Strategic Planning in Small High Tech Companies

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Do managers of small firms operating in the turbulent environment of high tech industries bother to plan for the longer term? Is strategic planning in these firms realistic or indeed feasible? This article presents the findings of an investigation into the strategic planning practices of small high tech firms based on UK science parks. Successful small high tech companies do use strategic planning to direct their long term growth and development and their planning processes become more sophisticated as they grow. Companies without strategic planning were led by entrepreneurs who had solely technical skills, the growth of the business was held back and its survival was put at risk by the entrepreneur's lack of strategic awareness.

Introduction

Over the last fifteen years, governments in industrialised economies have placed increasing emphasis on measures to support small high tech firms, largely based on the premise that such companies provide a powerful medium for the creation of new jobs, for regional economic regeneration, and for enhancing national rates of technological innovation and international competitiveness. The emphasis of many recent government small firm initiatives concentrates upon the provision of financial support to underpin R&D activities, encourage technology transfer and thus help such businesses access new technology. However, studies have shown that in rapid growth small high tech firms strategy formulation is important, if not essential, for successful long term development.[1] There is therefore a potential problem with government approaches which fail to acknowledge the importance of strategic management in such businesses—and in particular, the critical role of the technical entrepreneur in initiating and implementing effective strategic planning processes. This is particularly true given that previous research[2] has identified marketing and business planning as key areas of weakness within small high tech firms where management often tend to over-emphasise the purely technological side of their business and neglect other key strategic issues. It is surprising that, despite the perceived importance of small high tech companies in technological innovation and international competitiveness, very little detailed study has been undertaken into strategic management practice in these firms.[3]

This article builds on previous research into strategic planning in small businesses, but focuses on the unique circumstances facing small high tech firms which are often founded upon the R&D capabilities of the entrepreneur whose previous experience is within purely technical spheres, rather than in areas of general management.

Strategic Management in a Small Firm

Strategic management has often been attacked on the grounds that it is based upon theoretical ideals and not on the realities of management. Some writers have argued forcefully that formal strategic management procedures are particularly inappropriate for small firms which have neither the management nor fin-

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ancial resources to indulge in elaborate strategic management techniques, and for companies operating within the turbulent environment of high technology industries where conditions change so fast that environmental forecasting becomes meaningless and long range planning is of questionable value.[4]

Proponents of strategic management in the small firm have suggested that the type of planning employed will be contingent upon its stage of development and that this activity will evolve and become more formal and sophisticated over the life cycle of the business.[5] The literature suggests that as the activities and supporting functional areas of the organisation become more complex and sophisticated, planning will develop through various stages from its initial beginnings as simple financial plans and budgets, through to forecast-based planning, externally-oriented planning where the owner-manager begins to think strategically, proactively planning the firm's future rather than merely reactively responding to changes within the marketplace, and, ultimately, to formal strategic management techniques. It is often argued that the entrepreneur must make this necessary progression towards a strategic orientation and more sophisticated planning techniques as the business grows in order to ensure the future survival and long term success of the company, although it has been noted that the motivation to think and act strategically will frequently only be brought about by a crisis within the organisation.[6] The process of rapid, uncontrolled growth and its accompanying management, organisational and resource implications often stimulate the required evolution towards a strategic orientation within the small firm—indeed some have argued that such a crisis is often necessary for entrepreneurs to realise the importance and benefits accruing to the organisation from strategic management techniques.

Finally, it is always important to recognise that in studying management practice in small firms, the role of the entrepreneur is critical.[7] The entrepreneur's personal goals, characteristics and strategic awareness will all significantly impact on the development of the business. Previous studies have already shown that whether or not an effective strategy development process is implemented will be heavily influenced by the firm's owner-manager and that the ability to comprehend and make appropriate use of sophisticated strategic management practices is a function of the entrepreneur's previous experience.[8] Evidence arising from research by Schuman *et al.* (1985)[9] lends support to this view; entrepreneurs who had prepared a business plan prior to business start-up were more likely than those who had not to go through the major strategic planning steps once the company was operating, including: the testing of assumptions upon which strategies were based; competitive analysis; planning the allocation of resources; and the institution of procedures for control and co-ordination within the firm. Carland *et al.* (1989)[10] have usefully summarised the role of the entrepreneur in the following statement:

> "The individual responsible for planning in a small firm is the owner-manager. If that individual is not predisposed to planning, this activity will not take place ... personality will play a key role in that predisposition."

