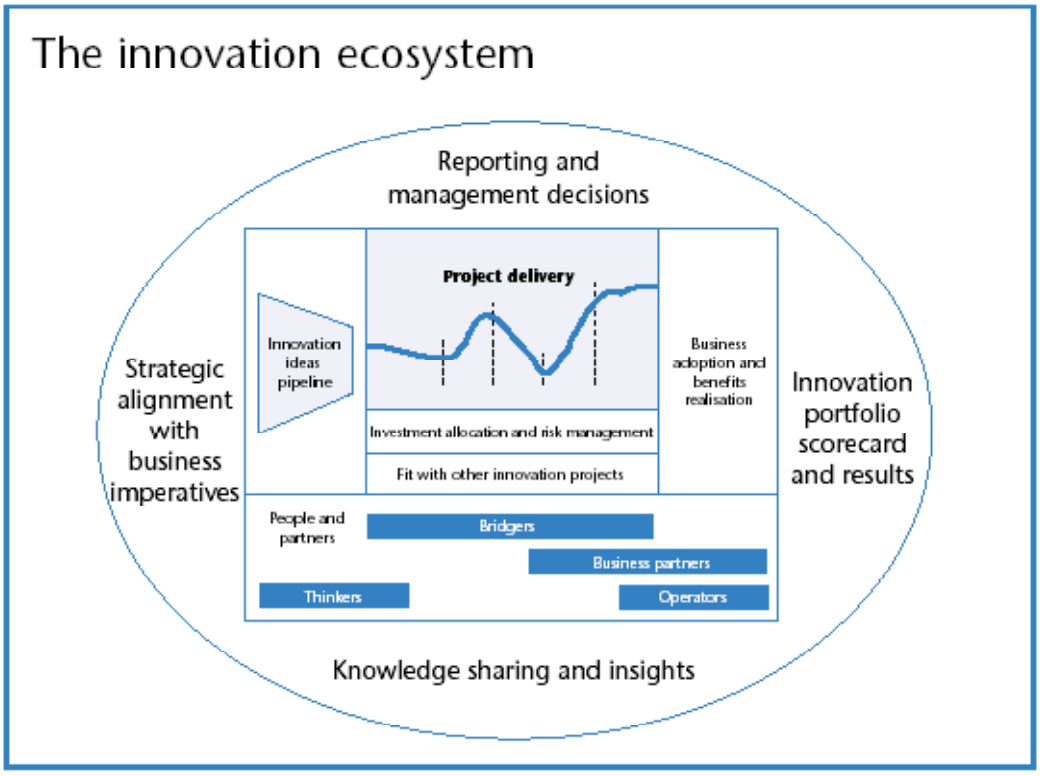


Fig.4

Risks in Innovation

Successful companies take steps to understand the nature of the risks involved, actively manage them through their development strategies and keep them within acceptable limits. Peter Drucker equates risk with ignorance rather than unpredictability, "The more you know about what you are doing, the less risk you run...you can define risks and seek to limit them". In the Configuration school, Ethan Simon (2003) believes that the support, involvement, commitment, and championing of the CEO and senior management is perhaps the most critical success factor. But Perel (2002) has said that CEOs and boards of directors have become the major impediment to sustaining innovation today, "Although most CEOs probably see themselves as fearless corporate leaders, in reality they lack the courage to embrace change or take a long-term view of their businesses".

3.4.1 Summary of the Configuration School

A high quality product and process definition, and a talented team with an in-depth understanding of the dynamics of the markets in which the company operates, and a real perception of the needs of customers - drive success. Networking with suppliers, collaborators, partners and customers is a principle philosophy of this school.

4. Theoretical Framework

Given the key points raised in the literature, and the theory of each school, the various philosophies can be tabulated according to the implications shown in table 1 below:

Table 1

PHILOSOPHY	INTERPRETATION
Development School Quality and definition of the innovative idea is the key criteria for success.	The product should offer unique and superior benefits that are highly visible to the user. A clear product and market definition is required early in the development process.
Process School Human performance, systems, processes, technology and strategy drive successful innovation.	During implementation the project should have a dedicated team of people and resources in place according to the agreed strategy and project plan
Context School Ability to exploit the opportunities within the environment. The talent, ingenuity and knowledge of the team and its leadership create a culture that drives success.	The product should be targeted at a high growth market with a lack of intense competition, and implemented by an experienced team with a dynamic leader and good networking and communication skills.
Configuration School Success is driven by a high quality product and process definition, and a talented team with an in-depth understanding of the dynamics of the markets	Early product and market definition drive success. An experienced, market orientated team should follow a formal innovation process that incorporates frequent networking with customers and suppliers.

Clearly the unanswered question in this review is the quantitative effect on successful outcome that these various factors impart.

5. Conceptual Framework

To assist in setting-out a conceptual framework through which the various elements of the research can be related, and to help develop a hypothesis, the author decided to conduct preliminary qualitative research at The National Centre for Product Design & Development Research, An interview with Jarred Evans, Commercial Manager, was recorded on 1 September 2004. A transcript of the interview is given in Appendix 1.

The key points made by Jarred Evans at this interview were as follows:

"I think the nine things you picked here are all good subject areas in themselves (figure 5), and it would be fair to say that you've probably got to be successful in all of these to have a successful product".

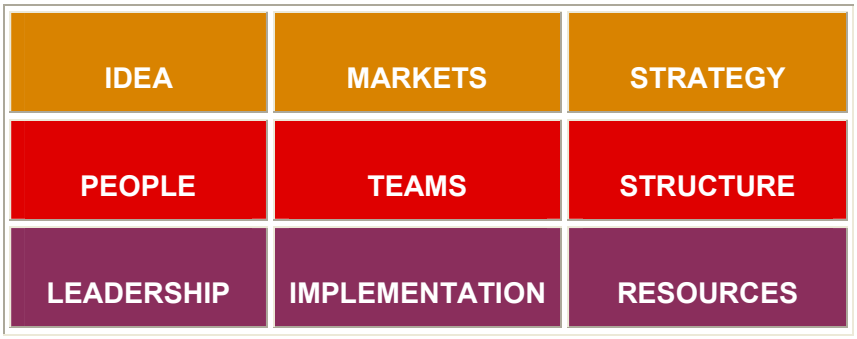


Fig.5 – Nine Key Factors

"Whether or not it's a big company or a small company, it's all about definition. You can push an idea through the process, whether or not you know its market. People will have a strategy, whether it's espoused, whether it's actually formalised is a new kettle of fish, but they will have a strategy of some kind or another. If there's leadership they will find the resources and the people, so you can link those two factors together – and they will quite often form a structure.

"I would take the right people first, that's my number one.
I would take an ability to understand the markets as number two.
And I would take the resources to do the job as number three.

Because I believe that with the right people, you generate the ideas and the leadership and form a strategy – I could form the team so I could put the structure together, and with the resources I could do the implementation properly. So that is the way I would link these factors".

The main challenge to qualitative data analysis is that there is no clear and accepted set of conventions for analysis (Robson 1993)[10], however, it is possible to use cognitive mapping to analyse the transcript and reveal a pattern of reasoning behind the issue. The chart below shows the hierarchy of cause and effect, and gives an indication of what the principal constructs of the survey should be:

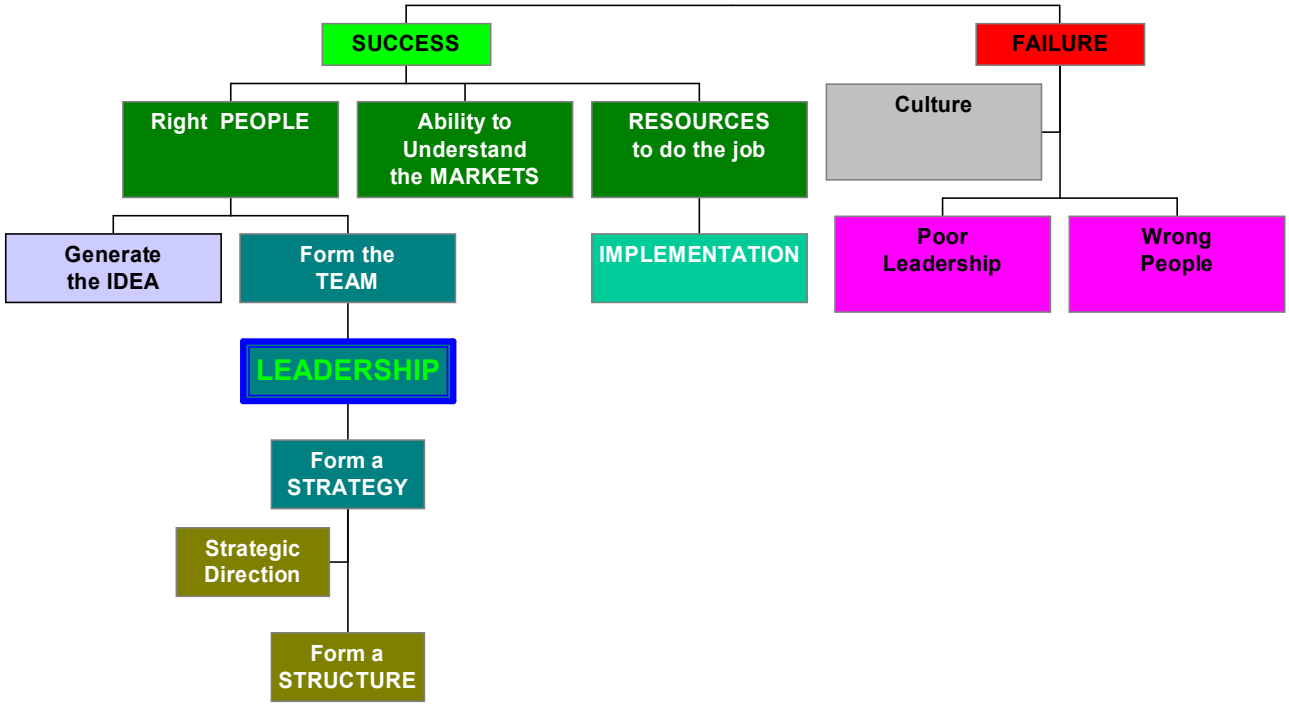


Chart 1. Factors influencing the success or failure of an innovation

This unstructured interview had a core theme that helped to explore the nine principal drivers indicated by the literature. The questions asked were open-ended, with the participant providing responses in his own words. The respondent had more control over the conduct of the interview in that he was allowed to discuss issues as they arose and not in an order predetermined by the author. The result of this open-ended approach was a richness of data which was unbiased by any interpretation which the author placed on it, and the results of the interview are used to supplement the quantitative analysis which is the principle objective of this study.

[10] Robson, C. (1993) Real World Research, Blackwell: Oxford

6. Hypothesis

From a study of the literature and the theories summarised in table1, together with the interpretation of those theories using preliminary qualitative research (chart 1), it is possible to develop a hypothesis that is simple, specific, and conceptually clear (Chart 2):

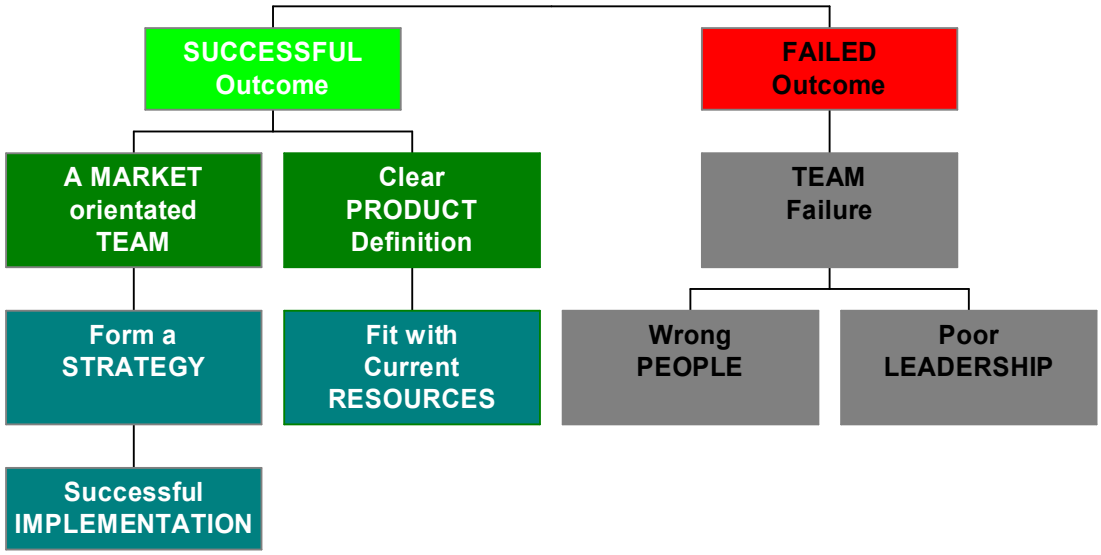


Chart 2. Development of Hypothesis.

The dependent variable in this hypothesis is **"successful outcome"**, as measured by sales growth, an increase in net present value, and an increase in intellectual capital. The independent variables are **"a market-orientated team" a**nd **"clear product definition"** which are constructs made up of various factors forming the "fuzzy-front-end" of the innovation process (see questionnaire design, Appendix 2). A market-orientated team and clear product definition are considered to be the primary drivers of success, with other criteria representing a sub-set of these constructs.

Hypothesis (H_1) is that a market-orientated team has a positive impact on successful outcome.

Hypothesis (H_2) is that product definition also has a positive impact on successful outcome.

The Null Hypothesis (H_0) is that neither of these factors have any impact on successful outcome. Technically, all statistical tests are tests of the null hypothesis first, which is rejected in favour of degrees of confidence in the alternatives.

7. *Research Methodology*

Chart 3. Summary of Methodological Approach

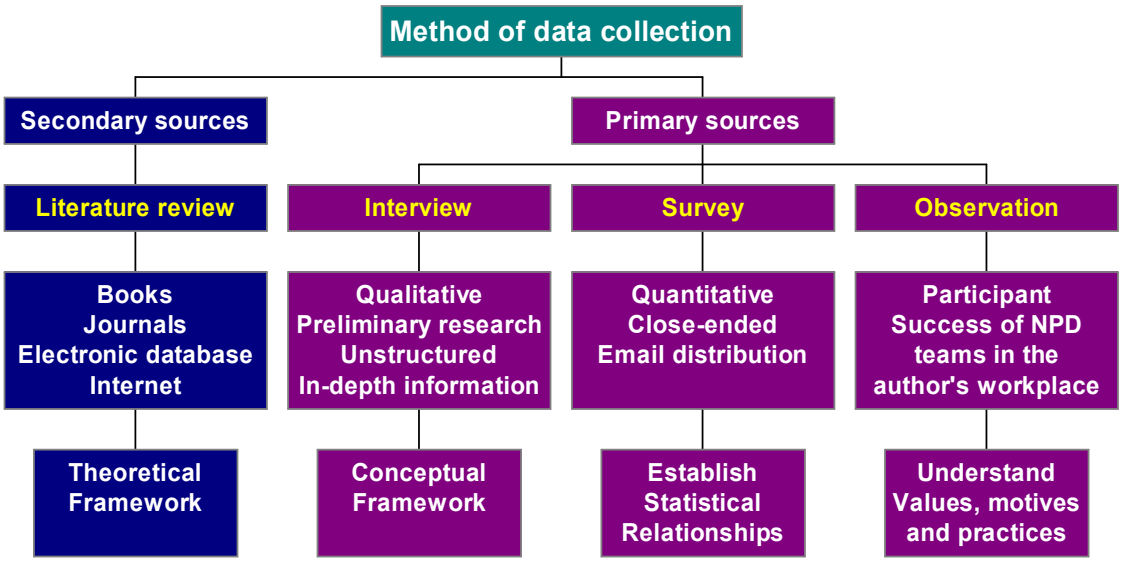


Chart 3 shows the approach taken to study the strength of association between success drivers and outcome of an innovation project. This positivistic approach to the problem is based on the belief that scientific relationships can provide a basis of explanation, anticipate phenomena, predict their occurrence, and therefore allow them to be controlled (Hussey 1997). The decision was based on the following paradigms of research (Table 2) based on the criteria of Maykut & Morehouse (1994).

