

Understanding Organizational Characteristics in UK SMEs ; The Factors And R&D

In Pyo Hwang*

〈 Contents 〉

1. Introduction
2. Research Approach
3. Theoretical Arguments and Constructions
4. Methodology for Empirical Test
5. Results and Discussion
6. Summary and Conclusions

1. Introduction

Economically the small and medium sized enterprises (SMEs) is an important asset within all economic areas including advanced industrial economies. Socially the SME fulfils a number of important functions in an industrial society by creating career opportunities (Deeks 1973; Keats and Bracker 1988). However they are occasionally held back by managerial and entrepreneurial limitations, in both innovation and ability. This may be because of inadequate appreciation and understanding of how the SME fits into the total economy and the consequent lack of systematic attempts to formulate any policies and practices relevant to the SME's needs.

* 광주여자대학교 경영정보학과(e-mail : iphwang@www.kwu.ac.kr)

Many SME owners are seeking and identifying sources to assist the successful management of their business (Davig 1986; Stoner 1987). One recommendation is that SMEs focus their efforts on any specific targets or niches that larger firms are likely to overlook or ignore (Broom and Longenecker 1971). SMEs are also advised to compete on the bases of customer and social service, product specialisation, and customisation, rather than price (Stegall et al. 1976; Dodge and Robbins 1992). Recent articles in the management literature suggest interestingly that an organisation will be more effective if certain factors are congruent or match each other (Covin 1991; Hoffman et al. 1992; Randolph et al. 1991). They highlights several variables that influence organisational performance in SMEs, which include a fit between strategy and technology (Covin et al. 1990), structure and technology (Hoffman et al. 1992; Randolph et al. 1991), and the environment, industry and strategy (Covin 1991).

This research is concerned with the strategies, leadership, organisational structure, and research & development in SMEs, which is focused on the state in UK manufacturing industry, specifically the precision equipment industry. The next section deals with the theoretical background which was used to identify measures and tools. Variable characteristics and reviews to enhance overall research efficiency are examined. In the empirical section, largely relationships between independent and dependent variables are shown. Implication for the future work and research limitations are explained in the section of the conclusions.

2. Research Approach

In the past few decades, many organisation studies have attempted to identify the relationships between a firm's environment, strategy, technology, structure, and performance. Researchers have attempted to define congruence and identify key interacting variables in the context of organisational effectiveness. Leavitt (1962) defines congruence in the context of fit or best match between key variables. He proposed four interacting variables that influence organisational effectiveness, i.e. technology, task, structure, and people. Randolph, Sapienza, and Randolph et al.

(1991) found out the effects of fit between technological innovation and organisation structure on SME financial performance.

So far, there have been quite diversified controversies to confirm these relationships, including that of Utterback and Abernathy (1975), Miles and Snow (1984), and Leavitt (1962) after Woodward (1965). Gerwin (1979) has especially explained that there are two main approaches to the study of organisational structure and technology. One is at the organisational level and the other is at the job level. His research shows that organisational level analysis starts with the major product or service offered while job level analysis starts with the tasks performed by individual employees. Lawrence and Lorsch (1967), Miller and Rice (1967), and Thompson (1967) have stressed the nature and intensity of technological interdependence among general activities as a critical determinant of organisation. Moreover, Hrebiniak (1974), Mohr (1971), and Van de Ven et al. (1976) have also reported significant correlations between interdependence and structural dimensions.

Hatton and Raymond (1994), in a research model for SMEs, state that the systems of congruence as organisational effectiveness is the most well enhanced if all variables of the organisation and its environment fit perfectly. In the study, they argued a firm is most effective if all six organisational variables, i.e. environment, strategy, task, technology, organisational design, and the individual, are simultaneously congruent. In the other hand, Miller and Toulouse identified that the top management personality in SMEs has very significant relationships with its strategy and organisational structure within firms (1986). Bamberger (1989) confirms the fundamental hypotheses on the relationships between the competitive conditions, strategies and objectives of the firms. Kim and Utterback (1983) has also examined an evolutionary pattern of relationships among technology, structure, environment and other contextual variables.

The purpose of this study is to investigate the state of SMEs in the UK, and furthermore, aimed at finding factors that affect any performance in such a viewpoint stated above. The study attempts to identify a relationship between managerial strategy and R&D activity as identified in the literature. This is achieved through an empirical study of firms that were judged as having produced any products or services with R&D activities. In order to obtain some key

findings, it tried out to address these issues by analysing firms within the same industry.

The key questions were considered as follows;

Firstly, SMEs have strategies which incorporate economic trends, financial conditions, corporate growth, community expectations, legislation changes, and management goals, etc. Secondly, SMEs always consider to introduce new products or services, and have any technology development plans, or use of outside co-operation. Thirdly, SMEs with a democratic leadership are more likely to be those firms with an R&D activities well than those with an autocratic leadership, and any relationship may exist between status of an organisational structure and developing a R&D activities.

