Project Planning Tools

Introduction

Project management is a well-established discipline that defines in detail the tools and techniques that are required to define, plan and implement any project. However, while many researchers have addressed the issues surrounding the management of projects within large firms (White and Fortune 2002; Bryde 2003) there has not been a lot published to date about the management of projects in SMEs.

This paper examines previous empirical studies on project management implementation in various industry sectors and the success criteria and factors most frequently adopted. The paper also examines the results of a survey distributed to 200 owner/managers of high-technology SMEs in Ireland that attempts to recognise the general characteristics of projects undertaken by SMEs, the issues they encounter and their opinions on how SMEs can use project management to achieve greater efficiency and competitiveness.

SMEs, ranging from the dynamic, innovative and growth-oriented to the traditional enterprises satisfied to remain static, are critical to the economy as an engine of economic and social development, (Hallberg 1999). (Floyd and McManus 2005) examining the increasing significance of small firms in the European Union (EU), point out that increased importance has been given to SMEs within EU industrial policy. According to the European Competitiveness report of 2003, SMEs account for 99 per cent of activity in the EU. The focus on high-technology SMEs derives from their importance to the Irish economy with their capacity for generating employment and promoting innovation (Warren and Hutchinson 2000).

Project management is well established with (White and Fortune 2002) describing it as a well developed and well accepted area of professional expertise and an area for academic

research aimed at encouraging improvement in a system. Project management offers a systematic approach to all stages of a project by ensuring that every step is carefully planned, monitored and measured. Although initially intended for application in large organisations with complex systems that require such a process, (Baccarini 1999), modern methods of project management can be adapted and altered to suit the needs of the smaller organisations.

This paper aims to develop an understanding of project characteristics and how they are managed within SMEs, what factors enhance project success and the perception of the potential of project management as a process. These findings will contribute to the development of a simplified approach to managing projects in SMEs.

Characteristics of SMEs

The definition of an SME has varied over time and there has been a lack of consensus about what constitutes a small or medium firm (McAdam, Reid et al. 2005). For the purpose of this research, the definition set out by the European on January 1st 2005 will be adopted. According to this definition an SME must have fewer than 250 employees, a turnover of less than €250 million and/or an annual balance sheet less than €43 million. The above definition also considers the potential relationships that exist between SMEs and other enterprises defining three categories of SMEs – autonomous, partner and linked. Most SMEs are autonomous meaning that they are completely independent or have only minority partnerships (less than 25%). For practical reasons within this study SMEs were defined by their staff count and annual turnover. This approach has been

adopted in many previous empirical studies (Johnson and Turner 2000; Hudson, Smart et al. 2001; Gray and Mabey 2005; McAdam, Reid et al. 2005).

SMEs exhibit both advantages and disadvantages when compared to larger organisations. (Audretsch, Prince et al. 1998) in their comparative paper examining small and large firms found that small firms have a greater potential flexibility and closeness to the customer and an edge towards customisation and innovation. They seek out markets where their advantages count and they are not in direct competition with their larger counterparts. However, despite these key advantages, SMEs lack economies of scale, scope and learning.

(Edwards, Delbridge et al. 2001), suggest that SMEs exhibit behavioural features that give them an innovative advantage over large firms these include the ability to respond rapidly to external threats or opportunities, more efficient internal communications and interactive management cycles. However, (Rothwell 1992) found that SMEs were limited in their ability to innovate as they, 'lack the material and technological resources that enable large firms to 'spread risk over a portfolio of new products' and 'fund longer-term R&D'.

An examination of the skills of project managers in small and large electronics firms (Ledwith 2004), showed that project managers in small firms were weak in the areas of motivation, marketing and management. Small firms demonstrated limited use of project management techniques and were not benefiting from project management in terms of increased new product success. Despite this it was observed that by improving project planning, establishing clear priorities and setting clear objectives, small electronics firms

could improve New Product Development (NPD) performance by reducing project delivery times.

High technology firms are predominantly founded by technical entrepreneurs who form a business based on the discovery and belief in a new product, (Oakey and Mukhtar 1999). High technology SMEs are characterised by long lead times from basic research to industrial application and short lead times in commercialisation. They suffer accelerated obsolescence under global competitive pressures from new product and process innovations, (Litvak 1992). High technology SMEs tend to have entrepreneurial management styles with organic structures and their success is often based upon sound knowledge of the business, highly skilled employees and the ability to spot a gap in the marketplace, (Warren and Hutchinson 2000).