Table 2. Questions	Positivist approach	Systemic approach
I. How does the innovation process work?	By carefully dividing and studying its parts, the process can be understood.	There are multiple scenarios. These scenarios are socio-psychological constructs that interconnect. Only the whole construct can be understood.
II. What is the relationship between the researcher and the process?	The researcher can stand outside of the process. True objectivity is possible.	The researcher and the process are interdependent.
III. What role do values play in understanding the innovation process?	Values can be suspended in order to understand the process.	Values mediate and shape what is understood about the process.
IV. Are causal linkages possible?	One event comes before another event and can be said to cause that event.	Events shape each other. Multidirectional relationships can be discovered.
V. What is the possibility of generalisation?	Explanations from one research study can be generalised to the population as a whole.	Only tentative explanations about the process are possible from one research study.
VI: What does research contribute to knowledge?	This positivist study seeks verification and proof of the stated hypotheses.	Generally, the systemist seeks to discover or uncover propositions.

A quantitative research methodology was appropriate since quantifiable measures of variables of interest were possible, and hypotheses had been formulated and could be tested, with inferences drawn from a small sample to the population of innovating companies as a whole.

The aim of the study was to provide a set of interrelated variables, definitions, and propositions that present a systematic view of the outcome of innovation by specifying relationships between the variables. However, it needs to be said that the main criticism of the positivistic approach is that it is impossible to treat people as being separate from their social contexts and their perceptions of their own activities. A highly structured research design such as this imposes certain constraints on the results and may ignore more relevant and interesting findings.

It is true that this research is not purely objective – the author's own direct observation, interests and values, over a 25 year period of working with innovation in the medical devices industry, have been brought to the design to add insight (hence the observation leg in the primary sources of data indicated in Chart 3). The conceptual framework, however, is supported by qualitative data, collected via a one-to-one interview, in order to provide depth to the hypothesis, and supplemented by a further interview to discuss the results and to add richness to the numerical data.

To organise the data from the qualitative research, cognitive mapping (Ackermann, Eden and Cropper 1990)[11] was used at the conceptual level – sorting, prioritising and interrelating the data into a structure (Chart 1). This revealed a pattern of reasoning for how the survey could be constructed, with distinct phrases used by the respondent linked to form a hierarchy of means and ends. This technique has frequently been used in similar projects concerned with the development of strategy. An analytical survey was therefore appropriate for this "cause-and-effect" type of study.

Based on a literature review and qualitative investigation, a hypothesis has been suggested using deductive reasoning, with generalisations leading to prediction, explanation, and understanding of the relationship between innovation success factors and outcome.

[11] Ackerman, Eden, Cropper (1990) Cognitive Mapping: A user Guide Working paper No12, Strathclyde University, Dept of Management Science

Questions were designed from concepts identified in the literature review and through preliminary qualitative research with the Commercial Manager of the National Centre for Product Design. Several authors who have designed studies to investigate success criteria in the field of new ventures, as shown in table 3, also support this methodology:

Study	Date	Study	Outcome
Vesper, K.H. and Gartner, W.B.	1997	Survey to discover if educational background and previous experience have an impact on successful innovation?	Innovators usually know their product, technology and industry, but need to learn more about financial management.
Stuart, R.W. and Abetti, P.A.	1987	Questionnaire developed to test if previous experience is one of the key characteristics of a successful innovation?	Previous experience and responsible managerial duties are one of the most important factors in explaining the success of new ventures.
Fried, H. and Hisrich, R.	1994	A case study methodology used to develop a model of the venture capital investment decision-making process.	1, Significant potential for earnings growth. 2, A business idea that can be brought to market within three years. 3, Substantial competitive advantage. 4, Reasonable overall capital requirements.

Table 3. Study designs in the field of new ventures

Once data had been compiled, factor analysis and multiple regression analysis were used to test the hypothesis that was derived from the conceptual framework, and a test was conducted to prove that the sample was representative of the general population.

7.1 Selection of subjects

In line with positivistic methodology, a survey was used on a sample of subjects drawn from the population of managers associated with the innovation process. The study was designed to make inferences about the population, and statistical techniques were used to generalise the findings. Natural sampling was through networking as this was a phenomenological study where it was essential to include people with experience of the innovation process and its outcome. The judgement as to whether the respondent had this knowledge or not was achieved through a set of screening questions at the beginning of the questionnaire. Several respondents screened themselves out of the survey if they felt they had insufficient knowledge of the outcome. A sample was drawn from 326 firms working in the field of product innovation with the desired informants being people with the relevant knowledge of product innovation.

7.2. Questionnaire design

The questions were of the author's own design based on three sources of data:

- The concepts / dimensions identified in the literature review
- Preliminary qualitative research
- Existing questionnaires used by the Department of Trade and Industry to evaluate innovative projects.

The questionnaire was designed to collect the following data.

- Biographical details about the respondents
- Respondent's perception of the outcome of successful innovation
- Multi-item scales for measuring the variables.

Questions were designed to operationalise the underlying constructs that were not directly measurable (e.g. successful outcome). According to Arthur Money (Henley Management College, Quantitative Analysis Seminar) the number of survey questions needed to operationalise a construct should be between 3 and 5. Since there were nine independent variables identified in the literature, it was decided to use 3 questions for each variable so that the total number of questions would be 27, a reasonable number for respondents to feel comfortable with. A thorough review of the literature indicated that a 5-point Likert scale had been used by other researchers in this type of study, and that coefficient alpha reliability with Likert-type scales had been shown to increase up to the use of five points, but then levelled off (Lissitz & Green, 1975).

Closed questions were used, offering respondents a number of defined response choices by using their left mouse button to inset a tick into a box. Closed questions were easily converted to the numerical format used by SPSS. The Likert scale gave a wide range of possible scores and increased the range of statistical analyses available. Clear instructions were given in the questionnaire and the tick mechanism proved to be virtually foolproof. The wording of the questions was based upon a review of the literature and also the "Investigating an Innovative Idea Diagnostic Tool" currently being piloted by the DTI Small Business Service who have constructed it form lengthy discussions with participating consultants.

The actual questionnaire (Appendix 2) was operationalised as shown in Table 4:

Table 4

	OPERATIONALISATION OF KEY DRIVERS AS SURVEY QUESTIONS	CONSTRUCT Dependent variable	OUTCOME MEASURES	
4	The benefits of the product were unique.	Product	SUCCESSFUL INNOVATION	**1** The project had a strong impact on sales growth
5	The benefits of the product were highly visible.			
6	The product had high purchase importance.			
7	The project had a close fit with business strategy.	Strategy		
8	There was a clear marketing & sales plan.			
9	The market need had been quantified.			
10	The leader was a good internal & external communicator.	Leadership		
11	The leader had good situational leadership style.			
12	Leader had a good motivational style			
13	The people who worked on the project had good knowledge of the market.	People		**2** The project made a positive contribution to the firm's Intellectual Capital
14	The people had emotional resilience.			
15	Senior management were committed to the project.			
16	The team had shared vision and values.	Team		
17	The team were dedicated & focused on the project.			
18	The team were accountable for the entire project.			
19	There was a cross-functional structure.	Structure		
20	The project was orientated towards the market.			
21	People had freedom to act in a "no-blame" culture.			
22	The intended market had a high growth rate	Market		**3** The project had a positive net present value
23	There was a lack of intense competition.			
24	The entry cost for new rivals was high.			
25	Sufficient time, money and energy were committed to the project.	Resources		
26	There was a clear focus on cashflow & capital.			
27	The project had a close fit with currently available resources			
28	The project had clear aims and objectives	Implementation		
29	The project had good planning and control.			
30	The project had tangible project milestones.			

7.3 Questionnaire test

The questionnaire (Appendix 2) was pilot tested on 10 cases to ensure that the instructions, questions, and scale items were clear. The pilot test was conducted on the same type of people who were used in the main study. All 42 questions could be completed in just over three minutes, and there were no misunderstandings except for section 3, the ranking of success factors. It was clear from discussions with the test sample that they had difficulty, and made errors, in ranking nine factors, and that a maximum of five would be preferred. The purpose of section 3 was re-evaluated, and it was concluded that it could be simplified by re-wording the question and asking respondents to tick just three boxes – their ranking of 1st, 2nd, and 3rd choice of the most important factors that influence successful innovation (chosen from nine options). Version 2 of the questionnaire (Innovation_Quest2) was then issued to the next set of respondents, and there were no further problems. The results from this simplified section remained effective in determining respondent's perceived ranking of success factors.

7.4 Data pre-test

A pre-test was conducted on the first 24 responses. A 'codebook' was prepared to record the process of converting information from each subject into a format that SPSS could understand (Julie Pallant, 2003). A data file was prepared in SPSS so that scales could be checked for internal consistency, and the dependent variable checked for normality. Data was checked for errors, and procedures used to obtain descriptive statistics for the continuous variables, including normality and outliers. Descriptives gave information on the distribution of scores on continuous variables (skewness and kurtosis), which were needed when variance techniques were applied to the data (also Tabachnick and Fidell, 1996 recommend inspecting the shape of the distribution using a histogram). It is a requirement of some statistical techniques that the distribution of the dependent variable score is "normal".

The graph shows the distribution of scores for the dependent variable in the pre-test sample:

In this group, scores appear to be reasonably normally distributed, with no data points sitting on their own and the score dropping away evenly at the high end. The distribution would be improved if additional "negative" scores were added, and this issue was addressed by rewording subsequent questionnaires (Appendix 2).

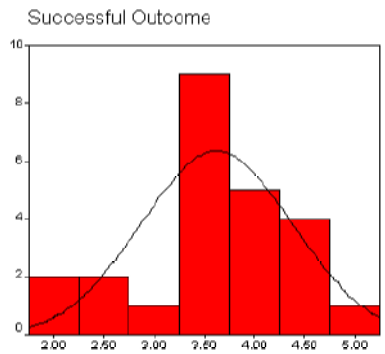


Chart 4.

7.5 Quantitative Data Analysis

The data collected was analysed using SPSS (Version 12). The analysis used a variety of univariate techniques, which seek simultaneously to analyse multiple measurements on the dependent variable under investigation, and which are based upon four fundamental assumptions (Hair et al., 1998):

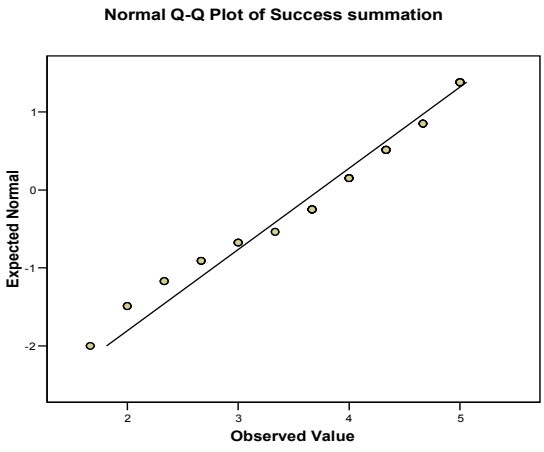
i. **Normality:** the degree to which the distribution of the sample data corresponds to a normal distribution.

ii. **Homoscedasticity:** the assumption that the dependent variable exhibits equal levels of variance across the range of predictor variables.

iii. **Linearity:** because only correlations representing linear associations between variables will be represented in the correlation value.

iv. **Absence of correlated errors:** prediction errors are uncorrelated with each other and independent of the predicted levels.

The process of data analysis involved three principle phases: firstly an initial examination of data to assess the assumptions of univariate analysis; secondly an exploratory factor and reliability analysis of the scales used; and finally the application of specific univariate techniques to test the hypothesis.
Normality, Linearity, Homoscedasticity, Independence of Residuals were tested by SPSS.



The dependent variable was measured by summing the responses to three questions about successful outcome. Each was anchored by 1,"strongly disagree" and 5, "strongly agree".

SUCCESSFUL OUTCOME	Mean
X1 -- Outcome_Impact on Sales Growth	3.60
X2 -- Outcome_Positive Net Present Value	3.68
X3 -- Outcome_Contribution to Intellectual Capital	3.92
Cronbach's Alpha	**0.7**

Cronbach's alpha measures the internal coherence of the successful outcome scale. The value varies between 0 and 1 and values equal to 0.7 and above are generally accepted (Cronbach, 1951)

Chart 5. Normal Probability Plot and Scale Reliability

In the Normal Probability Plot the points were in a reasonably straight line, which suggests no major deviations from normality within the sample.

7.5.1 Initial examination of the data

Initial data examination involves four stages (Hair et al., 1998): graphical analysis, missing data analysis, identification of outliers, and the assessment of the assumptions of univariate analysis.

There was no missing data. All variables were assessed for univariate normality, and extreme values judged to be relevant to the study were retained. Their impact was assessed and in this sample they were genuine scores with an appropriate effect on the analysis. The identification of univariate outliers and influential cases was undertaken by means of casewise diagnostics facility in SPSS, and examining the residual and normal probability plots, and by calculation of the Mahalanobis distances.

A more detailed description of the steps taken, and the processes involved, is given *in Appendix 3.*
The following section shows the main elements of the method used to analyse the data.

7.5.2 Reliability Analysis of the Scales

Reliability analyses were carried out prior to the application of specific univariate techniques. The purpose of factor analysis is to define the underlying structure in a data matrix by defining a set of underlying dimensions, or factors, and exploratory factor analysis may be used as an inductive procedure to develop scales (Hair et al., 1998). The factor model used was principal component analysis, in which the factors are based on the total variance.

In broad terms, the following criteria and rules of thumb were employed in the scale development (Hair et al., 1998):

i. Factors were extracted on the latent root criterion and only factors with an eigenvalue>1 were considered significant.
ii. Scale items with a communality <0.5 were deleted.
iii. Items with a measure of sampling adequacy <0.5 were deleted.
iv. A Varimax method of rotation was used.

7.5.3 Exploratory Factor Analysis

(File Reference Output_10_Oct_04)

Exploratory factor analysis was used to uncover the latent structure within the set of variables, and as such was a "non-dependent" procedure in that it did not assume a dependent variable was specified. Factor analysis was also used for the following purposes:

- To reduce a large number of variables to a smaller number of factors for modelling purposes.
- To select a subset of variables from a larger set based on which original variables have the highest correlations with the principal component factors.
- To create a set of factors to be treated as uncorrelated variables as an approach to handling multicollinearity in multiple regression.

Principal components analysis (PCA) is the most common form of factor analysis. PCA seeks a linear combination of variables such that the maximum variance is extracted from the variables. It then removes this variance and seeks a second linear combination that explains the maximum proportion of the remaining variance.

Interpretation of Output - Step 1

In the Correlation matrix there were a significant number of correlation coefficients above 0.3, which indicated that the matrix was factorable.
The Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO, Chart 6) value was > 0.6

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.752
Bartlett's Test of Sphericity	Approx. Chi-Square	876.696
	df	351
	Sig.	.000

Table 5.

The Bartlett's Test of Sphericity was significant, (i.e Sig. Value < 0.05)

Therefore factor analysis was appropriate for this sample.

Step 2: To determine how many components to extract, using Kaiser's criterion, only those components with an Eigenvalue of 1 or more were of interest (Table 6).

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	8.217	30.435	30.435	8.217	30.435	30.435
2	2.171	8.039	38.474	2.171	8.039	38.474
3	2.003	7.418	45.892	2.003	7.418	45.892
4	1.673	6.197	52.088	1.673	6.197	52.088
5	1.526	5.651	57.739	1.526	5.651	57.739
6	1.277	4.729	62.468	1.277	4.729	62.468
7	1.165	4.314	66.782	1.165	4.314	66.782
8	1.100	4.076	70.858	1.100	4.076	70.858
9	.969	3.588	74.447			
10	.871	3.227	77.673			
11	.806	2.984	80.658			
12	.635	2.353	83.010			
13	.597	2.211	85.221			
14	.589	2.182	87.403			
15	.541	2.002	89.405			
16	.422	1.561	90.966			
17	.394	1.458	92.424			
18	.348	1.289	93.713			
19	.318	1.177	94.890			
20	.287	1.063	95.953			
21	.226	.838	96.790			
22	.204	.755	97.545			
23	.181	.672	98.217			
24	.165	.611	98.828			
25	.148	.547	99.375			
26	.086	.319	99.695			
27	.082	.305	100.000			

Extraction Method: Principal Component Analysis.

Table 6.

In this sample, only the first eight components recorded Eigenvalues above 1.0. These 8 components explain a total of 70.858% of the variance (ref cumulative % column).

7.5.4 Factor Rotation and Interpretation

Total Variance Explained

Component	Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %
1	3.706	13.728	13.728
2	3.426	12.690	26.417
3	2.507	9.286	35.703
4	2.386	8.837	44.540
5	2.267	8.398	52.938
6	1.889	6.998	59.936
7	1.482	5.488	65.424
8	1.467	5.434	70.858

Extraction Method: Principal Component Analysis.

Table 7.