This raises important questions on the role of the technical entrepreneur in initiating strategic planning within small high tech firms, where top management are often heavily biased towards technical disciplines such as science and engineering rather than to areas of marketing and general business management expertise. Although the technical entrepreneur has not been studied extensively,[11] the significance of an "incubator organisation", that is, the organisation which the founder leaves to establish his new venture, is recognised by some authors as an important factor in the formation and nature of new technology-based small firms.[12] The founder typically starts his new firm to exploit that which he knows best and a significantly large percentage of new companies serve the same general market or utilise the same general technology as the incubator organisation. This study will also consider whether or not such incubator organisations play an important part in heightening the technical entrepreneur's strategic awareness prior to business start-up given that this too will significantly impact upon the company's future success.

Objectives of Study

Previous research suggests several issues of significance that merit further investigation. The present study therefore sought to answer the following questions in an attempt to highlight important considerations for managers of small high tech firms.

- Do managers of small high tech firms employ strategic planning to guide and control the long term development of their business?
- If so, what is the nature of this strategic planning activity?
- What role does the technical entrepreneur play in this process?
- Is strategic planning important to the successful long term growth and development of small high tech firms?

Methodology

Based upon previous studies,[13] the following working definition of a small high tech firm was developed and employed throughout this research:

- the firm has an annual turnover of less than £50m and fewer than 250 employees;
- the firm is not a subsidiary of an established company; ownership is less than 25% by one or more companies not falling within the above two parameters except where investment is provided by public investment corporations, venture capital companies, or institutional investors;
- the firm has been established by an individual or group of individuals; it is administered in a personalised way; management is independent and free from outside control in taking principal decisions;
- the firm has a strong scientific-technical base and has been established for the purpose of exploiting an invention or technological innovation.

Previous studies have cited universities as an important example of the "incubator organisation" and as a determinant of technical entrepreneurship.[14] Furthermore, research has confirmed that a significant number of university spin-off companies are based within science parks and such locations therefore provide a population rich in small high tech firms.[15] This study thus focused upon the population of small high tech firms based on science parks throughout the UK and this was identified from a database compiled by the UK Science Park Association.

The research combined two methods. Throughout the study data were collected from the firm's managing director since he or she is the most appropriate source for gathering accurate data relating to strategic planning processes in a small business context.[16] First, some 487 firms were initially surveyed by means of a postal questionnaire and this yielded a 53% response rate (257 companies). Second, this survey was followed by a series of in-depth interviews with a statistically representative sample of 30 respondent companies identified by means of cluster and proportional stratified sampling techniques.

This complementary methodology built upon the relative strengths of each approach and provided a comprehensive means of capturing both the quantitative and qualitative data required.* The postal survey was largely designed to gather exploratory and descriptive data on the sample under study, while in-depth interviews enabled a detailed examination of the nature of planning activity in small high tech firms, the role of the technical entrepreneur in this process, and the part played by incubator organisations in heightening the entrepreneur's strategic awareness prior to business start-up.

Figures 1 and 2 provide a descriptive analysis of postal survey respondents in terms of company activity and turnover levels.

Do Managers of Small High Tech Firms Employ Strategic Planning to Guide and Control the Long Term Development of their Business?

The results of the postal survey are presented in Table 1. Thirty-one per cent of firms considered long term business planning (defined in the questionnaire as a planning horizon of three or more years) to be of no importance or of limited importance to the future success of the business; 27% believed it was "important"; while 42% regarded business planning as either very important or essential. Sixty-nine per cent of firms prepared a business plan every six months or every year, 14% every 2 to 3 years and 3% every 3 to 5 years. Some 13% of respondents claimed that a long term business plan was never prepared and a small proportion (1%) stated that this was only prepared as and when they were required to do so by an external funding body such as a venture capital company or bank. The most common reason given for preparation of the business plan was that of internal control purposes (49%), with a further 17% of respondents clai-