Projects

The Project Management Institute, PMI (2000), define a project as 'a temporary (definitive beginning and definitive end) endeavour undertaken to create a unique (projects involve doing something that has not been done before) product or service.' Projects can be considered as the achievement of a specific objective and involve the utilisation of resources on a series of activities or tasks. (Munns and Bjeirmi 1996) in their paper on how to achieve project success, differentiate between project success and project management success. Their definition of a project suggests an orientation towards longer-term goals such as return on investment, profitability and competition, while project management focuses on short-term goals and a more specific context for

success. (Cooke-Davies 2002) proposes the following distinction between project success and project management success:

- **Project Success** is measured against the overall objectives of the project,
- **Project Management Success** is measured against the widespread and traditional measures of time, cost and quality.

(Munns and Bjeirmi 1996) conclude that despite the differences between project success and project management success they compliment each other. A project can succeed despite the failure of project management but successful project management implementation can increase the potential for success on an overall project scale.

Project Management

Project Management has existed, in theory, for centuries with its informal application by the Chinese and Egyptians in such feats as the Great Wall of China and the Pyramids. However, modern Project Management is a recent phenomenon gaining initial acceptance in the rapid development of the Information Technology industry, (Fox 2004).

The Project Management Institute (Institute 2000) provides a simplified definition of project management as 'the application of knowledge, skills, tools and techniques to project requirements.'

The emergence of modern project management owes to three core stimuli, (Baccarini 1999):

1. **Complexity** – Growing complexity of tasks and a need for a greater degree of specialisation.

2. **Change** – Increasingly dynamic environments with constant pressure within organisations to implement change due to global competition.
3. **Time** – Demand for tasks to be completed as quickly as possible.

Over time modern project management has emerged as a discipline that has constantly remoulded itself to allow for expansion in its practice. A valuable conclusion was made by (Crawford, Pollack et al. 2005) who carried out an analysis of the International Journal of Project Management and the Project Management Journal over the last ten years to try to uncover the trends in project management:

'As a field, project management is regularly facing new challenges, as the tools, methods and approaches to management that comprise the discipline are applied to different areas, for different ends, in different cultures.'

Success Criteria and Success Factors

When studying projects and their management a clear distinction should be made between critical success criteria and critical success factors. (Cooke-Davies 2002) defined the difference as follows:

Success Criteria are the measures by which success or failure of a project will be judged.

Success Factors are the inputs to the management system that lead directly or indirectly to the success of the project.

This is supported by (Belassi and Tukel 1996) who recommend that sound research on critical success factors has to:

1. Distinguish between success factors and success criteria.

2. Distinguish success factors within the control of the project manager and factors outside his/her control.

Determination of a project's success criteria has become far more complex in recent times (Belassi and Tukel 1996) with the traditional criteria of time, cost and performance no longer sufficient. On any project, there can be numerous parties each with their own perception of success. (Pinto and Slevin 1989) recognised this ambiguity in determining project success by concluding that it is still not clear how to measure success because the parties who are involved in projects perceive project success or failure differently. For the purpose of this study, senior management's perception of success was considered based on their overwhelming influence in SME procedures.

Research has contributed to a significant quantity of factors that could be described as critical to a projects outcome. But projects are individual and unique and each project can have a different set of success factors. (Belassi and Tukel 1996) proposed that, 'a combination of many factors, at different stages of the project life cycle, result in project success or failure'. Table 1 outlines the key success criteria and success factors seen to be most significant from previous empirical studies.

<< Take in Table 1 >>

The three basic criteria of time, cost and quality appear regularly in Table 1. Additionally, client satisfaction is seen as a significant factor in achieving overall project success. (Westerveld 2003) also considered the appreciation of the various parties involved both directly and indirectly in the project.

The success factors listed in Table 1 include many items that could be implemented within SMEs. But in considering the application of different success factors in SMEs it is important to remember that SMEs are generally characterised as having basic organisational structures with simple planning and control systems. This would suggest that SMEs should adopt a simplified approach to managing projects. Having reviewed the success factors in Table 1, six were considered to have the greatest potential benefit to SMEs:

- Clear Goals / Objectives
- Senior Management Support
- Resource Allocation
- Planning, Monitoring & Control
- Client Consultation
- Risk Management

These six factors are investigated through a survey that measures the opinions of SME owner/managers about the use project management within their organisations.

Methodology

A questionnaire was developed and distributed via email to the owner-managers of over 200 firms operating across many sectors that included medical devices, telecommunications, electronics and general engineering. A commercial business directory, Kompass, provides general information on organisations across Ireland and was used as the source for the collection of organisations for the distribution list. Selection of SMEs from the database was dependant on two factors; number of

employees and industry sector. In line with the SME definition provided earlier, employment levels had to be less than 250 people. The study concentrated on high-technology SMEs because of their importance to the Irish economy in terms of employment and wealth creation. Additionally, Oakey and Mukhtar (1999) highlight that poor business skills among technical entrepreneurs often cause their firms to be badly managed, both during formation and through expansion.