3. Theoretical Arguments and Constructions

3.1 Organisation Management in SMEs

3.1.1 Managerial strategies.

Most researchers agree that the process of strategic planning and the content of strategic plans are very useful for SMEs (Bracker and Pearson 1986; Robinson 1982; Robinson et al. 1986). Robinson and Pearce (1983; 1984) suggest that although SMEs' strategic planning has been characterised as informal, unstructured, irregular, and uncomprehensive, a short-term, informal approach may be appropriate given the unique problems and situations facing SMEs. Their research shows a consistent, positive relationship between the extent of planning activities and the performance of SMEs (Robinson and Pearce 1983). Shrivastava and Souder (1987) also proposed a contingency framework for examining the strategic management of technology, and identified environmental and organisational variables that influence the management processes.

The socio-ecological environment of SMEs includes the neighbourhoods and communities in which the firm operates together with the culture, social modes,

and ethical value systems as well as the natural surroundings (Alexander 1983). Though the actions of a SME may have little effect on society, when all SMEs are grouped together, their impact is major (Steinhoff and Burgess 1993). SMEs, in particular, on behalf of own advantages beyond the limit of the size need to perceive itself as being invested in the community. Solving societal problems can enhance the image of the SME even if the effect of the efforts may not be measured directly in bottom line profits (Kuriloff et al. 1993).

For this study, these strategies were assessed in seven categories taken from a list suggested by Greiner and Metzger (1983). These strategic elements were examined in two ways; by simple statistical analysis for descriptive explanation, and by secondary statistical analysis to analyse influences between managerial strategy and R&D activities. The eight categories are as follows: *Consideration of economic trends*- The monitoring of economic trends can reveal a great deal to a firm with respect to its future production plans, realistic inventory levels and price changes. *Financial conditions*- No business would be competitive without an exact review of the financial status of the firm, its financial needs, and the inevitable financial conflict. *Corporate growth*- Every firm is different in its growth pattern and its vulnerability to new competition. *Public service*- A firm's relationship with its surrounding community is seen to be important in terms of environmental problems, living conditions, and revenue contributions.

Furthermore, *Competitors information*- Many firms ignore their competition when business is good so they do not put their own products within a framework of relative vulnerability. *Adaptation for legislation changes*- Every firm must be alert continually to regional or national regulations governing its business which may place new constraints on the way in which a firm does business. *Management goals*- A problem common to most strategic planning in a firm is the contradiction between management's stated goals and its actual performance. *Adequate labour force*- The labour size in management must be analysed carefully and regularly to be consistent with the firm's objectives.

Many firms consider a well aligned and implemented manufacturing strategy within their organisation to be characterised by a long-range plan, created in a formal planning process and communicated to all employees. This attempt enables

manufacturing decision making to be consistent with the business strategy, and whether these implementations are correlated with well aligned and implemented firm's objectives is another important empirical question.

3.1.2 Leader behaviour.

The leadership is sometimes considered to be an independent variable in strategy formulation and a moderating variable in the strategy implementation and performance linkage. The work of researchers such as Guth and Tagiuri (1965), Hambrick and Mason (1984), and Gupta and Govindarajan (1984) is belong to the examples. They approached their researches by linking leadership style to strategy, by considering the role of the leader on both formulation and implementation, and by identifying moderators of the impact of the leader's style on organisational outcomes.

According to Jago (1982), leadership is both a process and a property. Pearson and Davies (1981) propose that depending on the situation, the task and the person, differing amounts of direction and reinforcement is required, which inevitably means that different leadership styles are required. Tannenbaum and Schmidt (1973) explained the continuum or range of possible leader behaviour available to a manager with two leadership styles, i.e. boss-centred leadership and subordinate-centred leadership, which was defined by themselves.

Two major situational theories of leadership the most well published to date have been developed respectively by Fiedler (1967) and by House (1971) based on the earlier work of Evans (1970). This study, however, used that of House (1971) because it is, according to Szilagyi and Wallace (1983), especially supportive when investigating the interaction with the style of task compared with the Fiedler's theory. His initial research utilised the two dimensions of initiating structure and consideration as representative of the leader's behaviour, while the current framework includes the four dimensions: instrumental, supportive, participative, and achievement-oriented behaviour (House and Mitchell 1974).

The four dimensions used in this study are: *Instrumental behaviour* is the planning, organising, controlling, and co-ordinating of subordinate activities by the

leader. It is similar to the traditional dimension of initiating structure in that the leader's emphasis is on letting the subordinates know what is expected of them. *Participative behaviour* is characterised by the sharing of information and an emphasis on consultation with subordinates and use of their ideas and suggestions in reaching group-related decisions. *Achievement-oriented behaviour* is characterised by setting challenging goals, expecting subordinates to perform at the highest level, and continually seeking improvement in performance. *Supportive behaviour* includes giving support consideration to the needs of the subordinates, displaying concern for their well-being and welfare, and creating a friendly and pleasant environment.

Occasionally, leadership in studying SMEs plays a critical role in understanding group behaviours toward any goal attainment within the firms. A more accurate predictive capability between an organisation and its leadership style can be valuable in not only improving a group performance but also developing individual characteristics.

3.1.3 Organisational structure.

SME owners have to make a fundamental decision about whether they want their firm to remain at a size where they can control its operations easily, or whether they want the firm to grow beyond that stage (Greiner 1972).