Table 7.

Only 8 components are listed, as compared with 27 in the previous unrotated output. The distribution of variance has also been restated, with the total variance explained being 70.858%.

7.5.5 Optimised Rotated Component Matrix

Table 8.

Rotated Component Matrix[a]

	Component							
	1	2	3	4	5	6	7	8
X11 --Situational Leadership Style	.861							
X10 -- Leader Good Communicator	.825				.316			
X12 -- Leaders Motivational Style	.754							
X21 -- No Balme Culture	.696					.385		
x4trans -- Benefits Unique and Well Defined		.728						
X6 -- High Purchase Importance		.710						
X20 -- Orientated Towards Market	.365	.624						
X5 -- Benefits Highly Visible		.599					.460	
X28 -- Clear Aims and Objectives	.354	.547		.357				
X16 -- Shared Vision and Values	.454	.500		.378		.321		
X27 -- Fit with Current Resources			.783					
X25 -- Sufficient Time Money and Energy			.704					
X26 -- Focus on Cashflow and Capital			.657			-.302		
X30 -- Tangible Project Milestones				.804				
X29 -- Good Planning and Control			.319	.686				
X8 -- Clear Marketing and Sales Plan				.503		-.448	.433	
X13 -- Good Knowledge of Market					.762			
X9 -- Market Need Quantified					.681			
x7trans -- Close Fit with Business Strategy				.329	.554			.507
X14 -- Emotional Resiliance		.418		-.366	.483			
X18 -- Accountable for Entire Project	.300		.405		.470			
X23 -- Lack of Intense Competition						.734		
X19 -- Cross-functional Structure				.321		.637		
X24 -- High Entry Cost for Rivals							.772	
X22 -- High Growth Market								.903

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 25 iterations.

From the results of Table 8, new scales were created by adding-up the scores for each of the items within the components identified by the exploratory factor analysis:

- Leadership
- Resources
- Market Orientated Team
- Implementation
- Product Definition

These components form the independent variables used in Multiple Regression Analysis.

The dependent variable (Successful Outcome) was also tested for reliability.

Each scale was assessed for normality (Chart 6). Results were within the acceptable range of –1 to +1.

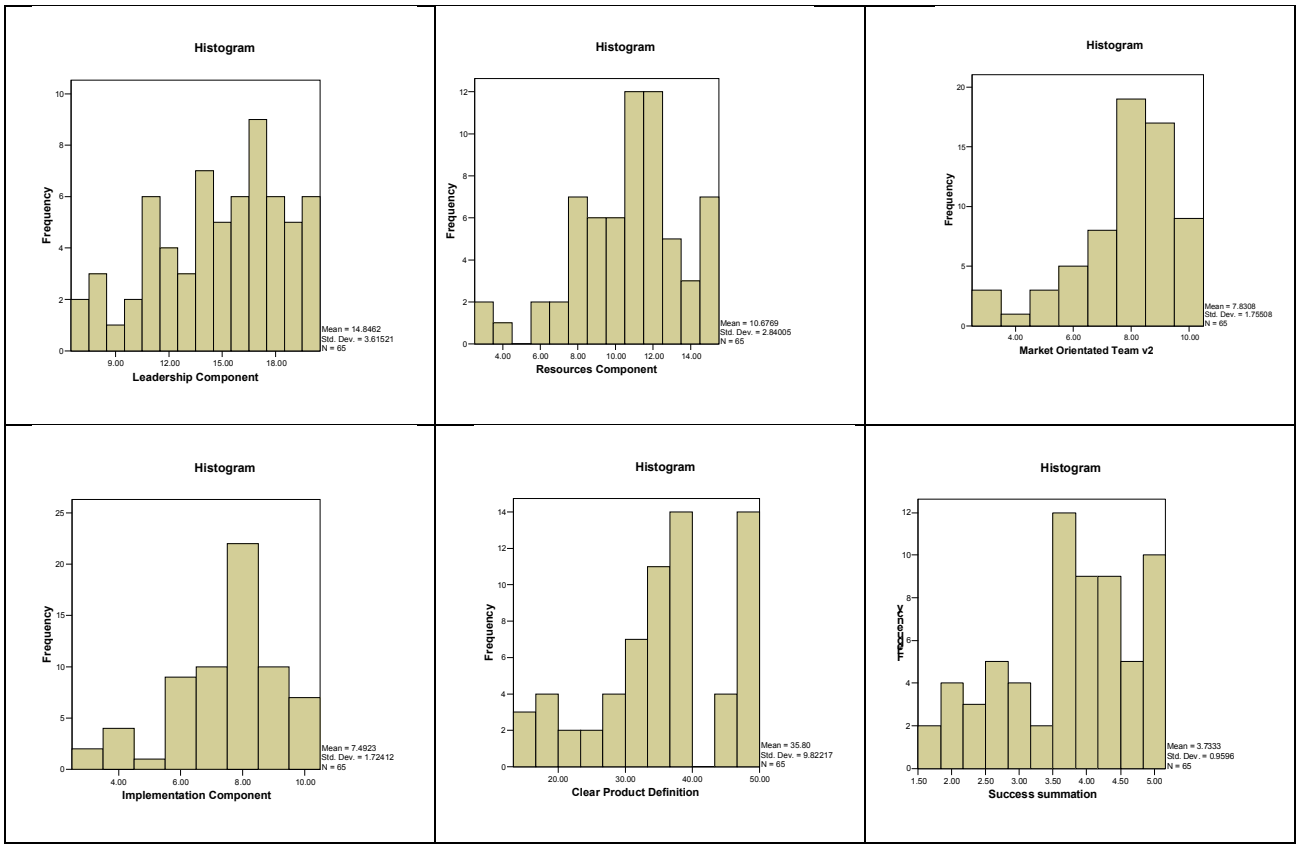


Chart 6.

Results:
All scales achieved a Cronbach alpha above 0.7 and a corrected item total correlation well above 0.3, which indicates that the scales were reliable within this sample (Chart 7).

Chart 7. Internal consistency of scales confirming that all questions are measuring the same underlying construct.

LEADERSHIP	Mean	Std. Deviation	N
X10 -- Leader Good Communicator	3.91	1.057	65
X11 --Situational Leadership Style	3.68	1.017	65
X12 -- Leaders Motivational Style	3.86	0.998	65
X21 -- No Balme Culture	3.40	1.285	65
Cronbach's Alpha			**0.844**

RESOURCES	Mean	Std. Deviation	N
X25 -- Sufficient Time Money and Energy	3.66	1.241	65
X26 -- Focus on Cashflow and Capital	3.55	1.186	65
X27 -- Fit with Current Resources	3.46	1.062	65
Cronbach's Alpha			**0.742**

PRODUCT DEFINITION	Mean	Std. Deviation	N
X6 -- High Purchase Importance	3.54	0.969	65
X20 -- Orientated Towards Market	4.05	0.856	65
X5 -- Benefits Highly Visible	4.03	0.984	65
X16 -- Shared Vision and Values	3.88	1.068	65
X28 -- Clear Aims and Objectives	4.18	0.934	65
X4 -- Benefits Unique and Well Defined	3.88	1.053	65
Cronbach's Alpha			**0.82**

IMPLEMENTATION	Mean	Std. Deviation	N
X30 -- Tangible Project Milestones	3.72	1.053	65
X29 -- Good Planning and Control	3.77	0.897	65
X8 -- Clear Marketing and Sales Plan	3.63	1.167	65
Cronbach's Alpha			**0.712**

MARKET-ORIENTATED TEAM	Mean	Std. Deviation	N
X13 -- Good Knowledge of Market	4	0.935	65
X9 -- Market Need Quantified	3.83	1.069	65
X14 -- Emotional Resiliance	3.8	0.939	65
X18 -- Accountable for Entire Project	3.71	1.208	65
X7 -- Close Fit with Business Strategy	4.31	0.865	65
Cronbach's Alpha			**0.714**

7.5.6 Checking the Assumptions

Multicollinearity:
The Correlations table showed that the independent variables had a relationship with the dependent variable > 0.3. The correlation between each of the independent variables was < 0.7, which according to Tabachnick and Fidell (1996) is acceptable. All the variables were therefore retained.

In the Coefficients table, values in the Tolerance column were not too low (all above 0.7) so the multicollinearity assumption had not been violated.

In the Scatterplot the standardised residuals were roughly rectangularly distributed with most scores concentrated in the centre along the 0 point. There was no evidence of a clear or systematic pattern, which suggests no violation of the assumptions.

Outliers, Normality, Linearity, Homoscedasticity and Independence of Residuals:
In the Normal Probability Plot, the points were on a reasonably straight diagonal line, which suggests no major deviations from normality.

The Mahalanobis distances presented in the Data file (MW_Data_10_Oct_04) show 2 outlying cases (critical value >18.47 when there are four variables), but they were judged as non-critical since this is not unusual for this sample size.

Evaluating the Model

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.675[a]	.456	.390	.74977

a. Predictors: (Constant), X22 -- High Growth Market, Implementation summed, X24 -- High Entry Cost for Rivals, Leadership Component, Market Orientated Team, Resources Component, Clear Product Definition

b. Dependent Variable: Success summation

The R Square value of 0.456 expressed as a percentage means that the model explained 45.6% of the variance in successful outcome. According to Pallant (2001), this is a respectable result.

The adjusted R Square statistic 'corrects' this value to provide a better estimate of the true population value when a small sample is used (Tabachnick & Fidell, 1996). Considering the limitations of the sample size used in this study, this has been reported at 39%.

Table 9.

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	26.890	7	3.841	6.834	.000[a]
	Residual	32.043	57	.562		
	Total	58.933	64			

a. Predictors: (Constant), X22 -- High Growth Market, Implementation summed, X24 -- High Entry Cost for Rivals, Leadership Component, Market Orientated Team, Resources Component, Clear Product Definition

b. Dependent Variable: Success summation

To assess the statistical significance of the result it is necessary to refer to the table labelled ANOVA:

The model in this study reaches statistical significance (Sig = 0.000)

Table 10.

7.5.7 Evaluating each of the Independent Variables

The 45.6% variance in "Successful Outcome" is explained by the following 7 variables: Table 11.

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Tolerance	VIF
1	(Constant)	-.488	.666		-.733	.467		
	Leadership Component	.002	.032	.009	.078	.938	.658	1.521
	Resources Component	.021	.042	.061	.492	.625	.614	1.629
	Clear Product Definition	.105	.033	.467	3.183	.002	.444	2.252
	Market Orientated Team	.082	.034	.294	2.375	.021	.621	1.609
	Implementation summed	-.119	.170	-.097	-.699	.487	.498	2.009
	X24 -- High Entry Cost for Rivals	-.052	.077	-.069	-.667	.507	.883	1.133
	X22 -- High Growth Market	.142	.089	.164	1.603	.114	.915	1.093

a. Dependent Variable: Success summation

Information in the box labelled Coefficients indicated which of the variables included in the model contributed to the prediction of successful outcome. These are the variables that were selected initially as those showing a high loading on components in the factor analysis.

The column labelled Beta under Standardised Coefficients compares the different variables. Standardised values have been converted to the same scale so that they can be compared (when constructing a regression equation the unstandardised coefficient values should be used). Inspecting the Beta column for the largest value indicated that the largest value ((0.467) is for Clear Product Definition. This means that this variable made the strongest unique contribution to explaining successful outcome, when the variance explained by all other variables in the model is controlled for. The Beta value for Market Orientated Team was slightly less (0.294) indicating that it made lesser, but still unique contribution.

For each of the variables, the column marked Sig was inspected. This indicated whether the variable was making a statistically significant unique contribution to the equation. This depended on which variables were included in the equation, and how much overlap there was among the independent variables. If the Sig values were less than 0.05 then the variables were making a statistically significant unique contribution to the prediction of successful outcome. If > 0.05 then this was likely to be due to overlap with other independent variables within the model.

In this study, both **Clear Product Definition** and **Market Orientated Team** make unique, statistically significant contributions to the prediction of the successful outcome of an innovation project.

7.5.8 Hierarchical Multiple Regression

Hierarchical Multiple Regression was used to analyse the variables in more depth. The effect of "clear product definition" and "market orientated team" was controlled to see if the remaining variables were able to explain any of the remaining variance in successful outcome:

Table 12

Model Summary[c]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.648[a]	.419	.401	.74295	.419	22.385	2	62	.000
2	.696[b]	.484	.400	.74349	.065	.987	7	55	.450

a. Predictors: (Constant), Market Orientated Team, Clear Product Definition

b. Predictors: (Constant), Market Orientated Team, Clear Product Definition, X23 -- Lack of Intense Competition, X22 -- High Growth Market, X24 -- High Entry Cost for Rivals, X19 -- Cross-functional Structure, Leadership Component, Implementation Component, Resources Component

c. Dependent Variable: Success summation

The output generated from this analysis was similar to the previous output, but with additional information. In the Model Summary box, Model 1 refers to the first block of variables (product definition and market-orientated team), while Model 2 includes all the other variables that were identified in the factor analysis. The R Square values show that Model 1 explains 41.9% of the variation in successful outcome. The model as a whole (all variables in both blocks) explains 48.4% of variation in outcome.

The value of additional variance explained by Model 2 (after the effect of product definition and market orientation have been removed) is shown in the column labelled R Square change. In this study, the other predictors were;

- Leadership
- Resources
- Implementation
- Cross-functional structure
- High growth market
- Lack of intense competition
- High entry cost for rivals

The additional predictors account for only **an additional 6.5% of the variance.** There is no significant contribution made by these factors, as indicated by the Sig F Change of 0.450.

The ANNOVA table (Table 13) indicates that the model as a whole (which includes both sets of variables) is significant (p<0.0005).

ANOVA[c]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	24.711	2	12.356	22.385	.000[a]
	Residual	34.222	62	.552		
	Total	58.933	64			
2	Regression	28.531	9	3.170	5.735	.000[b]
	Residual	30.402	55	.553		
	Total	58.933	64			

a. Predictors: (Constant), Market Orientated Team, Clear Product Definition

b. Predictors: (Constant), Market Orientated Team, Clear Product Definition, X23 -- Lack of Intense Competition, X22 -- High Growth Market, X24 -- High Entry Cost for Rivals, X19 -- Cross-functional Structure, Leadership Component, Implementation Component, Resources Component

c. Dependent Variable: Success summation

Table 13.

The Coefficients table (Table 14) indicates how much each of the variables made to the equation. The Model 2 row summarises the results of all of the variables entered into the equation:

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.303	.613		-.495	.622
	Clear Product Definition	.093	.025	.415	3.763	.000
	Market Orientated Team	.094	.031	.337	3.052	.003
2	(Constant)	-.287	.714		-.402	.689
	Clear Product Definition	.097	.031	.431	3.167	.003
	Market Orientated Team	.077	.034	.276	2.234	.030
	Leadership Component	.006	.032	.023	.187	.852
	Implementation Component	.026	.048	.067	.542	.590
	Resources Component	-.005	.043	-.015	-.115	.909
	X23 -- Lack of Intense Competition	-.052	.074	-.076	-.701	.486
	X19 -- Cross-functional Structure	-.131	.098	-.148	-1.329	.189
	X24 -- High Entry Cost for Rivals	-.023	.079	-.031	-.288	.774
	X22 -- High Growth Market	.162	.089	.187	1.826	.073

a. Dependent Variable: Success summation

Table 14

The Sig. Column shows that there are only two variables that make a statistically significant contribution (< 0.05) and they are, as expected, clear product definition and market-orientated team.

Remembering that the beta values represent the unique contribution of each variable, when the overlapping effects of all the other variables have been removed, the only other variable of note is "High Growth Market".

Thus the order of importance in predicting successful innovation outcome is:

Clear product definition	0.431
Market orientated team	0.276
High growth market	0.187
Total	0.894

N.B.
In different equations, with a different set of independent variables, or with a different sample, these Beta values would change.

Table 15.

8. Results

Having reviewed the literature on innovation management, new product development, and business venturing in previous sections and having developed a hypothesis and a research model to be tested, the methodology indicated a research paradigm and research strategy. A positivistic approach was selected and a survey design was developed. The previous section has considered the sampling process and the development of a survey instrument, and finally, the methods of data analysis have been outlined, including exploratory data analysis and multiple regression. The next section reports the results of the analyses.