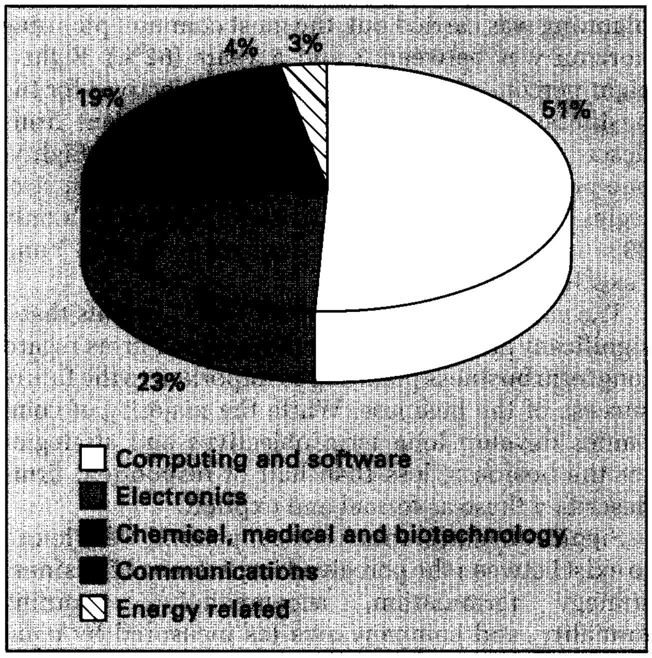

Figure 1. The companies' activities (% respondents)

*The findings were subjected to statistical analysis using the Spearman Rank-Order Correlation Coefficient (r_s) to measure the level of association between the variables under study. The significance of calculated r_s values under the null hypothesis (H_0) was tested by the **Z** statistic at a significance level of 0.05 (see the Appendix Table A1).

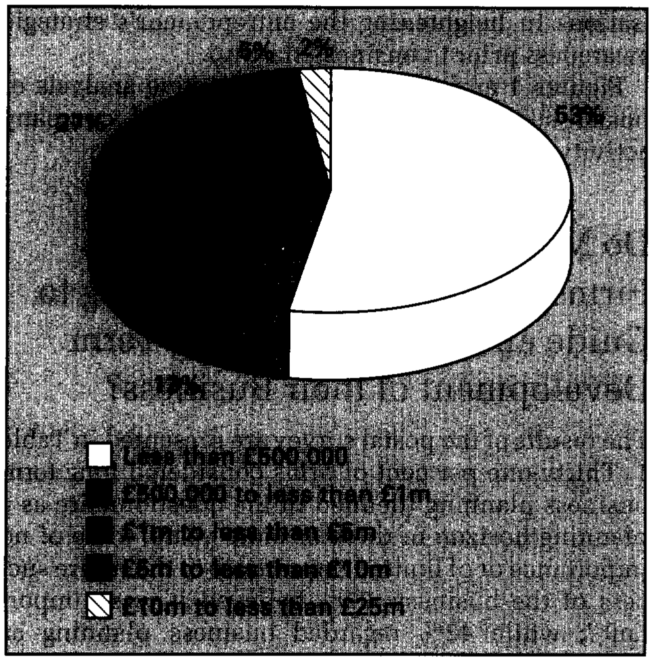

FIGURE 2. The companies' turnover (% respondents)

ming that the plan was prepared for reasons of both internal control purposes and external funding requirements.

Eighty-three percent of sampled companies carried out long term planning in relation to products and markets, with only 42% of firms describing this as a formal and explicit process. Where such long term planning was carried out, the most common planning horizon was between 3 and 5 years (62%). Eighty-eight percent of firms set long term objectives for the business; however, only 45% of respondent firms described these objectives as being "explicit". Eighty-one percent of companies developed long term strategies in relation to products and markets, with only 39% of firms stating that these were "formal" and "explicit" strategies.

The survey data presented in Table 1 reveals that a significant proportion of small high tech firms regard long term business planning as important to the future success of the business. While the majority of companies develop long term objectives and strategies for the business, less than half of respondent firms described these as formal and explicit.

Significant correlations (see Appendix) were found to exist between the perceived importance of business strategy formulation, accompanying planning formality, and company size (as measured by company turnover and number of employees) and this is consistent with the notion that different levels of strategic planning formality can be observed at different stages of growth in the small business. Notably,

TABLE 1. Postal survey results

How important is long term business planning (i.e. a planning horizon of 3 years or more) to the future success of your company?	% respondents
Of no importance	4.67
Of limited importance	26.66
Important	26.67
Very important	20.67
Essential	21.33
How often is a long term business plan prepared?	
Every 6 months	13.33
Every year	56.00
Every 2–3 years	14.00
Every 3–5 years	2.67
As required by external funding body	1.33
Never prepared	12.67
What is the main reason for the preparation of a business plan?	
Required by external funding body	21.33
Internal control purposes	48.67
Both internal control and for external funding bodies	17.33
Never prepared	12.67
Is long term planning carried out in relation to products and markets?	
Yes	83.33
No	16.67
Are these plans formal/explicit?	42.00
Are these plans informal/implicit?	41.33
What is the long term planning horizon of these plans?	
1–2 years	34.82
3–5 years	61.60
6–10 years	2.68
11–15 years	0.00
More than 15 years	0.90
Are long term objectives set for the business?	
Yes	88.00
No	12.00
Are these objectives formal/explicit?	44.67
Are these objectives informal/implicit?	43.33
Are long term strategies developed in relation to products and markets?	
Yes	80.67
No	19.33
Are these strategies formal/explicit?	38.67
Are these strategies informal/implicit?	42.00