Burns and Stalker (1961) discovered that managerial processes are different in various organisational traits and environments. They emphasise that type of organic system is more flexible and able to cope with and adjust to changes in the technological and the market situations, while rigidity of structure in the mechanistic organisation hinders its ability to adapt to change, thus, it is most appropriate to implement it in a more stable environment (Szilagyi and Wallace 1983). Schollhammer (1982) also identified that organisation structure with high degree of formalisation, such as mechanistic structure, interrupt corporate entrepreneurship because extensive descriptions of functional responsibilities for managerial positions discourage personal initiative and creative departures from approved norms. Greiner (1972) and Mintzberg (1978; 1979), arguing a fact that

organisations undergo structural change as they grow, developed a taxonomy of organisational structures. According to their suggestion, the transition between these stages depends on whether the firm started in a simple or complex environment, and involves entrepreneurial, bureaucratic, divisional, product group, and matrix structure.

The literature on structuring of organisation focuses on a number of mechanisms that organisations are able to use to design their structure (Bamberger 1989; Mintzberg 1980; Covin and Slevin 1988). Among the most commonly researched are the six listed below. *Centralisation* refers to the hierarchy of authority and decision making in the organisation. *Specialisation* concerns the number of tasks and the breath of each in a given position and the control over these tasks. *Formalisation* refers to the degree of codification specifying who is to do what, where, and when. *Controls* refer to the pattern used to manage the people who do work activities within organisation. *Adaptability* refers to the extent to which managerial principles making work can be changed to circumstances in business conditions. *Integration* refers to the structural devices designed to combine the workings of various subsystems to attain the common goals of the organisation.

In SMEs, organisational structure is typically informal, but highly centralised, which provides strength in decision-making and rapid implementation of decisions (Blili and Raymond 1993). This also enables more rapid application of changes in the organisation. Actually, it has been empirically confirmed that SMEs differ from larger firms in the organisational structure like in other matters such as maturity and environmental uncertainty (Raymond 1992).

3.1.4 R&D Activities in SMEs

Research and Development (R&D) has made significant contributions to the vitality of the SME community as well as the economy as a whole. Raymond et al. (1996), however, argue that there is no 'one best' strategy of technological change for SMEs. This is due to the inherent complexity and heterogeneity of the SME universe, and to the large number of factors that potentially affect the adoption of a new technology, or the progress of a technological development (Birnbaum 1985).

The manufacturing SMEs are sometimes faced with situations where the new opportunities offered by the fall in production thresholds due to economies of scale are offset by the desperate requirements of new technologies in relation to the level and complexity of intangible investments and the marketing of products on a customised basis (OECD 1992; Silverberg and Soete 1988). It especially is true of intangible investment, e.g. the management of intelligence, which combines the ability to obtain information through more or less obvious view of new technology, markets and competition, the ability to carry out R&D, and the training of human resources (Bannock 1980).

Chambers et al. (1985) suggest that the firm and R&D strategy must be coupled in such a way that both become more creative. Scott et al. (1996) indicate, in enhancing technology and skills in manufacturing SMEs, that the main barriers to access relate to the strategic perspectives with respect to the role of technology in the firm's future (Horwitch and Thietart 1987). Wilkinson (1987) argues two principles required for the management of R&D. Firstly, R&D should not be an isolated function planning and executing its own programme independent of other functions. Secondly, R&D should be contributing to the definition of the objective of all other functions. Raymond et al. (1996) emphasise the difficulty in clearly identifying an ideal strategy of technological change for manufacturing SMEs. They argue there are main determinants of the decision to adopt a new technology or proceed to a technological development, i.e. socio-economic pressures and the reaction of the firm to these pressures, their technological competencies and the technological culture.

Experienced researchers and practitioners suggest that identifying a single, all encompassing, measure of R&D activities is difficult (Rinholm and Boag 1987). Accordingly, this study are used several measures, too. The data has obtained through four areas, that is 1) results perception and satisfaction (Rinholm and Boag 1987), 2) new product development; R&D budget and manpower (Lee 1975; Rinholm and Boag 1987), 3) product development policy; long range plan; process/ex post evaluation (Rinholm and Boag 1987), and external co-operation (Dowling and McGee 1994), 4) overall recognition (Rinholm and Boag 1987; Dowling and McGee 1994).

There are further defined as follows: *Results perception* measures recognition of the success, impact, and importance of new product development activities, and, moreover, overall evaluation of total R&D activities. *Member's satisfaction* measures the degree of contentment over new product development controls. *New product development* refers to the degree of ingenious capability in developing new products. *R&D budget* means the level of funding available for new product development. *R&D manpower* refers to the number of workers employed in R&D activities in the organisation. *Product development incentive* formally outlines the drives or motives of new product development. *Process/ ex post evaluation* refers to the method and criteria used to proceed projects, and formally evaluate completed development efforts. *Long range plan* confirms the long-term direction of R&D activities. *External co-operation* means the actions used to encourage own R&D activities from outside.

Firms working with advanced technologies in areas where technology is evolving rapidly must be capable of seeing the future of technological developments they need. The financial ability and human resources, and so on of the SMEs, however, are often too small to do this or to establish its own on the range of external sourcing relationships in which large network firms are establishing.