8.1. Distribution of Respondents

Chart 8 – Distribution by Speciality

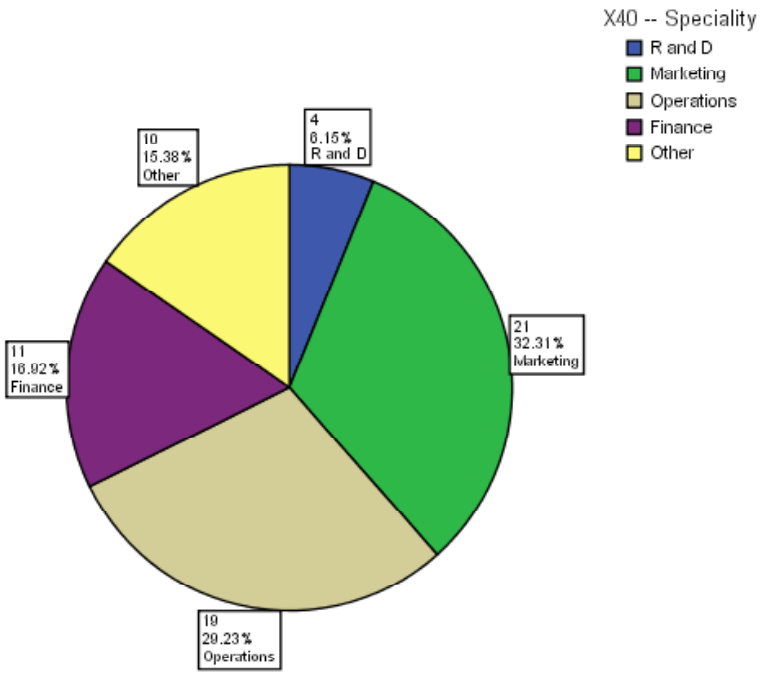
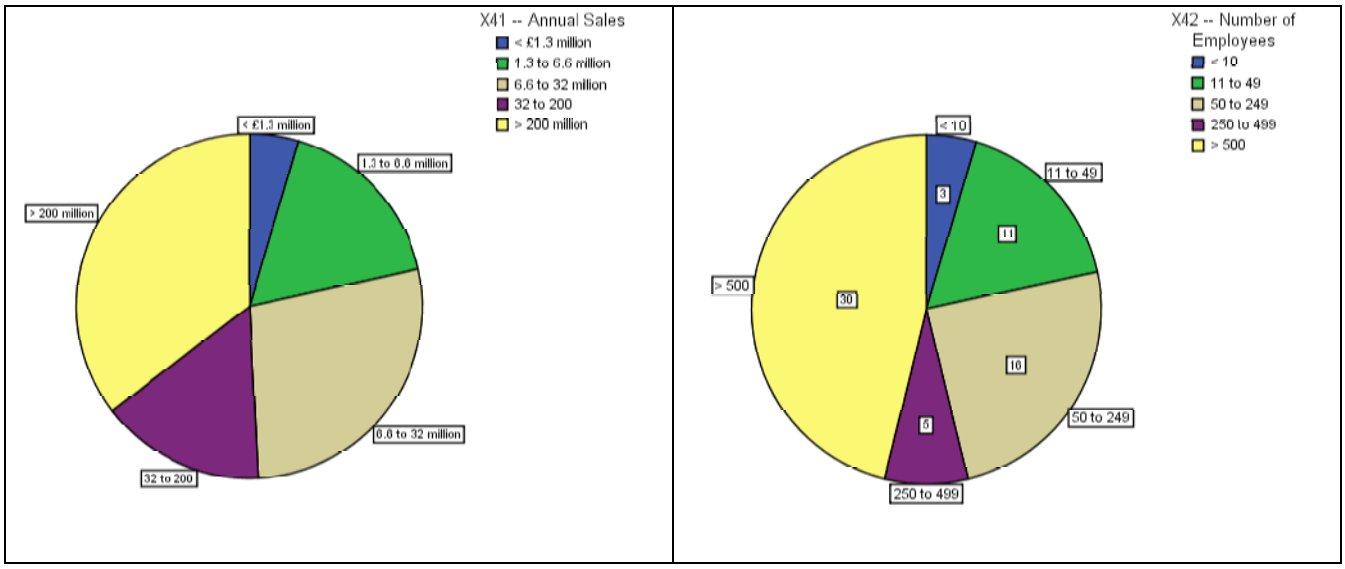


Chart 9. Distribution of Respondent's Organisation by Annual Sales and Number of Employees.



326 surveys were sent out via individually addressed emails. 65 questionnaires were returned by the 6th September 2004, a response rate of 20%. The sample was drawn from many different sectors and backgrounds. In this case, there was an accessible list of people likely to be involved with innovation, which had no distinguishing features, and each person had an equal chance of inclusion in the sample. Therefore it is possible to develop generalisable conclusions from the case data.

Multiple regression was used to account for the variance in successful outcome based on linear combinations of independent variables. The analysis established that Clear Product Definition and a Market-orientated Team explained 40% of the variance in Successful Outcome at a significant level (significance test of R^2), and established the relative predictive importance of each of these variables (by comparing beta weights). **Using hierarchical regression, it was shown that variance in successful outcome was not explained by the additional set of variables (leadership, resources, implementation, cross-functional structure, high growth market, lack of intense competition, high entry cost for rivals) over and above that explained by Product Definition and Market Orientation.**

The estimates (b coefficients and constant) could be used in further research to construct a prediction equation and generate predicted scores for the successful outcome of an innovation project.

8.2 Hypothesis Testing

Regression analysis using successful outcome as the dependent variable and the two independent variables, product definition and market oriented team, identified by factor analysis has provided support for the hypothesis stated in section 6, since these two variables explain 40% of the variation in successful outcome. The signs of the betas were positive, as predicted, showing a positive impact.

Product Definition (Beta +0.431 p=0.003 : Significant Positive Effect)

The hypothesis H_2 has a 99.7% chance of being true, therefore the null hypothesis H_0 is rejected. The individual factors that form the component "product definition" are:

- Unique and well-defined benefits
- High purchase importance
- Orientated towards the market
- Highly visible benefits
- Clear aims and objectives
- Shared vision and values

Factor analysis has indicated that these drivers are correlated. Dave Garson at North Carolina State University uses an interesting analogy to describe the significance of factor analysis as a data reduction technique[12]: *"A mother sees various bumps and shapes under a blanket at the bottom of a bed. When one shape moves toward the top of the bed, all the other bumps and shapes move toward the top also, so the mother concludes that what is under the blanket is a single thing, most likely her child. Similarly, factor analysis takes as input a number of measures and tests, analogous to the bumps and shapes. Those that move together are considered a single thing, which it labels a component. That is, in factor analysis the researcher is assuming that there is a "child" within the data in the form of an underlying clump of factors, and takes simultaneous movement (correlation) as evidence of its existence".*

A Market-Orientated Team (Beta +0.276 p=0.030 : Significant Positive Effect

The hypothesis H1 has a 97% chance of being true, therefore the null hypothesis H_0 is rejected. The individual factors that form the component "Market-orientated team" are:

- Good knowledge of the market
- The team have quantified the market need
- The project has a close fit with business strategy
- The team show high emotional resilience
- The team are accountable for the entire project

The implications of these results are discussed in the following sections.

[12] http://www2.chass.ncsu.edu/garson/pa765/factor.htm

9. Qualitative Evaluation of the Results

Positivist approaches that solely examine the results of quantitative outcome measures may not capture all the noteworthy influences and impacts of the relationship between key drivers and successful outcome. Qualitative and mixed method approaches are a useful way of "triangulating" the results to provide additional perspectives. To corroborate the results of this research, a further qualitative interview was undertaken with a view to explaining why *product definition* and *market-orientated teams* are the key drivers of success. A surprising result was that *Leadership* did not rate more highly as a key success driver, and this is investigated. In an interview with Max Derrick, International Group Marketing Manager of Alaris Medical Systems, the following key points were raised:

- Structure and Procedures

"The key thing is having a structure that is efficient in terms of delivering products. You may have good project teams but if they don't have the right resources or the right equipment or the right expertise then it is really no good, and obviously the customer has got to have a quick response to their request. We have a very flat structure in Alaris – we are matrix-organised so we report to different people at the same time which is fine but the danger is that people get pulled off projects and put on different projects and sometimes the overall control can be lost - you end up fighting for your project. You can have the procedures which help but what I have found is where the procedures are rigid it can be a hindrance You can good processes but more importantly they have to be flexible and the thinking also has to be flexible, so where you have a process you don't have to go through "a-b-c-d" all the way through to "z". As long as you have justification for moving away from that. Sometimes people are so rigid they don't see that you can do that and that's where I think the implementation and project management will come together because good project management will be able to do that".

- Clear Product and Project Definition

"The team must have a very clear objective and that is one of my other key things is that when we are developing the project, whatever it is, we make sure we define what we are trying to do. What we are finding is that with projects we get project creep; "while are you doing this could we have another one of these?" – "put another one of these in the box!" and suddenly the project gets very badly defined. And what we try to do is to keep focused on the original objective. The danger with that is that you take objective "A" and deliver objective "A" but in that time the market has changed, they want "A" plus "B" so it's being savvy if you like of what is going on in the market but also making sure that you keep checking your objectives".

- Communication

"If the objectives change, go back and communicate, so that if you want that specification change - it is going to take another few months to achieve it. Its your decision but recognise this is the impact. So communication within the teams, with the customer, the sales person, and senior management is very important".

- Leadership, and the influence on success or failure of the project

"I suppose I have been in both situations. If I could define a good leader - the leadership can have a strong impact on the team in the sense that they would set the overall objectives and the priorities but then back off so you know as a team member that there is somebody looking after you. Leaders must have the business at heart, but also the people at heart, and be able to make good, clear, sound judgements on the way the business is going, and how the priorities fit, and the way the projects fit, but not necessarily be involved in the activities. In bad leadership situations the priority is not there".

- The power of a well motivated team

"But if it's a good team, poor leadership doesn't necessarily stop products getting to market because the team, if they are sufficiently well motivated, enjoy their work and feel satisfied they will get the projects through anyway. Leadership has a role but it is not totally critical. I think good projects will always happen, as long as you have a good team then the leadership is sort of second order, but I do think that if you have a very good leader it does help set the boundaries and things then it makes the whole process a lot easier, more efficient, less stressful, and a feeling that somebody is batting on your side. The people in the teams will always be the most important thing and the danger is that when you get a de-motivated team - that is when it is difficult to do any innovation at all, and then you start picking out individuals who you know are still motivated, and you will work with them and then the rest of the team go by the wayside. It's difficult".

These extracts from the full transcript (Appendix 4) go some way to explaining why clear product definition and market-orientated teams appear to be the primary drivers of successful innovation. The interview also shows how a well-motivated team can, in some instances, compensate for poor leadership. But a good leader can have a positive impact on successful outcome. The sample used in this study indicates that good leaders are not always available to guide innovation projects.

10. Recommendations

A review of the literature indicates that new product failure rates are estimated to be between 80% and 95%, depending on the definition of success. The academic literature is divided as to which factors are most important in determining that success, and studies have approached the issue from many different perspectives. These approaches are characterised by the four different "schools" described in section 3. Venture capitalists would agree with the results of this research in that a market orientated team is a key factor for successful innovation. They often claim that 80% of their decision to invest is based on the quality of the people in a venture team and only 20% on what those people plan to do[13]. They believe that the success of innovation initiatives is having a team with the ability and passion to turn ideas into business reality. But an even more important factor is the team's ability to demonstrate a clear product and project definition early in the process. The following section aims to make practical recommendations as to how management can use the recommendations of this report to improve the innovation process. A number of tools have been described in the literature, and these are highlighted as a method of linking back to the theoretical and conceptual frameworks described in sections 4 and 5.

10.1 Clear Product Definition - Wisdom

Wisdom is the ability to apply knowledge successfully for a specific purpose. It combines knowledge and experience with common sense and insight. The crucial role played by product definition in the success of an innovation project has been highlighted by the work of Cooper and Kleinschmidt (1987), who sought to identify the characteristics that separate new product successes from failures. They found that applying knowledge of the product into a concise definition was critical to success. It is also important to apply that knowledge early in the innovation process (Cooper 1993). The benefit of early definition is that it disciplines the team by ensuring that development tasks can begin with certainty, and not be subject to needless changes which can be difficult and expensive to implement.

An example of this technique was introduced in the early 1970s to help design super-tankers in Mitsubishi's shipyards in Kobe, Japan. Its original Japanese name comes from "bin shitsu ki no ten kai", a phrase coined by Dr Yoji Akao in the 1960s (Akao, 1983). Literally, it can be translated as:

bin shitsu - **Q**uality, attributes or features

ki no - **F**unction or mechanisation

ten kai - **D**eployment, diffusion, development (Cohen, 1995; Tottie & Lager, 1995).

[13] Hender, J. (2004) *"Innovation Leadership"* Henley Incubator - Grist

10.1.1 Quality Function Deployment

One of the best management tools available to establish clear product definition is Quality Function Deployment (QFD). QFD is a structured approach to defining customer needs or requirements and translating them into specific plans to produce products to meet those needs (Karsak 2004)). The "voice of the customer" is the term used to describe these stated and unstated customer needs or requirements. The voice of the customer can be captured in a variety of ways: direct discussion or interviews, surveys, focus groups, customer specifications, observation, warranty data, field reports, etc.

Clear product definition in the form of QFD gives everyone in the organization a road map showing how every step, from design through delivery, interacts to fulfil customer requirements. The QFD process can be used by both product and service-based companies but it is not in itself a total solution. It will bring out the requirements at each development stage, but not any design details. Other engineering and creativity techniques are necessary for actual transformation of the design. Innovation must be done correctly to get the best possible results. Failure by management and the project team to understand the effort required will cause problems such as poor meeting attendance, low team morale, low interest in process, unrealistic expectations and lack of success. However, if done correctly, the process will quickly improve quality of products, satisfy customer needs, shorten development times and simultaneously reduce costs.

The QFD management tool is a team building technique. It links the two key drivers of successful innovation – product definition and market orientation. Team composition is critical. It is important to have representatives from different levels, from across the organisation and with differing perspectives of the customer (Tessler et al., 1996). These multi-disciplinary teams normally consist of five to seven people with all key functions that are involved with the product represented. The team should consist of members from process development, product planning, product design, prototyping, testing, manufacturing, marketing, sales and service. As teams are formed, there is a need to recognise the interpersonal dynamics that exist in an effort to make the team function effectively: "*People assigned to QFD teams will represent a variety of personalities and styles. The different perspectives that people bring to the team can enhance its vitality and creativity. However, team members need to have a basic orientation towards working in a team environment and toward group problem solving. The team leader should be skilled in coordinating and facilitating since QFD works best in a free environment. All members of the team need to work towards a shared goal of a customer-defined product completed by a specific date and at a specific cost*" (Kliewer et al., 1998).

Fuzzy-front-end

The “fuzzy-front-end” activities are the first important step in the innovation process because they qualify and define the project. The key questions that are raised in this research are:

- Is the project an economically attractive one?
- Will the product sell at sufficient volumes?
- Who exactly is the target customer?
- How should the product be positioned?
- What features should be built into the product to give it a differential product advantage?
- Can the product be developed at the right cost?
- What is the likely technical solution?

Many projects are poorly defined when they enter the development phase. This is often the result of weak pre-development activities: the target user is not well understood, user needs and wants are vague, and required product features and attributes are not clearly defined. With a poorly defined project, Development Engineers waste considerable time seeking definition and recycling back several times to "get the product right." Better project definition, the result of a QFD and/or stage-gate process, will speed up the innovation process.

An innovative idea rarely remains the same from beginning to end. The original concept that started the project is seldom the same as what is commercialised. Within the total innovation process, the time to make design changes is not when the product is moving out of development and into production. QFD and stage-gate encourage changes to occur earlier in the process rather than later, when they are inevitably more costly. The result is a considerable saving in time and money at the back-end of the project and a more efficient innovation process.

10.2 A Market Orientated Team - Culture

Many management teams believe that they are market-orientated, but the evidence shows otherwise in the area of innovation. In one study of new product case histories (Cooper and Kleinschmidt 1987), only 16 percent of the total effort expended on new product projects went to market-oriented activities. The breakdown for the average project in man-days spent was:

- Technical and production activities, 78 percent.
- Market-oriented activities (including launch), 16 percent.
- Evaluative and financial activities, 6 percent.

If launch activities are removed, the amount devoted to efforts such as market assessment, detailed market studies, customer tests, trial selling and test marketing, shrinks even further.

The most interesting result of Cooper's research is that those firms that did proportionately more market-related activities had a higher success rate. Overall, successful new products had considerably more time, money, and energy devoted to market-oriented activities than did failures. In successful projects, three times as many man-days and twice as much money were devoted to preliminary market assessment than was the case for failures. Twice as much market research (measured in both man-days and pounds spent) was conducted in successful products as in failures. But in both cases, the amounts were still small. Successful products had more than twice as much money spent on customer tests of the product, as did failures. Six times as much money and twice as many man-days were spent on the launch of successful products as for failures.