while analysis suggests that the two parameters of company turnover and number of employees significantly impact on issues relating to business planning within the firm, the date of company founding does not appear to be an influential factor in this respect. Thus the size of the organisation is judged to be a more robust parameter in measuring the company's stage of growth, rather than that of age. This is consistent with the views of some authors who propose that small businesses do not develop through each growth stage over the same time scale.[17] Progression through each life cycle stage is likely to result from resource changes within the organisation that are required to support an expansion in business operations as sales grow within the firm's chosen markets and turnover increases.

Results suggest that during the firm's infancy business planning is not perceived to be of primary importance to the company; business plans are likely to be prepared infrequently and for the sole purpose of securing external funding. During later life cycle stages, the importance of developing long term objectives and strategies is increasingly emphasised. Planning becomes more formal and explicit as the business grows, and occurs on a regular basis reflecting management's perception that benefits will arise for the company in terms of internal control.

The results of the postal survey confirm that a large number of small high tech firms do employ some form of strategic planning to guide and control the long term development of the business. In order to gain a better understanding of the nature of this planning activity and the management phenomena underpinning this process, in-depth interviews were conducted with a statistically representative sample of 30 respondent companies.

What is the Nature of Strategic Planning in Small High Tech Firms?

As noted earlier, previous studies have identified the firm's managing director as the most appropriate source for gathering accurate data relating to strategic planning in a small business context. He or she is responsible for, and will dictate the nature of, the planning process in such firms.[18] Following in-depth interviews with 30 managing directors from respondent companies, it was possible to develop a typology of the firms involved in relation to their planning activity. Table 2 illustrates the four classifications which emerged from cross-case data analysis.

The typology developed represents a continuum of planning formality and sophistication within small high tech firms consistent with previous studies which have suggested that the type of planning employed in small firms evolves through various stages from its initial beginnings as basic financial planning through to externally-oriented planning and ultimately the employment of more formal strategic management techniques. This research has shown, however, that not all firms will progress through every stage of this continuum. The nature of planning activities carried out within the organisation will in part be determined by the size and growth stage of the business, but will also be influenced to a significant degree by the previous experience of the entrepreneur and the balance of skills apparent in the management team (see Table 2). Where technical skills predominate, either no long range planning (non planners) or only basic financial planning and budgeting systems (formal financial: non strategic planners) will be initiated within the firm and no strategic orientation will be evident. Explicit or implicit objective and strategy formulation were not judged to be important and the views of management regarding strategic planning processes are typically reflected in the following statements:

> "The benefit of not having [outside] shareholders is that we just go and do things."

> "It's too difficult to plan at all; we can't predict anything."

> "We prefer to be opportunistic, one of my colleagues describes it as the 'Ouija Board' style of management."

In contrast, where technical skills are balanced with those of general management in other functional areas, a strategic orientation will be apparent and strategic planning systems—whether formal or informal—will be implemented.

Where strategic planning was undertaken in the companies investigated, interviews confirmed that during the early stages of the small high tech firm's life, management are likely to rely on informal strategic planning techniques which stress on-going management discussions and the importance of the firm's flexibility in responding quickly to marketplace stimuli. Although the business plan in such firms is primarily financial in nature, the development of objectives and strategies in relation to products, markets and technologies is regarded as important to guide the long term development of the organisation. While in this group of companies (formal financial: informal strategic planners) objectives and strategies are not formally expressed in a written document, they are clearly known and communicated throughout the company. The following statements typically express the views of this group:

> "We don't actually have them written down, but the directors are involved in setting objectives and strategies. It's an informal process, with informal discussions between all of us."

> "[Strategy formulation is] a continuous process because we work as a close team ... we basically arrive at where we think the future lies and the directions we should drive in."

TABLE 2. Types of planning.