4. Methodology for Empirical Test

4.1 Questionnaire Design

A questionnaire was designed and a pilot survey was carried out to refine and enhance its reliability. 100 manufacturing SMEs in UK were randomly selected to survey from a UK firm's directory (KOMPASS 1994). The questionnaire were sent to production managers by post, and a follow-up letter was sent to them two week after the first mailing. A total of 21 firms responded to the pilot survey. Several reviews with some academic staff and researcher were carried out to validate the questionnaire. They were focused on checking which variables were

irrelevant, duplicated, or obscure. As a result, two items were only indicated as being duplicated or obscure, and were deleted.

Managerial strategies

The eight dimensions of managerial strategies were selected, and measured. Respondents were asked to assess the extent of implementation to them on a five-point Likert scale (5=strongly agree .. 1=strongly disagree). The higher the index, the more strategic the SME's organisation management.

Leadership

This was measured with nine sub-items to confirm four types of leadership behaviours. Answers were recorded on a five-point Likert scale like in the managerial strategies. The higher the index, the more oriented towards any characteristic the SME's leader behaviour.

Organisational structure

A 7-point semantic differential scale was used, which measured organicity- that is, the extent to which organisations are structured in organic versus mechanistic manners. The respondents were asked to indicate on the scale, ranging from "low" (1) to "high" (7), the extent to which their firms are currently operating in relation to each of these measurement criteria. The higher the index, the more organic the SME's structure.

R&D activities

The four categories of R&D activities, which include perception & satisfaction, state, policy and overall evaluation, were measured along with some additional sub items. The respondents were asked to indicate on a 5-point Likert scale or a ten-point scale for results perception or satisfaction, and ratio or nominal scale for R&D state and policy, respectively. Each of the scores represents an amount of implementation, or output in the related activities

4.2 Sampling and Data Collection

After the pilot survey stated above, a five-page questionnaire was finally

prepared with the measures based on the related literature and was randomly sent to manufacturing SMEs within the UK precision industry (KOMPASS 1994) judged to employ fewer than 500 employees (Stanworth and Gray 1991). They were sent to 400 production managers. The production managers, all of whom were working in the manufacturing area at the time of the survey, were chosen, since they would be in a good position to judge the organisation management elements related to manufacturing SMEs.

The questionnaire contained items regarding managerial strategies, leadership, organisational structure, and R&D activities as explained in the theoretical background session. A covering letter explaining the purpose of the study and a self addressed and stamped envelope accompanied the questionnaire. Two weeks after this, a follow-up letter, the questionnaire, and a stamped return envelope was sent to the non-respondents.

Responses were received from 72 subjects, a response rate of above 18 percent. Out of this, 6 were not completed because the subjects had closed their jobs or selected wrong. Accordingly, a total of 87 questionnaires including those of the pilot survey available was useful to apply for an empirical analysis.

The average working career of the respondent was 24 years (s.d.=11.3) which ranged from 1 to 47 years. Also, the average number of staff in their firms was 103 (s.d.=104.5) which ranged from 4 to 500. The firms were all from the precision equipment industry including measuring, testing, and medical and surgical equipment etc.

4.3 Scale Reliability Analysis

The reliability of the survey results was evaluated using internal consistency which means the degree to which items in a set of measurement items are homogenous. It can be estimated using a reliability coefficient such as Cronbach's alpha, a commonly used indicator for assessing the reliability of measurement instruments (Peter 1979). The coefficient is computed for a scale based on a set of items or any its subset, and any satisfactory alpha value supports a view that the data are interpretable (Cronbach 1951). According to Nunnally (1967), Alpha values

of 0.60 or more indicate a reliable measurement instrument for the data to be used in the related research.

〈TABLE 1〉 Internal Consistency Analysis for Critical Factors

Factor	Original item numbers	Number of items	Items deleted (by number)	Alpha
Managerial Strategy	1-16	16	-	0.80
Leader Behaviour	17-28	12	-	0.87
Organisational Structure	29-34	6	-	0.70
R&D Activities	35-49	15	42, 45, 46	0.60

By using SAS an internal consistency analysis was performed separately for the items in each of the four critical factors. Table 1 reports the number of measurement items associated with the scale, and the reliability associated with the scale after any certain items is finally dropped. Reliability was increased as some items were deleted. Table 1 shows that the maximised reliability coefficients ranged from 0.60 to 0.87, indicating that some scales are more reliable than others.

This relatively high coefficient alpha value indicates a high degree of internal consistency of the instrument, and a high degree of internal consistency also supports the reliability of individual measures (Churchill 1979).

5. Results and Discussion

5.1 Managerial Strategies of SMEs

Respondents were asked to indicate the degree of implementation for each characteristic on managerial strategy. For each strategic characteristic, a mean response was computed and is given in Table 2, which shows the mean responses and the value differences between them. Mean scores for all the six characteristics exceed 3 except the monitoring of economic trends and the public service for the community.