10.2.1 The mission of the team

The first step taken on most innovation projects is to ensure that the whole team understands the mission and the scope of the project. This information is summed up in a mission statement created at the start of the first team meeting (Hales et al 1990). A good mission statement includes descriptions of:

- What the team will do (what is the scope).
- Why are they doing it - conceptually, this is a list that describes the current market.
- Who the customers are that they are supposed to address.
- What are the milestones that need to be met.
- Who will approve and implement the results.

(Menks et al., 1997; Becker & Associates, 2001):

The stage-gate system (Cooper, 1990) is a management tool that provides a guide to stronger market orientation in the innovation process. Those market-related activities, so often omitted or poorly handled in most new product projects, are built into the process by design, not as an add-on. The stages of the process typically include a number of market-related activities, such as user needs and wants research; concept tests; competitive analysis; development of a detailed marketing plan; product tests with customers; trial selling; and formal launch. Stage-gate processes link well with the QFD tool discussed in section 10.1.1, but the project leader must ensure that these critical steps are executed well. Unless they are, this study indicates a poor chance of success.

10.2.2 The leader of the team

Research on the characteristics of leaders who are likely to facilitate innovation has produced no clear picture, however, there is a consensus that a participative / collaborative style of leadership is most likely to foster innovation (Kanter, 1983). A team leader needs to be appointed by the team. The team leader is not the manager of the team, but can better be described as the chairman, facilitator, or coach. This distinction is important for the team to operate effectively in a balanced, self-directed way. This issue was emphasised by the results of the survey, where several respondents declared a successful outcome despite having a poor leader. One respondent outside of this group suggested that in these cases leadership was being confused with management, leading to a conclusion that poor managers were not a key success driver. According to Crow (2000) the role and responsibilities of a good innovation leader are to:

- Create an environment of trust, open communication, creative thinking, and cohesive team effort.
- Provide the team with a vision of the innovation project objectives.
- Motivate and inspire team members.
- Lead by setting a good example (role model) - behaviour consistent with words.
- Facilitate problem solving and collaboration.
- Ensure discussions and decisions lead toward closure.
- Ensure that team members have the education and training to participate effectively on the team.
- Encourage creativity, risk-taking, and constant improvement.
- Familiarize the team with the customer needs, specifications, design targets, the development process, design standards, techniques and tools to support task performance.
- Coordinate meetings with the product committee, project manager and functional management to discuss project hurdles, required resources or issues/delays in completing the task.

10.2.3 Cross-functionality and QFD

A market-orientated team is a cross-functional team set up to improve the operation of the innovation process. According to Ouyang et al., (1997) the team helps to reach consensus on:

- What to do,
- The best ways to do it,
- The best order in which to accomplish it,
- The staffing and resources required.

A market-orientated team should provide input to process from all areas of business. The concerns of marketing, design, deployment, and support organisations are discussed and dealt with early in the process. Core QFD team members, as well as others called in to help the team, gain intimate knowledge of customer wants and of the functional perspectives of the other team members. This spreads team building awareness through the organization (Khawaja, 1994). Since QFD brings together a cross-functional team, and helps challenge traditional design objectives and targets, the rate of design innovation is expected to increase. There are two reasons why cross-functional QFD teams are essential. First, a team provides the necessary 'mass' for generating new ideas. An important factor in these teams is a 'new eyes' philosophy through which a team member who knows nothing about a chosen topic can bring completely fresh thinking to a task. Second, the collective experience of the cross-functional team helps resolve complex design and business issues. Having various functional representatives on a team leads to faster decisions. QFD teams canl also have an important effect on breaking down barriers between functions.

Cross-functional, market-orientated teams bring together people from various disciplines and facilitate the understanding of customer requirements. These teams are formed with personnel from different functional departments to support the design, development and transition to production of a new product. The team should consist of people from all disciplines that can positively impact the development of the product and improve competitive factors, not just personnel from the various design engineering disciplines. This team concept is intended to promote open discussion and innovative thinking resulting in superior products, more efficient processes and ultimately a more satisfied customer (Crow, 1994).

10.2.4 Innovation Culture

Culture is the way things are done in an organisation - its personality. It comprises of the assumptions, values, norms, needs and behaviours of stakeholders. Culture is particularly important in an innovative environment. Managers have realised that despite the best-laid plans, being innovative means not only changing structures and processes, but also changing the corporate culture as well. Important advantages of a market-orientated team within an innovation culture are the structured manner of communication between the different members and the sharing of information during the innovation process. The customer / supplier focus of the team is equally important. The team agrees the vision of developing a product or service that will excite and delight the customer to such an extent that they will part with their money.

Effective teamwork is important to successful innovation. Teams have a vast capacity to drive an organisation beyond its boundaries. When managed well, teams stimulate creativity and new ideas and make an organisation more adaptive to market forces. If however, a firm's culture is not aligned with the innovation process, then there is a likelihood of failure. Several signs indicate potential failure of the innovation process. The checklist below shows some indications which management and the team should look for to try to prevent the innovation process from failing:

• Conflicting information from management • Dismantling of team for higher priorities • Little or no training for team • Low morale within team • Low skill level for team members • Many team members leaving organisation • No communication between team members • No group sessions among team • No incentives to keep team motivated • No one in charge • No project manager interest • No structured method for developing software	• Organisation of team not working • Shortage of team members • Team losing sight of project goals • Team member not accountable for actions • Too many reassignments of team members • Too much overtime • Unavailability of needed tools • Uncommitted senior management for project • Uninformed team members • Unsuitable working environment for team • Working with unrealistic deadlines

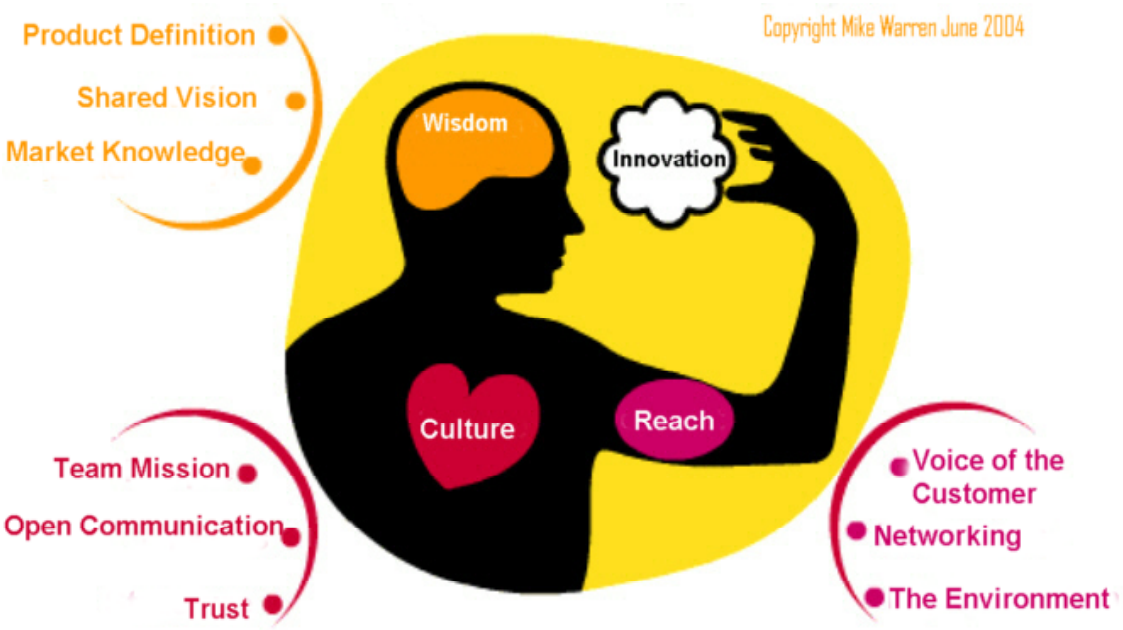
10.3 The Value Chain - Reach

Successful innovators are able to scan suppliers, customers, competitors, complementary innovators, related industries, research laboratories, universities, and their own value chain for any ideas or inventions that can be turned into profitable innovations. This concept is supported by Tushman and O'Reilly (1997) who talk about "ambidextrous" organisations that create innovation streams through all aspects of processes, structure, and culture. Indeed, those companies self-described as successful innovators work hard to take advantage of all potential areas for innovation and to nurture and support innovation. Successful innovating companies are open to changes in the environment that can stimulate innovation. They have a market orientation – they look hard at what is already going-on in the marketplace that can be used and expanded upon (Pearson, 1998), they "steal" ideas from other organisations (Peters, 1990). They focus on what the customer wants and needs and they encourage collaboration and networking as a way of reaching-out to the market.

10.4 Innovation: - Anatomy of the Key Success Drivers

A new model – the Anatomy of Innovation Management (AIM) is proposed as a metaphor to catch the mind with a central point of comparison between the seemingly unrelated drivers of successful innovation (wisdom, culture and reach) and their subsidiary success factors:

Fig.6. Anatomy of Innovation Management



In the next section, the Anatomy of Innovation Management is used as a tool to show how the implications of the research, and the key drivers that have been identified can benefit management practice within a business environment.

11. Implications – The Anatomy Model Applied

Taking the theoretical and conceptual frameworks of this study, and combining them with both the qualitative and quantitative analysis of the research findings, these are the primary implications of the key success factors that constitute the anatomy of innovation management:

WISDOM

- Innovation requires time - time to think, to experiment, time to talk about possibilities and ideas.
- People need to share their vision through curiosity, talent and motivation.
- Leaders need the wisdom to manage & evaluate ideas, recognising and rewarding those involved.
- The team needs to know how the project fits into the overall business strategy of the company

CULTURE

- Innovation is a blend of people and processes.
- Innovation means doing something that hasn't been done before, which implies risk. If there is no risk, there is no innovation.
- Innovation is driven by a market-orientated team built around a common objective and trust. Trust requires honesty and openness.
- Culture promotes the articulation of and distribution of ideas.
- Senior managers have to demonstrate their commitment.
- Communication is needed to discuss problems with the project, handle conflicts within the team as well as with the users.
- Every team member has to be informed and involved in making decisions that affects the team.
- Incentives help to ensure a focused and dedicated staff. It is important that the incentives are tied to the project's success.

REACH

- Innovation requires new processes, time, energy, commitment and resources.
- Innovation requires communication of new information - between co-workers, customers, suppliers, competitors and researchers.
- Reach enables ideas to be implemented.
- Customers have to be involved in the innovation process
- A system where team members, customers and suppliers can easily transfer knowledge between each other is a good way to improve the team's competence.

12 Conclusion

The aims and objectives of this study, as set out in section 2.2 have been achieved:

A critical review of the literature relating to the success factors of innovation has identified two common themes; a) that success is driven by market-orientated teams who share their knowledge of current and future customer needs across all departments and b) that market orientation has to be directed towards clear product definition early in the innovation process.

These results were tested empirically by researching the attitudes of people involved with innovation through face-to-face interviews and via questionnaires. The results confirm the theoretical views of previous authors and bring new quantitative information to the overall knowledge of the subject.

A new "Anatomy of Innovation Management" model has been developed which can now be taken forward as a utility for practicing innovation managers. The model has been used to frame recommendations that allow managers to increase the likelihood of success of their innovation processes. The study has provided a set of interrelated variables, definitions, and propositions that represent a systematic view of the outcome of innovation and has specified the relationship between those variables.

		
Success is defined by sales growth, a positive net present value, and a contribution to the intellectual capital of the organisation.	Success is driven by a market orientated team with good knowledge of customer needs and preferences, and with clear aims and objectives within the overall business strategy:	The team has shared vision and values and the commitment to commercialise a product with unique and highly visible benefits that has a high purchase importance for the customer.
	**"The INNOVATION point is the pivotal moment when talented and motivated people seek the opportunity to act on their ideas and dreams".** W. Arthur Porter, Ph.D., Dean for the College of Engineering and University Vice President for the Office of Technology Development at the University of Oklahoma.	

Appendix 1

Preliminary Qualitative Research
Transcript of discussion with Jarred Evans, Commercial Manager,
The National Centre for Product Design & Development Research: Wednesday 1st September 2004

A. Introduction to PDR by Jarred Evans

"PDR will go from germ of an idea to product launch, so we get involved with market feasibility assessment and we do some bits and bobs to do with buyer behaviour and technical feasibility work, but most of what we do is shown on the PDR Development Process map:

- Market feasibility
- Technical feasibility
- Concept design
- Detailed design
- Prototype test and validation
- Commercial implementation

We also do a lot of research on the innovation management side. People will step in and out of this process, some people do the early stages, step out and then come back at a later stage in the process. I guess where we stop is at market launch. So in summary, we go right through from pre-market feasibility to constructing the service manuals. We've got some degree of manufacturing here but our remit is not as a manufacturer, so if someone needs volume manufacture they'll go somewhere else, since they will do a better job than we would. I'd say probably about 18% of the design work we do is actually designed to be manufactured somewhere else, not here, and 70% of the stuff that comes into the workshop we don't see upstairs in design. We're just over 10 years old now and we have worked with about 10,000 companies and we've done about 500 products. Probably about 75% of our clients are Welsh based companies, the rest being UK and a couple of European.

Myself and another guy, Richard Kemper, look after the commercial side of PDR. Richard is from the automotive industry, and he is very strong on the tooling, moulding and some of the technical aspects. He also takes care of the operations management stuff and the day to day running of PDR. I've got responsibility for the design function, all the sales and marketing and business development. PDR has about 60 staff, the commercial side, which we are talking about today has about 26. Turnover in total of all three companies is just under £3 million pounds.

B. Objective of the meeting (MW)

I have identified nine factors that influence innovation:

IDEA	MARKETS	STRATEGY
PEOPLE	TEAMS	STRUCTURE
LEADERSHIP	IMPLEMENTATION	RESOURCES

The questionnaires don't show any of the links between these factors or what the order of priority is, so what I would like to do is be able to take it one stage further and indicate which are the, "show-stoppers" and in terms of which factors decide if an innovation is successful or not. So just take me through – if you were to rank these factors 1 to 9 how would you do it and what are you thinking of when you consider projects that were successful because one or more of the factors was strong in that particular project, and projects that were not successful because certain factors were lacking in that project.

C. Development & Implementation

"I think the nine things you picked here are all good subject areas in themselves, and it would be fair to say that you've probably got to be successful in all of these to have a successful product.

The definition of success will vary greatly, but if I just split it, for the sake of conversation, into two strata – I think first of all we can look at products that successfully make it through the product development process and make it as far as the market place, and then we talk about products that are successful in the market place. If we talk about that first one, products that get through the development process and make it to market, the factor I would rank last is **the idea**, it doesn't really matter – I have seen lots of absolutely dreadful ideas, not that I have any opinion on those, that people throw money at. I guess, just looking at your factors that one of the things that is key is **Leadership**, whether or not it's a big company or a small company. It's all about definition again; you can push an idea through the process, whether or not you know its market. **People** will have a **strategy**, whether it's espoused, whether it's actually formalised is a new kettle of fish, but they will have a strategy of some kind or another. If there's **leadership** they will find the **resources** and the **people**, so you can link those two factors together – and they will quite often form a **structure** – degree in-house, degree outsourced, so to get the product through the process you need all of those things on the left of your chart.

I would say once it's hit the market place, then it's **implementation, market, and idea** quality. If it's a good **idea, implementation** is really easy. I'm talking about if you have a new mouse-trap, and if it's executed well, it's been designed well, people can manufacture it well, it hits the margin buttons properly, if it hits the target audience – then the implementation is good, but you rely on luck if you don't understand the **market"**.

Resources – most people, statistically, haven't got them to do the job, but they can be quite easily found. You can recruit or you can outsource a little bit of the process. The problem with process is that it requires different skills at different times – a lot of it is project management, and most people recognise that you need different **team** skills as you go through the process.

You mentioned the Wales Innovators Network (WIN) earlier on, that's one extreme, where you have one guy who has an idea for a new mouse-trap – but he's got nothing else. Probably hasn't got a strategy, probably hasn't got a market and certainly hasn't got any resources. He's got an idea and he might have a little bit of leadership if he's the kind of person who can drive it through. At the other extreme you might have somebody like *Philips*, who've got all of those things on the right (strategy, structure, markets and resources) in the bucket load, but it doesn't necessarily mean they've got a particularly good idea of what they are doing either, so, going back to the WIN idea, the WIN people should be guided to these other things that they need, because they quite often try to jump to the implementation stage too quickly, in an attempt to save money and to get their feed-back in. So I do think that you need all of these factors.