The questionnaire was piloted in three SMEs, with two academic personnel working in related disciplines, and two project management professionals with extensive SME experience. These pilot studies led to the addition and removal of questions and general improvements in wording. The questionnaire was designed using the Survey Monkey survey tool and data were analysed using SPSS.

The main objectives in developing the questionnaire were to explore the following:

1. The basic characteristics of projects and perceived success of projects to date.
2. The level of recognition of project management as a process within SMEs.
3. Success criteria and success factors for projects.
4. Project management tools and/or techniques in use and their contribution to project success.

Forty responses, yielding a response rate of 20% were returned. The data collected is presented and analysed below.

Results & Discussion

Descriptive Analysis

Responses to the questionnaire came from the following sectors: Medical Devices (25%), Electronics (22.5%), Manufacturing (32.5%), Telecommunications (5%), Engineering & Construction (15%).

On average the firms employed 65 staff, the largest firm employing 210 and the smallest having 22 employees. Questions were asked about current organisational structures and general project characteristics. Table 2 reports the percentage responses from these questions. Most firms described themselves as having either a traditional functional structure or a matrix structure (i.e. a mix of functional and pure project structures). Only two firms were described as being organised around projects. Most of the projects undertaken by SMEs who responded to this survey were small; 63% of the firms reported that project expenditure was between 0-20% of turnover, and 85% had only 1-10 staff working on projects. Project durations varied considerably from under 3 months to over 12 months. However, there was agreement that projects undertaken were complex in nature.

<< Take in Table 2 >>

Over half the respondents, 60%, reported that project management was an identifiable process within their firms with 88% of them (or 53% of the complete sample) employing full time project managers. The remaining sixteen firms (40%) were not using project management.

Respondents were asked to rate success criteria and success factors on a scale of 1 to 5 in terms of their importance to the firm (where 1 = not important and 5 = very important). Table 2 shows the average values reported for each success criteria and success factor.

<< Take in Table 3 >>

It is interesting to note that quality is rated as the most important success criterion; the literature would suggest that this is not the case in larger firms with more mature quality management systems in place. The results also suggest that project success is based more on internal than external factors. This is supported by the level of agreement with the statement 'Success of projects within my organisation is mainly determined by internal factors' in Table 5. 'Clear Goals/Objectives' and 'Senior Management Support' were both considered the most important success factors, this supports existing literature. 'Resource Allocation' was also identified as an important success factor. This is not surprising as resources are frequently an issue for SMEs.

Respondents were also asked to identify the most influential decision makers on project in their firms, average results are shown in Table 4. Not surprisingly, owner-managers were found to have the most influence in decisions relating to projects, followed by project and functional managers. This supports the belief (Ghobadian and Gallear 1997) that owner-managers are closely involved in all aspects of operations with few layers of management in most SMEs.

<< Take in Table 4 >>

Respondents indicated their support for a range of statements, presented in Table 5. These results suggest that SME owner-managers understand the importance of a well-defined project management process and also feel that there is a difference between how large and small firms approach projects. This supports the findings of Ghobadian and Gallear (1997) who found that in managing projects large organisations possess greater capital and resources and a greater degree of specialisation than their small counterparts. The firms surveyed also appear to work closely with customers and suppliers.

<< Take in Table 5 >>

Respondents were asked how they could improve project performance; some of their comments are listed below:

> *'Prioritisation of project tasks over other work'*
>
> *'Reviewing EVMS (Earned Value Management System) methods and honing CPI (Cost Performance Index) and SPI (Schedule Performance Index) introduction of a strong matrix management structure'*
>
> *'By people being trained to understand the principles and benefits of same'*
>
> *'Training of Project Managers. Clearer Goals being set and communicated to all staff involved. Better client or fact finding on site at conception stage'*
>
> *'More control of project team'*

When asked if they thought that project management was too complex a process to implement in SMEs the responses were as follows:

> *'No, it can actually be easier to implement in a smaller organisation.'*
>
> *'No. I have worked in industries of various sizes – the approach is different but the tools are the same'*
>
> *'You would want to be clearly identifying the benefits of it and then it may not be that complex to achieving the implementation of same.'*
>
> *'No, I do not agree, it is as easy to implement. It is just that in SMEs it is very difficult to afford the time and the resources…..it is a growing issue for a company and a mindset.'*

'No, if adequate time and resources are given then there should not be any problems'

Finally, the level of usage of a variety of project management tools and techniques was measured. These results are shown in Figure 1. They show that while many of the firms use project teams and actually plan projects few SMEs are using the more complex project management tools such as Earned Value or CPM (Critical Path Method). The data also raises a question about how SMEs use Microsoft Project if they are not using it to implement the various project management techniques listed in Figure 1.