〈TABLE 2〉 Managerial Strategies in SMEs

Item	Number	s.d.	Mean
Economic Trends	87	0.61	2.95
Financial Conditions	84	0.74	3.85
Corporate Growth	87	0.61	4.33
Community Expectations	87	0.71	2.78
Competitive Positions	87	0.87	3.53
Legislative Adaptation	87	0.83	3.60
Management Goals	87	0.86	3.75
Labour Force	86	0.79	3.60

Based on the mean ranking of the characteristics, it can be seen that “development of business and services” is considered as the most important strategic characteristic for them, while “public service for the community” regarded as a somewhat less important strategic characteristic by the SMEs. The keeping of financial conditions was the next most implemented strategic characteristic, and third was an establishment of management goals. The remaining four characteristics showed similar or relatively lower mean scores in each other. Having ability required against economic trends, and engaging in significant activities for community expectations revealed unexpectedly low scores in the SMEs’ strategic management.

In conclusion, it means that SMEs are sensitive to any change or action which can affect their profit and output within a short term like corporate growth and financial condition. They consider less important public service to the community, where their office, branch and plant are located and have been less competent in forecasting or judging the economic trends which need the more long-term insight or lots of experience, and occasionally much time.

5.2 Organisational Structure and Leadership of SMEs

5.2.1 Factor analysis of leadership for further analysis.

To determine the further research orientation, a principal components factor

analysis was performed to obtain the best linear combinations of the twelve leadership items. All the items were first factor analysed. Rotated factor loadings were examined assuming four numbers of factors for extraction based on the variable definitions reviewed in the conceptual framework. The results, unfortunately, showed no interpretable grouping of items. Deleting four items, all the remaining items could be reconsidered into the analysis.

The results showed considerable improvement over the previous attempt as critical meaningful patterns emerged. The meaning of each factor is achieved by collectively viewing these variables with a loading of 0.4 or more. Two factors with eigenvalues approximating to one or greater were extracted and rotated with varimax factor rotation. From this analysis, the factor matrices showed that they were unifactorial; that is, the items in the two measures formed a single factor, respectively.

Table 3 presents the factor analysis results. Examination of the content of the item loading of each factor was re-defined in the following names in order to apply to the further analysis, that is, autocratic leadership and democratic leadership, respectively.

<TABLE 3> Summary of Separate Factor Matrices for Each Construct

Construct	Item Loading Range	Eigenvalue	% Variance Explained by Factor 1
Autocratic Leadership	.59 to .85	2.30	58
Democratic Leadership	.73 to .83	2.52	63

The first factor constitutes the autocratic leadership construct since insisting on time keeping, assignment of responsibility by order, regular notification of requirement, and reprimand for lower performance contribute to this factor. It accounts for 58 percent of the variance. The next factor presents the democratic leadership. Encouraging of good judgement, concern for the personal welfare, friendliness and approachability to superiors, and favourable treatment over employees contribute to this factor. This factor explains 63 percent of the variance.

Accordingly, two of the dimensions, i.e. instrumental and participative behaviour

were combined with supportive and achievement-oriented behaviour, respectively. The two definitions finally used in this study are; autocratic leadership- is characterised by setting challenging goals, expecting employees to perform at the highest level, and continually seeking improvement in performance, democratic leadership- includes giving support consideration to the needs of the employees, displaying concern for their well-being and welfare, and creating a friendly and pleasant circumstance.

5.2.2 Organisational structure and leadership of SMEs.

Respondents indicated the extent of implementation of various leader behaviours in their organisations on a 5-point scale. Values based on mean responses indicate that in SMEs, a democratic leadership is the more usual leader behaviour style (=3.88). This means that owner or managers in SMEs are exerting more frequently democratic leadership on their management skills when making any critical decision for their firm's operation or something relevant to their employees.

Respondents, also, were asked to choose the closest characteristics with organisational structure being used within their firms. Each characteristic signified that the higher the index, the more organic the organisational structure. Data presented in Table 4 shows that 'centralisation' of six items is characterised as the most salient component in SMEs' organisational structure followed by 'adaptability' and 'specialisation', in order. From this analysis, it can be seen that most SMEs are strongly allowed the middle or line manager's individual styles to range from the formal to the informal, emphasised on adapting freely to changing circumstances rather than concern for past practice, and accepted defining on-job behaviour by the requirement and the individual's personality.

These results give some interesting implication compared to Raymond et al.'s (Blili and Raymond 1993; Raymond 1992) who defined SME's structure only as typically informal, but highly centralised, so more adaptable to any environmental changes.

〈TABLE 4〉 Organisational Structure and Leadership in SMEs

Variable/Item	Number	s.d.	Mean
Leader Behaviour			
Autocratic Leadership	86	0.74	3.45
Democratic Leadership	86	0.70	3.88
Organisational Structure*			
Centralisation	86	1.16	5.13
Specialisation	87	1.27	4.78
Formalisation	87	1.50	3.83
Controls	87	1.63	3.83
Adaptability	87	1.39	5.10
Integration	87	1.68	3.97

* Note that the lower the score the more centralised, non-specialised, formalised, controlled, non-adaptive, and integrated the characteristics, respectively.

5.3 R&D Activities of SMEs

The various major activities related R&D are presented in Table 5 and 6. The roughly problem areas mentioned were seven units. In fact, these might be the most basic and critical problems in the R&D activities of manufacturing SMEs, who wish to remain as going concern and survive in the competitive world.