Types of planning	Planning characteristics	Characteristics of top management team
Non planners	No planning activities apparent; no objectives or strategies developed for either short or long term development of the company.	Top management all technically qualified with no previous general management experience gained in incubator organisation.
Formal financial: non strategic planners	Management stress importance of tight financial controls, the development of short to medium term (six to 18 months) financial goals and objectives, and the constant monitoring of financial performance through monthly management accounting systems; strategy formulation in relation to products and markets not judged to be important.	Top management dominated by technically qualified directors; directors may have had previous management experience within an incubator organisation prior to start-up but this was within a purely technical sphere with limited profit and budget responsibility.
Formal financial: informal strategic planners	Financial performance tightly controlled and monitored, long term financial objectives clearly specified over a two to five year planning horizon; also stressed the importance of informal strategic planning; objectives and strategies developed for the medium term future of the business (one to two years) in relation to products, markets and technologies; objectives and strategies not formalised in a written business plan but clearly communicated and known throughout the company; management stress on-going discussions as an important aspect in establishing how financial objectives to be achieved through product/market/technology developments.	Top management predominantly technically qualified but either (a) founding directors had previous general management experience within an incubator organisation prior to business start-up or (b) balance of skills in management team achieved through appointment of marketing and financial executive/non-executive directors at start-up.
Formal strategic planners	Stressed the importance of formal and explicit strategy formulation process; long term objectives and strategies developed in relation to products, markets and technologies over two to five year planning horizon; developed and reviewed on a six monthly or annual basis by a multi-disciplinary management team; formal written strategic plan produced.	Multi-disciplinary management team; wide range of general management experience gained within incubator organisations.

While the firm is in its infancy written business plans are prepared infrequently and for the sole purpose of securing external funding. More sophisticated strategic management techniques which involve formal strategic review sessions on a six monthly or annual basis and result in a written strategic plan (formal strategic planners) are likely to be apparent in small firms which have grown successfully through the early stages of their life cycle. In such cases strategic planning occurs on a regular basis reflecting management's perception that significant benefits will arise for the company in terms of both internal control and enhanced corporate performance. The words of one managing director encapsulates this process.

> "We have a twice a year strategy meeting with all branches of the company. Everything is included—marketing, management, R&D, which courses of action we should follow and how we should lead this company. It's a very thorough and formal exercise."

Informal planning in the companies studied does not imply that less planning is carried out and findings substantiate a number of previous studies[19] which suggest that the direction, goal and ultimate destiny of the firm can be enhanced by emphasising a customer orientation and employing the more substantive, analytical elements of the strategic management process (for example: scanning the environment; analysing competitive activity; assessing strengths and weaknesses; identifying and evaluating alternative courses of action; reviewing and revising plans).

Findings suggest that during early stages of the firm's life formalisation of strategic planning efforts through explicit written documentation is unnecessary in terms of enhancing corporate performance.

However, where simple strategic planning techniques are implemented, enhanced corporate performance was evident in comparison to those firms where no strategic planning occurred. Negative or zero growth in turnover was apparent in non planners and respondents in this group reported poor attainment of corporate and profit objectives. In contrast, where strategic planning is carried out in the firm, whether formal or informal, management were satisfied with turnover growth rates and attainment of corporate and profit objectives. Statistical analysis confirms that significant correlations exist between the presence of strategic planning processes, growth in turnover, and attainment of corporate and profit objectives (see Appendix).

Evidence from company interviews corroborates the view that planning sophistication in successful small high tech firms evolves as the business grows. In later life cycle stages, enhanced levels of corporate performance will be maintained where strategic planning systems become more formalised. This reflects a need within the business for more explicit methods of strategy formulation as the firm becomes organisationally more complex, functional specialisations become apparent, and communication channels lengthen, in order to ensure that objectives and strategies are effectively developed and clearly disseminated throughout the company.

What is the Role of the Technical Entrepreneur in the Strategic Planning Process?

It has been suggested that the corporate planning typology developed by this author represents a progression in terms of increased planning sophistication within the firm. However, it is conceded that not all firms will progress through every stage of this continuum. This is consistent with previous studies in this area which suggest that because there is no stereotyped entrepreneur, there can be no single pattern of growth in the small business.[20] These results reinforce the view that the entrepreneur plays a critical role in determining the strategic orientation and planning practices of the small business. A significant conclusion from this study is that the type of planning initiated within the firm will depend on the previous experience of the entrepreneur and whether or not a diversified management team is in place (see Table 2).