D. How do you prioritise projects?

Jarred – "When you talk about prioritising projects, nearly every company we work with have normally got a list of projects, and we advise a four-part screening process:

- You should look at its **strategic synergy**, so, i.e if you make aircraft carriers and this is a design for a new toilet, it doesn't fit, irrespective of whether it makes money or not.
- Technical feasibility – very quick look-over, is it feasible?
- Market feasibility – is anyone going to buy it?
- And then the bottom-line really – which drives off those three is some kind of cash flow or ROI.

At the end of the day you've got product designers, engineers, marketing people, etc, you're going to have some key gate-keepers in any company, and irrespective of the company one of them is the guy who signs the cheques. One of the ways you can communicate with these people when you have cross-functional communication is by using something that they understand, so there's lots of different ROI techniques – the one I prefer is discounted cash flow, because it forces the discipline of how many you are going to sell, over what time scale, how much it is going to cost to develop, how long it is going to take to develop, and you can build-in "what -if" factors to it as well, and it comes out with a number. If it's got a positive discounted cash flow then in theory, if you use the right discount rate, you should start that project, even if it means you have to borrow money. If you've got six projects and this one is much better, and the risk is less, then that's the one you should start first.

It's as good as any other method and it works well with SMEs. If you're talking about much larger corporations where there's much more **strategic intent**, where they've got the financial resources and they've got 20 projects to start 20 projects, if they all look like they are going to make a positive return, it's much more important to look at the strategic direction it's going to take you in, because what DCF doesn't address is what kind of R&D work it needs. If you think of Sony developing the memory stick media, I can't imagine they sat down with a discounted cash flow to start the project – they were looking at the direction they wanted to go in, where this technology was going to take them.

E. What are the main reasons that cause a project to fail?

Think of a project that you know of and take me through the main reasons that caused it to fail.

JE – Related to these 9 criteria?

MW – If possible, that would be great, but if the reason is not related to these then that's fine too.

JE, "I would have to say, probably, **Leadership and People**, the soft side of it is the thing that causes the most trouble. I guess product development isn't taught very well at school unless there is a real need for it. When I worked at Huntley they were very good at product development there, but probably because the guy who started the company was an engineer by trade – he drove and pushed product development through. You think of somewhere like *Acme* for example, where the company strategy was based on me-too, buying and selling, effectively market trading, then they had no history, need, or desire for product development, and if you don't want it then it's not going to happen.

I think you can overcome **resources**, but if you haven't got the **leadership**, haven't got the **culture**, haven't got the **people** , and culture is probably the one that is missing from your list – then that's much more difficult to overcome. You can throw money at the others; you can throw money at it and fix it.

F If the concept is great but the competition is too strong and the market too small

MW - You mentioned the internal, soft side of the process, what about the hard side? Do you know any examples where the whole concept has been good but the competition was too strong or the market wasn't big enough to accept the idea – is that really a factor in your opinion.

JE – Well it is. I personally do not believe in the old strap line that 9 out of 10 products fail, because I believe that if you do the job properly, by the time it gets onto the market, it should be a damn-site less than that. 9 out of 10 may not get through the development process after being weeded-out. There are lots of cases where people believe that a product that they have a desire for, and need that they have, is common to all people, or is big enough to justify the market they are going for.

G If you could only take three of these factors to make a successful product

JE – Desert Island Products yeah?

MW – Yes, the product has to go all the way through the development process and be successful on the market, so you have identified your market and your expectations of revenue and a return on investment.

JE – I would take the **right people** first, that's my number one.

I would take an **ability to understand the markets** as number two.

And I would take the **resources to do the job** as number three.

Because I believe that with the right people, you generate the ideas and the leadership and form a strategy – I could form the team so I could put the structure together, and with the resources I could do the implementation properly. So that would be my answer.

MW – Well thanks for that Jared.

JE – Yes, it's good stuff.

Appendix 2 – Questionnaire

The Innovation Success Factors Questionnaire

SCREENING AND RAPPORT QUESTIONS

Hello, my name is Mike Warren and I am a student at Henley Management College. I would like to know your opinion on what are the key drivers of a successful innovation project.

1 Do you have experience of innovation or new product development projects ? ☐ Yes ☐ No

2 Do you have knowledge of whether the outcome of one of these projects was successful or not ? ☐ Yes ☐ No

If you answered "yes" to both questions please answer a few questions about your experience of of that project. The survey will only take three minutes and will be very helpful to identify the factors that influence success.

Please answer all questions carefully. If you do not understand a question point to the box for supporting information. ?

Section 1: Was the Project Successful ?

Think of a recent project that you were involved with, and you know the outcome was successful or not (unsuccessful works best) The following are three characteristics that could be used to describe the outcome. Using a scale from 1 to 5 where 5 is "agree strongly" and 1 is "disagree strongly", to what extent did the project meet these criteria:

	disagree strongly 1	disagree somewhat 2	neutral 3	agree somewhat 4	agree strongly 5	
1 The project had a strong impact on sales growth	☐	☐	☐	☐	☐	?
2 The project had a positive net present value	☐	☐	☐	☐	☐	?
3 The project made a positive contribution to the firm's intellectual capital	☐	☐	☐	☐	☐	?

Section 2: Perceptions Measures

To what extent do you agree or disagree that the following characteristics made a contribution to the success or failure of the project ?

	1	2	3	4	5
4 The benefits of the product were unique and well defined.	☐	☐	☐	☐	☐
5 The benefits of the product were highly visible	☐	☐	☐	☐	☐
6 The product had high purchase importance	☐	☐	☐	☐	☐
7 The project had a close fit with business strategy	☐	☐	☐	☐	☐
8 There was a clear marketing and sales plan	☐	☐	☐	☐	☐

	disagree strongly 1	disagree somewhat 2	neutral 3	agree somewhat 4	agree strongly 5
9 The market need had been quantified	☐	☐	☐	☐	☐

	1	2	3	4	5
10 The leader was a good internal and external communicator	☐	☐	☐	☐	☐
11 The leader had a good situational leadership style	☐	☐	☐	☐	☐
12 The leader had a good motivational style	☐	☐	☐	☐	☐
13 The people who worked on the project had a good knowledge of the market	☐	☐	☐	☐	☐
14 The people had emotional resilience	☐	☐	☐	☐	☐
15 Senior management were committed to the project	☐	☐	☐	☐	☐
16 The team had shared vision and values	☐	☐	☐	☐	☐
17 The team were dedicated and focused on the project	☐	☐	☐	☐	☐
18 The team were accountable for the entire project	☐	☐	☐	☐	☐
	disagree strongly	disagree somewhat	neutral	agree somewhat	agree strongly
19 There was a cross-functional structure	☐	☐	☐	☐	☐
20 The project was orientated towards the market	☐	☐	☐	☐	☐
21 people had freedom to act in a "no-blame" culture	☐	☐	☐	☐	☐
22 The intended market had a high growth rate	☐	☐	☐	☐	☐
23 There was a lack of intense competition	☐	☐	☐	☐	☐
24 The entry cost for new rivals was high	☐	☐	☐	☐	☐
25 Sufficient time, money, and energy were committed to the project	☐	☐	☐	☐	☐
26 There was a clear focus on cashflow and capital	☐	☐	☐	☐	☐
27 The project had a close fit with currently available resources	☐	☐	☐	☐	☐
28 The project had clear aims and objectives	☐	☐	☐	☐	☐

		1	2	3	4	5
29	The project had good planning and control	☐	☐	☐	☐	☐
30	The project had tangible project milestones	☐	☐	☐	☐	☐

Section 3: Ranking of Success Factors

Following are some typical factors that influence successful innovation. Think about your experience with new product development and please rank three of these factors in order of importance: 1st, 2nd and 3rd

Please tick only 3 boxes……

		1st	2nd	3rd
31	Product Design	☐	☐	☐
32	Good Strategy	☐	☐	☐
33	Strong Leadership	☐	☐	☐
34	Experienced people	☐	☐	☐
35	Good team	☐	☐	☐
36	Flexible Structure	☐	☐	☐
37	Attractive Market	☐	☐	☐
38	Adequate Resources	☐	☐	☐
39	Good Implementation	☐	☐	☐

Section 4: Classification Questions

Please indicate the answer that classifies you best.

40	Your speciality (please select one)	☐	R&D 1
		☐	Marketing 2
		☐	Operations 3
		☐	Finance 4
		☐	Other 5
41	Your organisation's annual sales (£million)	☐	< 1.3 1
		☐	1.3 to 6.6 2
		☐	6.6 to 32 3
		☐	32 to 200 4
		☐	> 200 5
42	Number of employees in your organisation	☐	under 10 1
		☐	11 to 49 2
		☐	50 to 249 3
		☐	250 to 499 4
		☐	> 500 5

Thank you very much for your help. Please email the questionnaire to
mikewarren@hotmail.com or post to 10 Doe Close, Penylan, Cardiff CF23 9HJ, United Kingdom.
If you would like a copy of the final report or a presentation of the conclusion and recommendations, please tick the box.

Please send me a copy of the report ☐
Please contact me about a presentation of the conclusion and recommendations to my staff ☐

Appendix 3 - Method

All procedures in this section are based on Pallant, J. (2001) *SPSS Survival Manual,* McGraw-Hill

Assessing Normality

When the distributions of scores on the measures were checked, some of them were negatively skewed (scores at the high-end of the scale). Given that many parametric statistical tests assume normal distribution, these scores were transformed mathematically by squaring them. This produced skewness results within the acceptable range of –1 to +1.

Descriptive Statistics

	N	Mean	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
X1 -- Outcome_Impact on Sales Growth	65	3.60	-.566	.297	-1.042	.586
X2 -- Outcome_Positive Net Present Value	65	3.68	-.859	.297	-.263	.586
X3 -- Outcome_ Contribution to Intellectual Capital	65	3.92	-.424	.297	-.772	.586
X4 -- Benefits Unique and Well Defined	65	3.88	-1.154	.297	1.040	.586
x4trans	65	16.1231	-.422	.297	-.428	.586
X5 -- Benefits Highly Visible	65	4.03	-.876	.297	-.141	.586
X6 -- High Purchase Importance	65	3.54	-.324	.297	-.420	.586
X7 -- Close Fit with Business Strategy	65	4.31	-1.548	.297	2.953	.586
x7trans	65	19.2923	-.829	.297	.011	.586
X8 -- Clear Marketing and Sales Plan	65	3.63	-.692	.297	-.306	.586
X9 -- Market Need Quantified	65	3.83	-.918	.297	.209	.586
X10 -- Leader Good Communicator	65	3.91	-.549	.297	-.922	.586
X11 --Situational Leadership Style	65	3.68	-.316	.297	-.963	.586
X12 -- Leaders Motivational Style	65	3.86	-.589	.297	-.629	.586
X13 -- Good Knowledge of Market	65	4.00	-.945	.297	.799	.586
X14 -- Emotional Resiliance	65	3.80	-.402	.297	-.122	.586
X15 -- Senior Managemenmt Commitment	65	4.17	-1.141	.297	.335	.586
x15trans	65	18.5077	-.750	.297	-.812	.586
X16 -- Shared Vision and Values	65	3.88	-.938	.297	.604	.586
X17 -- Dedicated and Focused on Project	65	4.05	-1.520	.297	2.973	.586
x17trans	65	17.2769	-.550	.297	.084	.586
X18 -- Accountable for Entire Project	65	3.71	-.616	.297	-.668	.586
X19 -- Cross-functional Structure	65	3.62	-.382	.297	-.548	.586
X20 -- Orientated Towards Market	65	4.05	-.707	.297	.038	.586
X21 -- No Balme Culture	65	3.40	-.387	.297	-.963	.586
X22 -- High Growth Market	65	3.55	-.320	.297	-.707	.586
X23 -- Lack of Intense Competition	65	2.62	.373	.297	-1.215	.586
X24 -- High Entry Cost for Rivals	65	3.08	-.102	.297	-1.072	.586
X25 -- Sufficient Time Money and Energy	65	3.66	-.737	.297	-.432	.586
X26 -- Focus on Cashflow and Capital	65	3.55	-.683	.297	-.349	.586
X27 -- Fit with Current Resources	65	3.46	-.381	.297	-.620	.586
X28 -- Clear Aims and Objectives	65	4.18	-1.096	.297	.454	.586
x28trans	65	18.3692	-.662	.297	-.566	.586
X29 -- Good Planning and Control	65	3.77	-.859	.297	.739	.586
X30 -- Tangible Project Milestones	65	3.72	-.905	.297	.454	.586
Valid N (listwise)	65					

Factor Analysis (File Reference Output_10_Oct_04)

Procedure (Part 1)

1. From the menu at the top of the screen click: **Analyse, Data Reduction, Factor**
2. Move requires variables into variable box
3. Click **Descriptives** – **Correlation Matrix, Coefficients, KMO and Bartlett's test**.
   In statistics tick **Initial Solution** – then click Continue.
4. Click **Extraction** – **Method = Principal Components**
   Analyse – **Correlation Matrix**.
   Display – **Screeplot & Unrotated factor solution**
   Extract – **Eigenvalues over 1** – click Continue
5. Click **Options**
   Missing values – **Exclude cases pairwise**.
   Coefficient Display Format – click **Sorted by size**
   Suppress absolute values less than 0.3 typed in the box – Click **Continue, OK**

Interpretation of Output - Step 1

In the Correlation matrix there were a significant number of correlation coefficients above 0.3, which indicated that the matrix is factorable.

The Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) value was > 0.6

The Bartlett's Test of Sphericity was significant, (i.e Sig. Value < 0.05)

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.752
Bartlett's Test of Sphericity	Approx. Chi-Square	876.696
	df	351
	Sig.	.000

Therefore factor analysis is appropriate.

Step 2

To determine how many components to extract, using Kaiser's criterion, only those components with an Eigenvalue of 1 or more were of interest.

Total Variance Explained

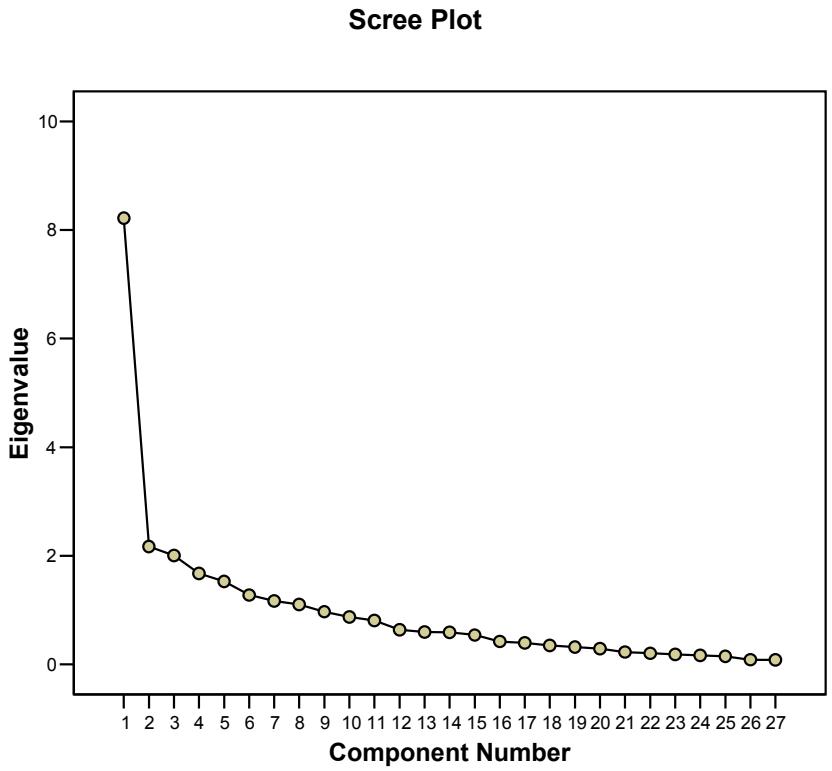
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	8.217	30.435	30.435	8.217	30.435	30.435
2	2.171	8.039	38.474	2.171	8.039	38.474
3	2.003	7.418	45.892	2.003	7.418	45.892
4	1.673	6.197	52.088	1.673	6.197	52.088
5	1.526	5.651	57.739	1.526	5.651	57.739
6	1.277	4.729	62.468	1.277	4.729	62.468
7	1.165	4.314	66.782	1.165	4.314	66.782
8	1.100	4.076	70.858	1.100	4.076	70.858
9	.969	3.588	74.447			
10	.871	3.227	77.673			
11	.806	2.984	80.658			
12	.635	2.353	83.010			
13	.597	2.211	85.221			
14	.589	2.182	87.403			
15	.541	2.002	89.405			
16	.422	1.561	90.966			
17	.394	1.458	92.424			
18	.348	1.289	93.713			
19	.318	1.177	94.890			
20	.287	1.063	95.953			
21	.226	.838	96.790			
22	.204	.755	97.545			
23	.181	.672	98.217			
24	.165	.611	98.828			
25	.148	.547	99.375			
26	.086	.319	99.695			
27	.082	.305	100.000			

Extraction Method: Principal Component Analysis.