Respondents answered that most new product development programs their firms carried on were relatively successful during the past five year (=3.28) while, in contrast, the process of controlling new product development over the same years has been a bit less satisfactory (=2.73). The results also show that a higher priority is never given to R&D activities within SMEs compared to others such as marketing, production etc. while they think that new technological developments have an impact on the growth of their firms, and new production methodologies assure better products and processes for their firms.

Respondents were asked to comment on questions concerning the number of new product by their own endeavours or the result of technology transfer from outside institutions over the past five years, respectively and furthermore, budget and manpower related to R&D activities. For each question, a mean response was computed and is given in Table 5. The Table shows that the development of new

product accomplished seven and three, respectively by own efforts or technology transfer on the average during the past five years by own efforts or technology transfer.

〈TABLE 5〉 State of R&D Activities in SMEs

Item	Number	s.d.	Mean
Perception/Satisfaction ^a			
Success of New Product Development	83	0.97	3.28
Control of Product Development Process	82	1.01	2.73
Priority of R&D Sector	83	0.94	2.78
Impact of Technological Development	84	0.94	3.85
Effect of New Production methodology	83	0.92	3.76
Development of New Product			
By Own Efforts	76	5.68	7.16
By Technology Transfer	48	3.02	2.94
R&D Budget			
% of Turnover	43	7.15	7.34
R&D Manpower	73	11.25	9.42
Overall Evaluation of R&D Activities ^b	80	2.21	5.43

^aAnswers on 5 point Likert scales, but ^b on a ten-point scale

It also indicates that nearly seven percentage of turnover on business has fed back into reinvestment for R&D activities, and about nine staffs on the average are employed for R&D activities in a SME. These values, however, showed big differences according to each firm which responded to the questions. Finally, the overall evaluation of R&D which was asked to mark on a ten-point scale what extent each respondent would evaluate the R&D activities of their firm in general showed almost a middle level (=5.43) which means the R&D related activities in SMEs are never activated so much as we expected.

Table 6 displays that in the question whether a firm has a significant technology development plan for the future, most respondents showed the positive responses (71.8 percent) while 28.2 percent only answered 'no'.

〈TABLE 6〉 R&D Plan and Co-operation in SMEs

Item	Frequency	Cumulative Frequency	Percent
Technology Development Plans			
Yes	56	56	71.8
No	22	78	28.2
Use of Outside Co-operation			
Yes	51	51	65.4
No	27	78	34.6

Secondly, 65.4 percent of respondents indicated to use R&D co-operation from outside compared to 34.6 percent marked on the negative answer. Here, outside co-operation means that a firm uses co-operative R&D arrangement such as externally sub-contracted R&D, joint R&D ventures, co-operative R&D with suppliers or customers, etc. Consequently, SMEs acknowledge the need for outside co-operation as a way of solving a series of management difficulties related to R&D activities within their firms.

These indicate that most SMEs have simultaneously taken own efforts and outside assistance for improving their R&D endeavours or performance. Both inside development and outside supporting facilities are all important for manufacturing SMEs so as to overcome a shortage of resources, finance and professional experience they currently have.

5.4 Relationships between Organisation Management and R&D Activities

Table 7 shows that management goals, labour force, and financial conditions correlate significantly with the perception of the success of new product development, the satisfaction of the process of new product development, and overall evaluation of R&D activities. There is no doubt that R&D activities in SMEs have integral relationships with numerous aspects of strategies.

The results are indicated that the effect recognition of the new production methodology relates also to the labour force, competitive positions, and

<TABLE 7> Pearson Correlations between Managerial Strategy and R&D Activities

Item	Perception/Satisfaction					State of Activities				Overall Evaluation of R&D Activities
	Success of NPD	Control of PDP	Priority of R&D Sector	Impact of TD	Effect of NPM	NPD (I)	NPD (II)	R&D Budget	R&D Manpower	
Economic Trend	.15	.22*	.06	.05	.10	.16	.05	.03	.29**	.27**
Financial Condition	.24**	.26**	-.03	.05	.17	-.06	-.09	-.04	-.04	.27**
Corporate Growth	.02	.12	-.09	.14	.11	-.09	.37***	.13	.16	.12
Community Expectation	.17	.25**	.09	.03	.14	.03	-.07	.01	.17	.15
Competitive Position	.18	.24**	.01	.16	.31***	-.00	.15	-.02	.15	.14
Legislative Adaptation	.15	.23**	.01	.03	.23**	-.01	-.06	.13	-.07	.14
Mgt Goal	.36***	.35***	-.12	-.03	.29***	.08	.19	.21	.09	.27**
Labour Force	.27***	.24**	.16	.12	.32***	.10	.07	.22	.11	.35***

* p<.10 ** p<.05 *** p<.01

NPD; New Product Development, PDP; Product Development Process, TD; Technological Development

NPM; New Production Methodology

management goal in the firms. Besides, the relationships between new product development by technology transfer and corporate growth, R&D manpower and economic trends respectively are very significant in SMEs is shown from Table 7.