<< Take in Figure 1 >>

Statistical Analysis

Statistical analyses in the form of independent sample T-tests and the Pearson correlations were performed to further explore the responses and the potential relationships between them. One of the aims of the survey was to try to understand how high-technology SMEs manage projects and to identify management practices that may be linked with success.

In order to determine if there was a relationship between a firm's organisational structure, size and project expenditure, and the decision to employ a full-time project manager a series of t-tests was performed, see Table 6. The results show that there is a relationship between the organisational structure in place and the existence of a project manager. Firms that employ a project manager were more likely to have a matrix-like structure. Firms without a project manager were more likely to have a more functional structure.

The results also show that there is no relationship between the number of employees and the employment of a project manager. In other words the very small firms in the sample are as likely to have full time project managers as the larger firms surveyed. However, it was found that the firms with a project manager employed were more likely to spend a greater percentage of turnover on projects.

<< Take in Table 6 >>

Table 7 examines the relationships between the existence of an identifiable project management process and the same factors examined in Table 6 above. Again a relationship between organisation structure and the presence of an identifiable project management process was identified. This suggests that firms who employ full time project managers or have project management as an identifiable process are more likely to be organised as 'project organisations' where the work undertaken by the organisation is in the form of projects.

<< Take in Table 7 >>

For the purpose of this research three components of project success were measured:

- Budget – completion within the proposed or allocated budget.
- Schedule – completion within the estimated duration.
- Performance – completion to specification and meeting client's requirements.

Overall project success was calculated as the average of these three components. The data were tested for any significant relationships between key project management variables and project success; results are presented in Table 8. Success was considered

both in terms of the three components described above, budget, schedule and performance, and in terms of overall success. One of the most interesting findings from the analysis was that there was a significant positive relationship between the employment of a Project Manager and overall and performance success. While neither the application of project management nor the use of Microsoft Project were found to significantly enhance project success organisations that use project planning techniques were more likely to achieve success in project budget and schedule. This is supported by the level of agreement to the statement - 'A well defined Project Management process is a necessity for successful implementation of projects' as was seen in Table 5.

<< Take in Table 8 >>

The data were analysed to identify any relationships between the rating by firms of difference success criteria and project success, see Table 9. The only success criterion that was linked with overall project success was 'completion within schedule'. In other words firms who consider completing a project within schedule as an important success criterion are more likely to achieve project success. This is interesting in the light of the results reported in Table 3 where 'completion within schedule' was not reported as one of the most significant success criteria. However, previous research (White and Fortune, 2002) has identified 'completion within schedule' as an important success criterion. It is also worth noting that the relationship between two success criteria, 'appreciation by user, and 'appreciation by project personnel', and project success is negative. This implies that firms who are concerned about the extent to which users and project personnel approve of (or appreciate) a project's progress are less likely to achieve project success.

<< Take in Table 9 >>

Finally, the data were tested to identify any significant relationships between the success factors that firms considered important and project success, no significant relationships were identified.

Conclusion

The findings presented in this paper are an attempt to understand the current project management practices in high-technology SMEs. The paper also reviews the major contributors to project success in SMEs. Results suggest that a majority of SMEs have identifiable project management processes and also full time project managers, but that owner/managers are still the most influential when it comes to making decisions about projects. Also, these SMEs are more likely to be organized along projects rather than functional lines.

Meeting quality standards and specification are considered to be the most important success criteria by the SMEs surveyed while clear goals/objectives and senior management support were judged to be the most important success factors. Additionally, the results show that having a full time project manager and applying project planning techniques are most likely to increase the chances of success. Despite the presence of a project management process being considered by the respondents as a necessity to success it is not found to contribute to project success. Finally, SMEs that consider

meeting completion schedules to be a success criterion are more likely to have successful projects than those who do not.

These findings can be summarised in terms of implications for projects management within SMEs as follows:

- Project success is more likely in firms that have full time identifiable project managers and that apply project planning techniques.
- Project success is more likely in firms that consider completion schedules to be important.

This study begins to identify the manner in which SMEs manage projects and also some project management practices that are linked with success. However it also raises several questions about the use of project management tools and techniques within SMEs and how these tools and techniques can be used to increase project success.

Further investigation is required to answer these questions, to deepen the understanding of project management in SMEs and to develop an approach to project management that can increase the likelihood of project success within SMEs.