In this sample, only the first eight components recorded eigenvalues above 1.0. These 8 components explain a total of 70.858% of the variance (ref cumulative % column).

Step 3

Often using Kaiser criterion, too many components are extracted, so only the components above the elbow in the screeplot are noteworthy:



In this plot there is a clear break between the 1st and 2nd components. Component 1 captures much more of the variance than the remaining components. There is another slight break between the 3rd and 4th component. Therefore factors 1 to 4 were judged to be of interest.

Factor Analysis (part 1)

Component Matrix[a]

	Component							
	1	2	3	4	5	6	7	8
x17trans -- Dedicated and Focused on Project	.806							
X16 -- Shared Vision and Values	.789							
x28trans -- Clear Aims and Objectives	.693							
X10 -- Leader Good Communicator	.681	-.500						
X11 --Situational Leadership Style	.669	-.446						
X20 -- Orientated Towards Market	.656					-.376		
X12 -- Leaders Motivational Style	.653	-.381				-.327		
X26 -- Focus on Cashflow and Capital	.630		-.432					
X25 -- Sufficient Time Money and Energy	.628						.428	
X29 -- Good Planning and Control	.624				-.450			
X18 -- Accountable for Entire Project	.607					.434		
x15trans -- Senior Management Commitment	.605							
x4trans -- Benefits Unique and Well Defined	.578	.516						
X9 -- Market Need Quantified	.558			.385				
X8 -- Clear Marketing and Sales Plan	.505		-.362	.344		-.303		
X27 -- Fit with Current Resources	.503						.483	
X5 -- Benefits Highly Visible	.489	.482			.347			
X13 -- Good Knowledge of Market	.486	-.339			.301	.369		
X21 -- No Balme Culture	.481	-.421	.441					
X14 -- Emotional Resiliance	.481				.465			
X6 -- High Purchase Importance	.389	.456						
X23 -- Lack of Intense Competition			.713					
X19 -- Cross-functional Structure			.632					-.364
x7trans -- Close Fit with Business Strategy	.350			.715				
X30 -- Tangible Project Milestones	.444	.411			-.451			
X22 -- High Growth Market				.367		-.315	.459	-.424
X24 -- High Entry Cost for Rivals	.323		.393			-.337		.405

Extraction Method: Principal Component Analysis.

a. 8 components extracted.

The component matrix shows the loadings of each of the items with eigenvalues above 1
Most of the items load quite strongly (above 0.4) on the first and second component as indicated by the scree plot. All of the eight components have at least one item loaded above 0.4.

Factor Rotation and Interpretation (Part 2)

Varimax rotation was used as this is the most common approach, and it tends to be easier and clearer to interpret.

1. From the menu at the top of the screen click **Analyse, Data Reduction, Factor**.
2. Check that all the variables are listed in the variables box.
3. Click **Descriptives** button – deselect Initial Solution, Coefficients, and KMO Bartlett's.
4. Click **Extraction**
   Method = **Principal Components**
   In **Analyze** select **Correlation matrix**
   In **Display** deselect Screeplot and Unrotated factor solution
   In **Extract** select **Number of factors**
   In the box type **number of factors to be selected (8)** – Continue
5. Click **Options**
   In **Missing values** section click **Exclude cases pairwise**
   In **Coefficient Display Format** select **Sorted by size** & **Suppress values less than 0.3**
6. Click on **Rotation** button
   In method section click on **Varimax**
7. Click **Continue, OK**

The output generated from this procedure is shown below:

Total Variance Explained

Component	Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %
1	3.706	13.728	13.728
2	3.426	12.690	26.417
3	2.507	9.286	35.703
4	2.386	8.837	44.540
5	2.267	8.398	52.938
6	1.889	6.998	59.936
7	1.482	5.488	65.424
8	1.467	5.434	70.858

Extraction Method: Principal Component Analysis.

Only 8 components are listed, as compared with 27 in the previous unrotated output. The distribution of variance has also been restated, with the total variance explained being 70.858%.

The preliminary result for the Rotated Component Matrix is shown in the following table:

Rotated Component Matrix[a]

	Component							
	1	2	3	4	5	6	7	8
X11 --Situational Leadership Style	.860							
X10 -- Leader Good Communicator	.818			.322				
X12 -- Leaders Motivational Style	.751							
X21 -- No Balme Culture	.694					.398		
x15trans -- Senior Management Commitment	.359		.321					
x4trans -- Benefits Unique and Well Defined		.744						
X6 -- High Purchase Importance		.694						
X20 -- Orientated Towards Market	.356	.632						
X5 -- Benefits Highly Visible		.593						.459
x28trans -- Clear Aims and Objectives	.367	.574			.327			
X16 -- Shared Vision and Values	.446	.531			.360	.310		
x17trans -- Dedicated and Focused on Project	.349	.473		.410				
X27 -- Fit with Current Resources			.769					
X25 -- Sufficient Time Money and Energy		.301	.706					
X26 -- Focus on Cashflow and Capital			.667					
X13 -- Good Knowledge of Market				.760				
X9 -- Market Need Quantified				.687				
X18 -- Accountable for Entire Project			.390	.495				
X14 -- Emotional Resiliance		.395		.495	-.356	.311		
X30 -- Tangible Project Milestones					.796			
X29 -- Good Planning and Control			.302		.697			
X8 -- Clear Marketing and Sales Plan					.491	-.459		.425
X23 -- Lack of Intense Competition						.738		
X19 -- Cross-functional Structure					.318	.617		
X22 -- High Growth Market							.872	
x7trans -- Close Fit with Business Strategy				.534	.318		.556	
X24 -- High Entry Cost for Rivals								.770

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 19 iterations.

In the rotated component matrix above, the main loadings on each component can be seen. In the following matrix, some of the factors which load moderately onto several components, have been removed to give a more optimal solution:

Optimised Rotated Component Matrix

Rotated Component Matrix[a]

	Component							
	1	2	3	4	5	6	7	8
X11 -- Situational Leadership Style	.861							
X10 -- Leader Good Communicator	.825				.316			
X12 -- Leaders Motivational Style	.754							
X21 -- No Balme Culture	.696					.385		
x4trans -- Benefits Unique and Well Defined		.728						
X6 -- High Purchase Importance		.710						
X20 -- Orientated Towards Market	.365	.624						
X5 -- Benefits Highly Visible		.599					.460	
X28 -- Clear Aims and Objectives	.354	.547		.357				
X16 -- Shared Vision and Values	.454	.500		.378		.321		
X27 -- Fit with Current Resources			.783					
X25 -- Sufficient Time Money and Energy			.704					
X26 -- Focus on Cashflow and Capital			.657			-.302		
X30 -- Tangible Project Milestones				.804				
X29 -- Good Planning and Control			.319	.686				
X8 -- Clear Marketing and Sales Plan				.503		-.448	.433	
X13 -- Good Knowledge of Market					.762			
X9 -- Market Need Quantified					.681			
x7trans -- Close Fit with Business Strategy				.329	.554			.507
X14 -- Emotional Resiliance		.418		-.366	.483			
X18 -- Accountable for Entire Project	.300		.405		.470			
X23 -- Lack of Intense Competition						.734		
X19 -- Cross-functional Structure				.321		.637		
X24 -- High Entry Cost for Rivals							.772	
X22 -- High Growth Market								.903

LEADERSHIP
PRODUCT DEFINITION
RESOURCES
IMPLEMENTATION
MARKET-ORIENTATED TEAM
NON-SIGNIFICANT CONTRIBUTIONS

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 25 iterations.

Total Variance Explained

Component	Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %
1	3.504	14.015	14.015
2	3.015	12.059	26.074
3	2.380	9.518	35.592
4	2.289	9.154	44.746
5	2.143	8.572	53.319
6	1.875	7.501	60.820
7	1.484	5.936	66.755
8	1.404	5.615	72.370

Extraction Method: Principal Component Analysis.

These 8 factors explain 72.37% of the variance.

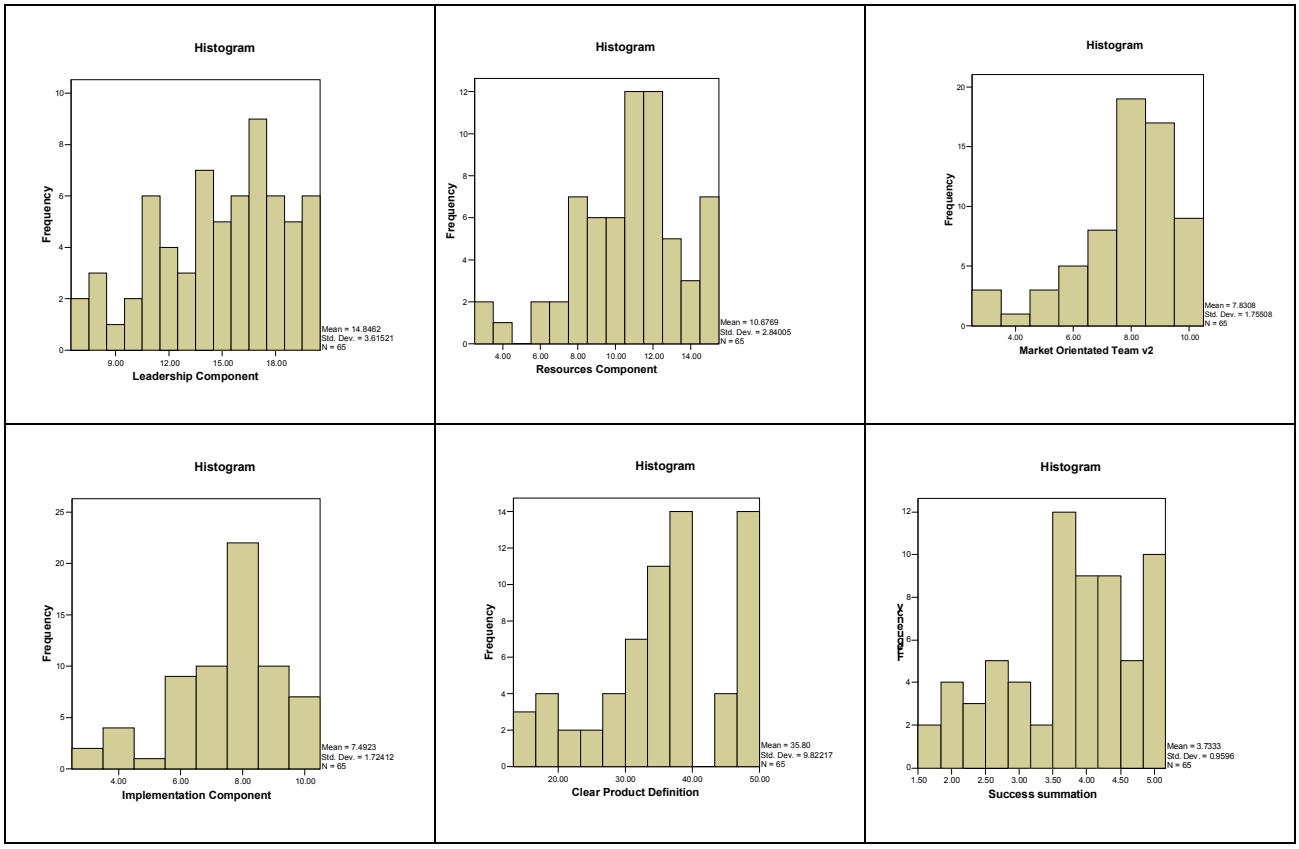
Calculation of total scale scores

New scales were created by adding-up the scores for each of the items within the component:

- Leadership
- Resources
- Market Orientated Team
- Implementation
- Product Definition

These components form the independent variables used in Multiple Regression Analysis.

Each scale was assessed for normality. Results were within the acceptable range of –1 to +1.



Checking Reliability of scales

Procedure:

1. From the menu at the top of the screen click **Analyze**, **Scale**, **Reliability Analysis**
2. Move individual items of the scale into **Items**
3. In the Model section select **Alpha**
4. Click **Statistics**
   In Descriptives click **Item, Scale, Scale if Item deleted**. Continue, OK.

Results:

All scales achieved a Cronbach alpha above 0.7 and a corrected item total correlation well above 0.3, which indicates that the scales were reliable within this sample.

Table showing internal consistency of scales to confirm that all questions are measuring the same underlying construct

LEADERSHIP	Mean	Std. Deviation	N	
X10 -- Leader Good Communicator	3.91	1.057	65	
X11 --Situational Leadership Style	3.68	1.017	65	
X12 -- Leaders Motivational Style	3.86	0.998	65	
X21 -- No Balme Culture	3.40	1.285	65	
Chronbach's Alpha				**0.844**

RESOURCES	Mean	Std. Deviation	N	
X25 -- Sufficient Time Money and Energy	3.66	1.241	65	
X26 -- Focus on Cashflow and Capital	3.55	1.186	65	
X27 -- Fit with Current Resources	3.46	1.062	65	
Chronbach's Alpha				**0.742**

PRODUCT DEFINITION	Mean	Std. Deviation	N	
X6 -- High Purchase Importance	3.54	0.969	65	
X20 -- Orientated Towards Market	4.05	0.856	65	
X5 -- Benefits Highly Visible	4.03	0.984	65	
X16 -- Shared Vision and Values	3.88	1.068	65	
X28 -- Clear Aims and Objectives	4.18	0.934	65	
X4 -- Benefits Unique and Well Defined	3.88	1.053	65	
Chronbach's Alpha				**0.82**

IMPLEMENTATION	Mean	Std. Deviation	N	
X30 -- Tangible Project Milestones	3.72	1.053	65	
X29 -- Good Planning and Control	3.77	0.897	65	
X8 -- Clear Marketing and Sales Plan	3.63	1.167	65	
Chronbach's Alpha				**0.712**

MARKET-ORIENTATED TEAM	Mean	Std. Deviation	N	
X13 -- Good Knowledge of Market	4	0.935	65	
X9 -- Market Need Quantified	3.83	1.069	65	
X14 -- Emotional Resiliance	3.8	0.939	65	
X18 -- Accountable for Entire Project	3.71	1.208	65	
X7 -- Close Fit with Business Strategy	4.31	0.865	65	
Chronbach's Alpha				**0.714**

Multiple Regression

Procedure

1. From the menu choose **Analyse, Regression, Linear**
2. Click on dependent variable (Successful Outcome) and move it to Dependent box
3. Click independent variables and move them to Independent box
4. For **Method**, make sure **Enter** is selected (standard multiple regression)
5. Click **Statistics** button
   Tick **Estimates, Model fit, Descriptives** and **Collinearity diagnostics**
   In **Residuals** tick **Casewise diagnostics** and **Outliers outside 3 standard deviations**.
   Click **Continue**
6. Click **Options** button. In **Missing Values** click **Exclude cases pairwise**
7. Click **Plots** button
   Click *ZRESID and move it into the Y box
   Click *ZPRED and move it into the X box.
   In Standardised Residual Plots tick **Normal probability plot**. Continue
8. Click **Save** button, in **Distances tick Mahalanobis**. Continue, OK.

Results

Checking the Assumptions

Multicollinearity:
In the Correlations table the independent variables show a relationship with the dependent variable > 0.3. The correlation between each of the independent variables is < 0.7, which according to Tabachnick and Fidell (1996) is not too high. All the variables were therefore retained.

In the **Coefficients** table, values in the **Tolerance column** are not too low (all above 0.7) so the multicollinearity assumption has not been violated.

In the **Scatterplot** the standardised residuals are roughly rectangularly distributed with most scores concentrated in the centre along the 0 point. There was no evidence of a clear or systematic pattern, which suggests no violation of the assumptions.

Outliers, Normality, Linearity, Homoscedasticity and Independence of Residuals:
In the **Normal Probability Plot** the points were on a reasonably straight diagonal line, which suggests no major deviations from normality.

The Mahalanobis distances presented in the Data file (MW_Data_10_Oct_04) show 2 outlying cases (critical value >18.47 for four variables), but they were judged as non-critical since this is not unusual.