A review of bivariate correlations for the leadership, organisational structure and R&D activities was conducted as a relationship analysis. Pearson correlations between pairs of the leadership or organisational structure and R&D activities are displayed in Table 8. The perception of success of new product development, of process of its control, and also, of effect of new production methodology exhibited significant correlations with the both leadership styles, suggesting that a well considered and implemented leadership can contribute to the work of a firm's R&D

activities since the better levels of leadership may induce more productive behaviours between inside staffs, professionals or other outside institutions. None of the remaining variables exhibit any significant correlations between the two leadership styles and R&D activities. However, this does not mean that leader behaviours is never important to the other R&D activities in manufacturing SMEs but, unfortunately, our results only do not support this explanation.

〈TABLE 8〉 Pearson Correlations between Leadership, Structure, and R&D Activities

Variable/Item	Perception/Satisfaction					State of Activities				Overall Evaluation of R&D Activities
	Success of NPD	Control of PDP	Priority of R&D Sector	Impact of TD	Effect of NPM	NPD (I)	NPD (II)	R&D Budget	R&D Manpower	
Leader Behaviour										
Autocratic Leadership	.22*	.33***	.01	-.03	.33***	.02	.12	.07	.06	.18
Democratic Leadership	.35***	.29***	.03	.09	.38***	-.10	.15	-.02	-.12	.13
Organisational Structure										
Centralisation	-.27**	-.25**	.04	.18	.08	.00	.07	-.07	.16	.14
Specialisation	.08	-.17	-.07	-.10	.09	-.20*	.04	-.09	-.11	.14
Formalisation	-.09	-.14	.00	-.09	-.05	-.16	.05	-.13	.00	.08
Controls	-.19*	-.22**	-.02	-.08	-.27*	-.07	-.08	-.01	-.07	.04
Adaptability	-.05	-.16	-.14	-.02	.04	-.08	-.04	-.09	-.04	.17
Integration	-.18	-.15	.19*	-.03	.04	-.05	-.12	-.27*	-.17	.06

* p<.10 ** p<.05 *** p<.01

NPD; New Product Development, PDP; Product Development Process, TD; Technological Development

NPM; New Production Methodology

Table 8, also, explains the relevance of certain organisational structures in R&D activities of SMEs. To test how components of organisational structure correlates with various R&D activities in a firm, overall relationships were analysed. The significant correlations as a result were largely observed in the use of controls, centralisation, and integration in the characteristics of organisational structure. However, they have all shown negative relationships except that between integration and priority of R&D sector. The relationships between success of new product development or its control process and centralisation or controls which is being shown another relationship with effect of new production methodology mean that strong allowance of managers' individual styles to range freely from the formal to the informal or loose, informal control with dependence on informal relationships and co-operation are likely to affect negative effects against reception or satisfaction of various R&D activities in SMEs. There are significant a positive correlation between priority of R&D sector and integration.

That means that strong emphasis on allowing independent working within functions such as R&D, markets, productions etc. can be affected more positive effects to make even more increasing R&D support. Finally, the results showed that the numbers of new product development and R&D budget can be received any negative influences as having strong acceptance on defining on-job behaviour by the requirement and the individual's personality, and strong stress on allowing independent working by individual units unlike in 'priority of R&D sector', respectively.

6. Summary and Conclusions

The managerial strategy seems to have very significant relationships with selected elements of R&D activities. Leadership or organisational structure also were associated with such R&D activities as a main effect itself or a role of moderating variable between managerial strategies and R&D sector. Given the very exploratory nature of this study, we were a little surprised that the relationships were quite strong, especially since leadership and organisational

structure hitherto have been few considered in the researches on managerial strategy and R&D activity. No doubt our studying small and medium sized organisations had a good deal to do with the exploratory power of the findings. As Table 3 and 6 suggest, the relationships might be so meaningful in manufacturing SMEs facing strategic, directive, and structural environments relevant to any R&D activities.

The principal findings for each analysis can now be summarised. The development of business and services analysed as the most important strategic characteristic for SMEs while public service for the community regarded as a somewhat less important strategic characteristic by them. The results showed, furthermore, that management goals, labour force and financial conditions correlate significantly with the perception or satisfaction of the success of new product development, its process, and overall evaluation of R&D activities. A relationship between new product development and corporate growth, or between R&D manpower and economic trends, also, was strong. Values based on mean responses indicated that in manufacturing SMEs within the UK precision industry, a democratic leadership is the more usual leader behaviour compared to an autocratic leadership style.

Data analysed showed that in the characteristics of organisational structure, decentralisation is carrying on as the most interesting component followed by adaptability and specialisation in order. The use of controls, centralisation, and integration revealed also significant correlations with various R&D activities, but all the negative relationships. Another result indicated that too much specialisation which means having strong acceptance on defining on-job behaviour by the requirement and the individual's personality can give any negative influence for the numbers of new product development.

Respondents answered that most their new product development programs during the past five years were relatively successful, while the process of controlling new product development over the same years has been somewhat less satisfactory. The results are also shown that a higher priority is never given to R&D activities in their firms compared to others such as marketing, production etc. while they think that new technological developments have an impact on the growth of their firms, and new production methodologies assure better products

and processes for their firms. In a question whether a firm has a significant technology development plan for the future, most respondents showed the positive responses, but also wanted to use R&D co-operation from outside for it. Finally, the overall evaluation of R&D which was asked to evaluate own activities in general revealed also that R&D activities in SMEs are never activated so much as we expected as showing almost a middle level on the average.