Where strategic planning processes are not initiated within the firm at its inception and no effort is made to balance the technical skills of the firm's management team with those of other functional areas such as marketing, companies are dominated by technologists who have not gained general management experience within an incubator organisation prior to business start-up. Typically, the orientation of such firms is inward-looking, business activities are primarily technology-driven, and marketing considerations are not given prominence in decision-making processes. The following comments characterise management's view in "non planners" and "formal financial: non strategic planners".

> "... from my experience we don't rate marketing research very high; we're the only guys that understand how we can use the technology ... it's driven by what we think [customers] require, it's our judgement of the market."

> "The essence of this company is R&D, that's what drives it; the philosophy is if we can make it we do, then we try and sell it."

In those companies where strategic planning systems do exist, two patterns of historical development are apparent. First, are those firms where the founding directors of the company perceive a need to balance the inherent technical skills of the management team through the appointment of non-technical directors at company start-up; or, alternatively, where the management team is dominated by technically-qualified directors, all gain general management experience prior to the launch of the company within an incubator organisation. Second, are those firms which are established by technical entrepreneurs with no previous management experience who perceive no need at company start-up to complement their expertise with business management skills. In these latter cases, no long range planning is carried out within the company during the early stages of the firm's life. Initially the company grows and survives successfully on the strength of technical skills alone and innovative technologies. However, during later stages of the firm's life cycle rapid, unplanned growth results in poor financial performance. Typically, new product technologies proliferate through R&D efforts which are unsuccessful within the company's existing markets. Uncontrolled R&D activities result in cost escalation, diminishing profits and severe liquidity problems. In such cases this crisis necessitates a re-financing of the business which results in changes to the management team imposed by external corporate stakeholders, usually venture capital companies or banks. Non-technical directors are appointed to the company's board of directors and formal strategic planning systems and controls are initiated within the firm. The following statements summarise events typical of these firms.

> "[The firm's] strategy and management has changed drastically because of the financial problems of the company. At the beginning it was very much developing a technology and trying to do something with it; it was a big mess; there was no sense of market orientation; the venture capital company moved in and insisted professional management people manage the company."

> "We had quite a change in our style; we were blasé about the whole thing; growth was so rapid the costs were out of control and we didn't realise it; we brought in a consultant and the end

result was our business plan; we've been forced to formalise our controls; we're far more in control of what's going on now and there's far more information available to us."

The strategic awareness of the technical entrepreneur is therefore important in determining the nature of planning activity carried out in the small high tech firm. Where the entrepreneur is unaware of the importance of initiating strategic decision-making processes in his business due to a lack of general management experience within in incubator organisation, the firm will be driven by technological considerations throughout each of its life cycle stages. While the business may survive and grow during the early stages of its life on the basis of the entrepreneur's technical expertise and his ability to generate innovative ideas, these technical skills alone will not be sufficient to sustain the business during later growth stages. As core technologies mature, as markets targeted initially by the firm become saturated, and as competitive pressures intensify, there is a need to balance technical skills with those of other functional areas and to develop a strategic orientation within the firm in order proactively to assess new market opportunities to guide and control the firm's R&D effort. Respondents describe this process in the following manner:

"The focus has changed from technology for technology's sake to technology that addresses the demands of the market."

"We were more research oriented when we started, but that was a short term issue, at the end of the day if you're not market-driven you can't survive."

"As the company has grown it has become increasingly important to talk to customers before commercialisation; it's been an evolutionary thing; it's [now] all part and parcel of selecting commercially successful products."

"As the company has grown we have had to basically formalise our goals and objectives; there has been much more formalisation of R&D plans and company objectives over the last two or three years."

"Engineers tend to go off and do the project that is most interesting in an engineering sense but not necessarily in a commercial sense; now [there is] a strategy session involving production, administration, sales, marketing and R&D people to develop the [business] plan."

Ultimately the entrepreneur's strategic awareness and his perception of the benefits arising from the initiation of a marketing orientation and simple strategic management systems within the firm—whether formal or informal—will be a significant determinant of the success and survival of the business in the long term. The strategic awareness of the technical entrepreneur will be heightened through exposure to strategic management techniques within an incubator organisation prior to inception of the business, or alternatively through contact with individuals who are aware of the benefits such processes may bring to the business. Significantly, therefore, in some small high tech firms, external corporate stakeholders exert considerable influence on the management style and practice of the technical entrepreneur. They are likely to have a substantially beneficial effect upon those firms whose management is dominated by technically-qualified entrepreneurs who have not gained general management experience and exposure to strategic management techniques within an incubator organisation. If at the company's inception, investment is provided from an external source such as a venture capital company, the firm is usually required to appoint a director to the firm who has recognised business skills. Thus the inherent technical skills of the company are balanced with those of, for example, marketing or finance. Similarly, the firm's management will be required to produce a business plan on a regular basis, and as a result the discipline of more formalised management systems and controls are imposed upon the company from inception of the business.