Step 2. Evaluating the Model
The R Square value of 0.456 expressed as a percentage means that the model explains 45.6% of the

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.675[a]	.456	.390	.74977

a. Predictors: (Constant), X22 -- High Growth Market, Implementation summed, X24 -- High Entry Cost for Rivals, Leadership Component, Market Orientated Team, Resources Component, Clear Product Definition

b. Dependent Variable: Success summation

variance in successful outcome. This is quite a respectable result according to Pallant (2001).

The adjusted R Square statistic 'corrects' this value to provide a better estimate of the true population value when a small sample is used (Tabachnick & Fidell, 1996). This is noteworthy considering the limitations of the sample size used in this study.

To assess the statistical significance of the result it is necessary to refer to the table labelled ANOVA:

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	26.890	7	3.841	6.834	.000[a]
	Residual	32.043	57	.562		
	Total	58.933	64			

a. Predictors: (Constant), X22 -- High Growth Market, Implementation summed, X24 -- High Entry Cost for Rivals, Leadership Component, Market Orientated Team, Resources Component, Clear Product Definition

b. Dependent Variable: Success summation

The model in this study reaches statistical significance (Sig = 0.000)

Step 3. Evaluating each of the Independent Variables
The 45.6% variance in "Successful Outcome" is explained by the following 7 variables:

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	-.488	.666		-.733	.467		
	Leadership Component	.002	.032	.009	.078	.938	.658	1.521
	Resources Component	.021	.042	.061	.492	.625	.614	1.629
	Clear Product Definition	.105	.033	.467	3.183	.002	.444	2.252
	Market Orientated Team	.082	.034	.294	2.375	.021	.621	1.609
	Implementation summed	-.119	.170	-.097	-.699	.487	.498	2.009
	X24 -- High Entry Cost for Rivals	-.052	.077	-.069	-.667	.507	.883	1.133
	X22 -- High Growth Market	.142	.089	.164	1.603	.114	.915	1.093

a. Dependent Variable: Success summation

Information in the box labelled Coefficients indicated which of the variables included in the model contributed to the prediction of successful outcome. The variables selected initially are those showing a high loading on a component in the factor analysis.

The column labelled **Beta** under **Standardised Coefficients** compares the different variables. Standardised means that these values have been converted to the same scale so that they can be compared (when constructing a regression equation the unstandardised coefficient values should be used). Inspecting the Beta column for the largest value indicates that the largest value ((0.467) is for **Clear Product Definition**. This means that this variable makes the strongest unique contribution to explaining successful outcome, when the variance explained by all other variables in the model is controlled for. The Beta value for **Market Orientated Team** is slightly less ((0.294) indicating that it made less of a contribution.

For each of the variables, the column marked Sig can be inspected. This indicates whether this variable is making a statistically significant unique contribution to the equation. This is very dependent on which variables are included in the equation, and how much overlap there is among the independent variables. If the **Sig value is less than 0.05** then the variable is making a statistically significant unique contribution to the prediction of successful outcome. If > 0.05 then this may be due to overlap with other independent variables within the model.

In this study, both **Clear Product Definition** and **Market Orientated Team** make unique, statistically significant contributions to the prediction of the successful outcome of an innovation project.

Furthermore, if Hierarchical Multiple Regression is used to analyse these variables, the effect of "clear product definition" and "market orientated team" can be controlled to see if the remaining variables are able to explain any of the remaining variance in successful outcome:

Model Summary[c]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.648[a]	.419	.401	.74295	.419	22.385	2	62	.000
2	.696[b]	.484	.400	.74349	.065	.987	7	55	.450

a. Predictors: (Constant), Market Orientated Team, Clear Product Definition

b. Predictors: (Constant), Market Orientated Team, Clear Product Definition, X23 -- Lack of Intense Competition, X22 -- High Growth Market, X24 -- High Entry Cost for Rivals, X19 -- Cross-functional Structure, Leadership Component, Implementation Component, Resources Component

c. Dependent Variable: Success summation

The output generated from this analysis is similar to the previous output, but with additional information. In the Model Summary box there are two models listed, Model 1 refers to the first block of variables (product definition and market-orientated team), while Model 2 includes all the other variables that were identified in the factor analysis. The R Square values show that Model 1 explains 41.9% of the variation in successful outcome. The model as a whole (all variables in both blocks) explains 48.4% of outcome.

The value of additional variance explained by Model 2 (after the effect of product definition and market orientation have been removed) is shown in the column labelled **R Square change**. In this study, the other predictors; **Leadership**, **Resources**, **Implementation**, **Cross-functional structure**, **High growth market**, **Lack of intense competition** **and** **High entry cost for rivals** account for only **an additional 6.5% of the variance.** There is no significant contribution made by these factors, as indicated by the Sig F Change of 0.450.

The ANNOVA table indicates that the model as a whole (which includes both sets of variables) is significant (p<0.0005).

ANOVA[c]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	24.711	2	12.356	22.385	.000[a]
	Residual	34.222	62	.552		
	Total	58.933	64			
2	Regression	28.531	9	3.170	5.735	.000[b]
	Residual	30.402	55	.553		
	Total	58.933	64			

a. Predictors: (Constant), Market Orientated Team, Clear Product Definition

b. Predictors: (Constant), Market Orientated Team, Clear Product Definition, X23 -- Lack of Intense Competition, X22 -- High Growth Market, X24 -- High Entry Cost for Rivals, X19 -- Cross-functional Structure, Leadership Component, Implementation Component, Resources Component

c. Dependent Variable: Success summation

The **Coefficients** table indicates how much each of the variables makes to the equation. The Model 2 row summarises the results of all of the variables entered into the equation:

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.303	.613		-.495	.622
	Clear Product Definition	.093	.025	.415	3.763	.000
	Market Orientated Team	.094	.031	.337	3.052	.003
2	(Constant)	-.287	.714		-.402	.689
	Clear Product Definition	.097	.031	.431	3.167	.003
	Market Orientated Team	.077	.034	.276	2.234	.030
	Leadership Component	.006	.032	.023	.187	.852
	Implementation Component	.026	.048	.067	.542	.590
	Resources Component	-.005	.043	-.015	-.115	.909
	X23 -- Lack of Intense Competition	-.052	.074	-.076	-.701	.486
	X19 -- Cross-functional Structure	-.131	.098	-.148	-1.329	.189
	X24 -- High Entry Cost for Rivals	-.023	.079	-.031	-.288	.774
	X22 -- High Growth Market	.162	.089	.187	1.826	.073

a. Dependent Variable: Success summation

The Sig. Column shows that there are only two variables that make a statistically significant contribution (< 0.05) and they are, as expected, clear product definition and market-orientated team.
Remembering that the beta values represent the unique contribution of each variable, when the overlapping effects of all the other variables have been removed, the only other variable of note is "High Growth Market" – thus the order of importance in prediction successful innovation outcome is:

Clear product definition	0.431
Market orientated team	0.276
High growth market	0.187
Total	0.894

In different equations, with a different set of independent variables, or with a different sample, these values would change.

The multiple regression equation takes the form y = b1x1 + b2x2 + ... + bnxn + c. The b's are the regression coefficients, representing the amount the dependent variable y changes when the independent changes 1 unit. The c is the constant, where the regression line intercepts the y axis, representing the amount the dependent y will be when all the independent variables are 0. The standardized version of the b coefficients are the beta weights, and the ratio of the beta coefficients is the ratio of the relative predictive power of the independent variables. Associated with multiple regression is R2, multiple correlation, which is the percent of variance in the dependent variable explained collectively by all of the independent variables.

The beta weights are the regression (b) coefficients for standardized data. Beta is the average amount the dependent increases when the independent increases one standard deviation and other independent variables are held constant. If an independent variable has a beta weight of .5, this means that when other independents are held constant, the dependent variable will increase by half a standard deviation (.5 also). The ratio of the beta weights is the ratio of the estimated predictive importance of the independents. Note that the betas will change if variables or interaction terms are added or deleted from the equation. Reordering the variables without adding or deleting will not affect the beta weights. That is, the beta weights help assess the relative importance of the independent variables relative to the given model embodied in the regression equation.
Note that the betas reflect the unique contribution of each independent variable. Joint contributions contribute to R-square but are not attributed to any particular independent variable. The result is that the betas may underestimate the importance of a variable that makes strong joint contributions to explaining the dependent variable but which does not make a strong unique contribution. Thus when reporting relative betas, one must also report the correlation of the independent variable with the dependent variable as well, to acknowledge if it has a strong correlation with the dependent variable.

Appendix 4. Qualitative Evaluation of the Results

Transcript of discussion with Max Derrick, International Group Marketing Manager, Alaris Medical Systems: Thursday 14th October 2004

A. Introduction to Alaris by Max Derrick

My title is International Group Marketing Manager and I am responsible for the marketing of disposable products within Alaris medical. I have been in my current role for about three and a half years and was responsible for engineering and operations for two years prior to that. I am an engineer by background so technically, the move into marketing has made me much more commercially aware. My contact now is more with customers, the sales team, and customer services whilst trying to bring products to market through innovation and through the requirements of the market place, which keeps changing all the time. And really trying, to make everything a bit faster.

What is the turnover of the group?

We have recently been purchased by a company called Cardinal Health, which has an annual turnover of 60 billion dollars. Alaris equivalent is about half a billion dollars and the Alaris International Division which is basically Alaris but without the US is about 180 million dollars.

How many employees here in Alaris?

At the headquarters here in Basingstoke about 250 people within Alaris International we are about 1,500. Alaris worldwide is about 5,000.

B. Constructs

We touched on the fact that there were nine constructs on which the questionnaire was based. Can you take me through what you feel are the most important elements of a successful outcome to an innovation product.

IDEA	MARKETS	STRATEGY
PEOPLE	TEAMS	STRUCTURE
LEADERSHIP	IMPLEMENTATION	RESOURCES

C. The Idea – Don't fix too early – brainstorm the total concept.

I think looking at your structure here, the idea is the key thing because you have got to have something to start the process, but the question is how is that idea contained, because often the best ideas can be just a flash in the pan - suddenly it is decided that this may fit a need, and the danger is that you try and fit that idea into a way of working. Maybe that sometimes is good, but sometimes it can kill the innovation process because it stops the early brainstorming and what I have found it that particularly with an idea that somebody has put forward (and I can think of one or two examples at the moment) is that you then need to take time to brainstorm the idea and see whether it really is totally inspirational, or actually is of no use at all because of cost or operational reasons or in fact it is just a small part of the final concept. So what we tend to do is to take ideas when the come along and try and brainstorm them. We are trying to look at it within our own business and also outside the business, and that can be quite difficult for us particularly for those that have been in the company for a long time as you tend to get stuck in a rut. So the idea obviously starts the process and I think the importance is not trying to box that in until all the possibilities have been explored.

D. Market Orientation

So what we tend to do following brainstorms is to take the idea out into the market (which is your second box) and look at opportunities, getting feedback from the market, and seeing what the problems are with the customers. Those ideas are fed back to us and we have our screening system where we filter these ideas, some of them we reject, sometimes we explore them before we get into that screening process by taking the idea out beyond the originator to other markets. Customer feedback is part of the brainstorming process, which is sometimes difficult on a global scale, but you can do it. So the markets for us are very important - so what you are doing in the UK may be totally different from what goes on in France for example and we find this regularly, particularly where the product is very cost sensitive - possibly you would market it in UK, in South Africa, Australia but take it to the German and French markets and no way can they afford it. You don't want to kill the idea but you do want to try and make it a little more practical, that is where the market aspect is useful.

Having established the idea and identified the markets, what are the fundamental factors that make it a winner? Is it the implementation of the idea that can make the difference between success and failure?

E. Structure and Procedures

Thinking of my time at Alaris the key thing is having a structure that is efficient in terms of delivering products. You may have good project teams but if they don't have the right resources or the right equipment or the right expertise then it is really no good, and obviously the customer has got to have a quick response to their request. We have a very flat structure in Alaris – we are matrix-organised so we report to different people at the same time which is fine but the danger is that people get pulled off projects and put on different projects and sometimes the overall control can be lost - you end up fighting for your project. You can have the procedures which help but what I have found is where the procedures are rigid it can be a hindrance You can good processes but more importantly they have to be flexible and the thinking also has to be flexible, so where you have a process you don't have to go through "*a-b-c-d"* all the way through to "*z"*. As long as you have justification for moving away from that. Sometimes people are so rigid they don't see that you can do that and that's where I think the implementation and project management will come together because good project management will be able to do that - they will also look at contingencies which is a key part of project management because if you don't plan for contingencies they will always get you. Also you then have got a more realistic view of your timeline.

F. Time to Market – the Team is Critical

What we have found is that where we have taken a long time to bring the idea to market even though it may be fairly simple, if it takes 12 months then often the customer has moved on, often physically or he may have bought the product from a competitor. The idea may be brilliant but if the time to market is too long it can kill it. We have examples of just that, where we have got the product to market, we are all happy, we look at the warehouse several months later and the stock is still there - and it then demotivates the team because we think, "what is the point of doing it?"

So what we try to do is make our product development process more efficient. We don't have a set structure for developing products, and I don't mean protocols - sometimes we do things in house - sometimes we go out to other suppliers which may have much more expertise, and particularly within the quality processes within an American organisation, they are pretty strong and we find that working with suppliers if the supplier is prepared to put their own CE mark on the product we can get it out in two months, if we have to go through our own system, it often becomes 6 plus months. And that time to market may be the critical factor in doing that - so "people", I think is a very general term in which we can project manage things and that the team is absolutely critical because within the team what we try to do is prioritise projects so that those that can bring in the maximum revenues are ranked high because that is the net benefit for the company.

G. Clear Product and Project Definition

The team must have a very clear objective and that is one of my other key things is that when we are developing the project, whatever it is, we make sure we define what we are trying to do. What we are finding is that with projects we get *project creep;* "while are you doing this could we have another one of these?" – "put another one of these in the box!" and suddenly the project gets very badly defined. And what we try to do is to keep focused on the original objective. The danger with that is that you take objective "A" and deliver objective "A" but in that time the market has changed, they want "A" plus "B" so it's being savvy if you like of what is going on in the market but also making sure that you keep checking your objectives.

H. Communication

If the objectives change, go back and communicate, so that if you want that specification change - it is going to take another few months to achieve it. Its your decision but recognise this is the impact. So communication within the teams, with the customer, the sales person, and senior management is very important. .

I. How do you construct your team membership?

When I was running the business group then we had a team of four or five engineers and two or three marketing people and it depended upon the type of project, The structure has got to be there but it has to be flexible enough to make sure that you can cope with unknowns.

J. Leadership

One of the outcomes of the research was that leadership came relatively low down on the list of drivers, which could be because it is an anomaly within the sample that I looked at. But it is possible that people have been in good teams that have been very objective-driven despite being lacking in some key areas. What are your views and feelings on leadership and successful outcome versus the strength of the team? I am thinking of interaction here that can make or break the project.

I suppose I have been in both situations. If I could define a good leader - the leadership can have a strong impact on the team in the sense that they would set the overall objectives and the priorities but then back off so you know as a team member that there is somebody looking after you. Leaders must have the business at heart, but also the people at heart, and be able to make good, clear, sound judgements on the way the business is going, and how the priorities fit, and the way the projects fit, but not necessarily be involved in the activities. In bad leadership situations the priority is not there.

The problem is that with a clash of priorities you get things thrown in “left right and centre” and you are not sure if necessarily that the senior people are really interested in what you are doing or not, even though you are getting good feedback from the customer and sales people. As regards the priority of the project you don’t really know where it fits, and this can lead to difficulty in getting resources for example, where in a well run team although the project leader isn’t necessarily getting involved in the detail they can actually plan ahead so that if you need a test lab or a suppler they can run ahead to get that set up so that when you are ready for it you can pick it up.

K. The Power of a Good Team

But if it’s a good team, poor leadership doesn’t necessarily stop products getting to market because the team, if they are sufficiently well motivated, enjoy their work and feel satisfied they will get the projects through anyway. Leadership has a role but it is not totally critical. I think good projects will always happen, as long as you have a good team then the leadership is sort of second order, but I do think that if you have a very good leader it does help set the boundaries and things then it makes the whole process a lot easier, more efficient, less stressful, and a feeling that somebody is batting on your side. The people in the teams will always be the most important thing and the danger is that when you get a de-motivated team - that is when it is difficult to do any innovation at all, and then you start picking out individuals who you know are still motivated, and you will work with them and then the rest of the team go by the wayside. It’s difficult.

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