Is Strategic Planning Important to the Long Term Growth and Development of Small High Tech Firms?

As small high tech firms grow, they must adapt both organisationally and philosophically as their markets evolve and mature. Results of this research confirm that during early life cycle stages, the business tends to be driven by technological considerations and R&D capabilities. As the firm grows, as technologies mature and competitive rivalry intensifies, the small high tech company must begin an evolution from a primarily inward orientation at inception focusing upon technological possibilities generated through R&D efforts, towards an evolving outward orientation in later life cycle stages in which management increasingly devotes attention to customers, competitive activity and the market. In order to achieve this transformation, the small firm must develop a strategic orientation over its life cycle. The long term development of the business in later life cycle stages must be guided by a coherent growth strategy which has been formulated within the framework of identified environmental trends, competitive activity, market opportunities and the recognition of the existing skills, competencies and resource requirements of the firm. R&D policies and technological considerations must therefore be subsumed within a corporate strategy determined by the parameters of clearly delineated market opportunities. This strategic reorientation of the business necessitates a concurrent development in the strategic planning processes required to manage the company effectively. Strategic planning within successful small high tech firms becomes increasingly sophisticated, formal and explicit over the life cycle of the business. Where firms have not evolved towards a marketing orientation and the use of more sophisticated management techniques as the business has grown, rapid unplanned growth has resulted in the companies experiencing severe financial difficulties and the survival of the business has been threatened. Evidence from this research therefore supports the view that strategic planning is a distinctive feature of successful management practice in small high tech firms.

Implications for Management

The preceding research findings suggest six conclusions which have significant implications for managers of small high tech firms.

1. *Strategic planning is important to their long term growth and development.* Companies which employ strategic planning processes—whether formal or informal—exhibit enhanced corporate performance in relation to turnover growth and attainment of corporate and profit objectives when compared with those companies where no strategic planning is carried out.

2. *During the early stages of the company's life strategic planning does not need to be a highly formalised process.* Explicit written documentation to support planning efforts within the firm can be unnecessarily bureaucratic for some companies given the flexible and fluid communication channels apparent within the company. Management of successful small high tech firms do, however, stress the importance of on-going discussions in the development of implicit objectives and strategies to guide business activities while maintaining the firm's flexibility in responding quickly to marketplace stimuli. As the business grows and becomes organisationally more complex, there is a need for strategic planning to become more formalised and explicit to ensure effective communication of corporate objectives and strategies throughout the company. Formal strategic review sessions involving a multidisciplinary team must be implemented and these should take place on a regular basis to ensure that benefits arise for the company in terms of internal control and enhanced corporate performance.

3. *Whether formal or informal strategic planning is carried out, managers should emphasise the substantive analytical elements of the process,* namely: scanning the environment; analysing competitive activity; assessing strengths and weaknesses; identifying and evaluating alternative courses of action; reviewing and revising plans.

4. *Successful firms undergo a strategic transformation over their life cycle as the business and its core technologies mature.* Managers of these firms recognise that as the business matures it must progress from a primary focus upon technical innovativeness into more balanced operations which increasingly devote attention to marketing issues. Such a re-orientation within the small technology-based firm requires a concurrent development in the skills, techniques and processes required to manage the enterprise effectively. While the business will have been founded upon the technical competencies of the entrepreneur, these skills will need to be complemented by general management and marketing expertise in order to support the required transformation towards a market-led organisation in later life cycle stages. It is unlikely that the small high tech firm will evolve successfully from a technology-driven towards a market-led organisation unless a strategic orientation is developed and more sophisticated planning processes are implemented within the business. The required strategic reorientation of the business is unlikely to be achieved where management skills remain focused within narrow technical spheres and may often only occur as the result of a financial crisis within the firm which necessitates the implementation and formalisation of strategic management techniques in order to ensure the firm's survival in the long term.

5. *A key feature of successful firms is the quality of leadership provided by management* which infuses their organisation, culture and practices. The professional orientation and previous experience of company managers will significantly influence the type of planning activity adopted by the small high tech firm through their intrinsic involvement in decision-making processes. The presence of a diversified management team, where marketing and business skills complement technological skills, is an important factor in relation to the long term success of the company. While the business may survive and grow successfully during the early stages of its life on the basis of the entrepreneur's technical expertise and his ability to generate innovative ideas, these technical skills alone will not be sufficient to sustain the business in the long term. Where technological considerations dominate the leadership style and culture within firms throughout its later life cycle stages the long term growth and development prospects of the business are constrained and its survival threatened. The technical entrepreneur must therefore adapt philosophically and managerially

as the firm grows, as core technologies mature and as marketing imperatives become dominant.

6. *The technical entrepreneur's strategic awareness will determine the nature of planning used within the firm.* The strategic awareness of the entrepreneur will be heightened by exposure to strategic management techniques within another organisation prior to business start-up or alternatively through contact with individuals (for example external advisors or non-executive directors) who are aware of the benefits strategic planning may bring to the business. No strategic planning will be implemented in firms where the entrepreneur exhibits a lack of strategic awareness. In such cases the business will be driven by technological considerations throughout each of its life cycle stages and in the long term this will threaten the survival of the company.

Ultimately the key determinant of success in the small high tech firm will be the ability of the technical entrepreneur to develop long term growth strategies which match the technical innovativeness of the business with clearly delineated market opportunities. This will only be achieved through the development of a strategic orientation within the company, where R&D activities are controlled, directed and integrated with corporate strategy formulation through the implementation of effective strategic management procedures.

Concluding Observations

This research indicates that there are some useful lessons to be learned by technical entrepreneurs and policy makers alike about successful management practices in small high tech firms. While technical entrepreneurs may regard the key source of their competitive advantage as being the innovativeness of their technologies, it is equally important that they should adopt a strategic orientation and implement strategic planning procedures in order to achieve long term growth and development. While many government initiatives concentrate upon the provision of financial support to underpin R&D related activities, this focus on technology development ignores a number of key management issues which can affect the survival of such businesses. Entrepreneurs and policy-makers must recognise that as technologies mature, the competitive advantage initially won through innovative R&D cannot be maintained by merely increasing investment in R&D. Governments and practitioners must place equal weight on developing the general management and marketing skill-base of small high tech firms in order to ensure their continued effective contribution to economic regeneration, innovation and international competitiveness.

Appendix

Table A1. Spearman Rank-Order correlation coefficients and computed Z tests

Variables	r_s	Z	Accept/ reject H_0
Date company founded			
Importance of long term business planning	0.006	0.07	Accept
Reason for business plan preparation	−0.095	−1.16	Accept
Long term planning formal/explicit	−0.043	−0.53	Accept
Long term objectives set for the business	0.015	0.18	Accept
Long term objectives formal/explicit	−0.010	−0.12	Accept
Long term strategies developed	−0.029	−0.35	Accept
Long term strategies formal/explicit	−0.039	−0.48	Accept
Company turnover			
Importance of long term business planning	0.152	1.86	Reject
Reason for business plan preparation	−0.218	−2.66	Reject
Long term planning formal/explicit	−0.238	−2.91	Reject
Long term objectives set for the business	−0.193	−2.36	Reject
Long term objectives formal/explicit	−0.280	−3.42	Reject
Long term strategies developed	−0.199	−2.43	Reject
Long term strategies formal/explicit	−0.267	−3.26	Reject
Total number of employees			
Reason for business plan preparation	−0.138	−1.68	Reject
Long term objectives formal/explicit	−0.162	−1.98	Reject
Long term strategies formal/explicit	−0.143	−1.75	Reject

Table A1: continued

Variables	r_s	Z	Accept/ reject H_0
Importance of business planning			
Business plan prepared	−0.355	−4.33	Reject
Reason for business plan preparation	−0.255	−3.11	Reject
Long term objectives set for the business	−0.372	−4.54	Reject
Long term objectives formal/explicit	−0.438	−5.35	Reject
Long term strategies developed	−0.414	−5.05	Reject
Long term strategies formal/explicit	−0.474	−5.79	Reject
Strategic planning (formal or informal)			
Turnover growth	0.315	1.73	Reject
Attainment of corporate objectives	0.440	2.41	Reject
Attainment of profit objectives	0.508	2.78	Reject

Significance level of 0.05.
Critical value of $Z = 1.65$.

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