This study might be useful for subsequent researchers to begin to study organisations over time in order to establish the relative importance of each managerial strategy, leadership, organisational structure, and R&D activities in manufacturing SMEs, and furthermore, the causal relations between not only managerial strategy and R&D activities but also them on two levels of leadership or structural style, respectively as a moderating variable. This might help identify the applicability and the appropriateness of the technology development and the strategic choice of organisation management in SMEs. It is true that more mature organisations look for managerial strategies which can match the leadership and the organisational structures needed for their R&D activities in firm.

Finally, because perceptual measures were used to gauge managerial strategy, leader behaviour, organisational structure, and some of R&D performance, common method variance remains a possibility for these classes of variables. Attempts to replicate these findings might therefore benefit from using archival data and more objective measures of R&D performance, and obtaining responses on managerial strategy, leader behaviour, and organisational structure from multiple members of an organisation.

References

1. Alexander, M. J., *Business Strategy and Policy*, Atlanta: University Publications, 1983.
2. Bamberger, I., "Developing Competitive Advantage in Small and Medium-size Firms," *Long Range Planning*, Vol. 22, No. 5, 1989, pp. 80-88.
3. Bannock, G., *The Economics of Small Firms*, Oxford: Basil Blackwell, 1980.
4. Birnbaum, P. H., "Political Strategies of Regulated Organisations as Functions of Context and Fear," *Strategic Management Journal*, Vol. 6, 1985, pp. 135-150.
5. Blili, S. and Raymond, L., "Information Technology: Threats and Opportunities for Small and Medium Sized Enterprises," *Int'l J. of Information Management*, Vol. 13, 1993, pp. 439-448.
6. Bracker, J. S. and Pearson, J. N., "Planning and Financial Performance of Small, Mature Firms," *Strategic Management Journal*, Vol. 7, 1986, pp. 503-522.
7. Broom, H. N. and Longenecker, J. G., *Small Business Management*, Cincinnati: South-Western, 1971.
8. Burns, T. and Stalker, G. M., *The Management of Innovation*, London: Tavistock, 1961.
9. Chambers, J. C., Emerald, R. L. and Rubenstein, A., "Coupling Corporate Strategy and R&D Planning," *Managerial Planning*, Vol. 33, No. 6, 1985, pp. 35-49.
10. Churchill, G. A., "A Paradigm for Developing Better Measures of Marketing Constructs," *J. of Marketing Res.*, Vol. 16, 1979, pp. 64-73.
11. Covin, J. G., "Entrepreneurial versus Conservative Firms: A Comparison of Strategies and Performance," *Journal of Management Studies*, Vol. 28, No. 5, 1991, pp. 439-462.
12. Covin, J. G. and Slevin, D. P., "The influence of organisation structure on the utility of an Entrepreneurial top management style," *Journal of Management Studies*, Vol. 25, No. 3, 1988, pp. 216-234.
13. Covin, J. G., Prescott, J. E. and Slevin, D. P., "The Effects of Technological Sophistication on Strategic Profiles, Structure and Firm Performance," *Journal of Management Studies*, Vol. 27, No. 5, 1990, pp. 485-510.
14. Cronbach, L. J., "Coefficient Alpha and the Internal Structure of Tests,"

- Psychometrika*, Vol. 16, 1951, pp. 297-334.
15. Davig, W., "Business Strategies in Smaller Manufacturing Firms," *Journal of Small Business Management*, January, 1986, pp. 38-46.
 16. Deeks, J., "The Small Firm- Asset or Liability," *Journal of Management Studies*, February, 1973, pp. 25-47.
 17. Dodge, H. R. and Robbins, J. E., "An Empirical Investigation of the Organisational Life Cycle Model for Small Business Development and Survival," *Journal of Small Business Management*, January, 1992, pp. 27-37.
 18. Dowling, M. J. and McGee, J. E., "Business and Technology Strategies and New Venture Performance: A Study of the Telecommunications Equipment Industry," *Management Science*, Vol. 40, No. 12, 1994, pp. 1663-1677.
 19. Evans, M. C., "The Effects of Supervisory Behaviour on the Path-Goal Relationship," *Organisational Behaviour in Human performance*, May, 1970, pp. 277-298.
 20. Fielder, F. F., *A Theory of Leadership Effectiveness*, New York: McGraw-Hill, 1967.
 21. Gerwin, D., "Relationships between Structure and Technology at the Organisational and Job Levels," *Journal of Management Studies*, February, 1979, pp. 70-79.
 22. Greiner, L. E., "Evolution and Revolution as Organisations Grow," *Harvard Business Review*, Vol. 50, No. 4, 1972, pp. 37-46.
 23. Greiner, L. E. and Metzger, R. O., *Consulting to Management*, Englewood Cliffs, N.J.: Prentice-Hall, 1983.
 24. Gupta, A. K. and Govindarajan, V., "Business Unit Strategy, Managerial Characteristics, and Business Unit Effectiveness at Strategy Implementation," *Acad. of Management Journal*, Vol. 27, 1984, pp. 25-41.
 25. Guth, W.D. and Tagiuri, R., "Personal Values and Corporate Strategy," *Harvard Business Review*, Vol. 43, 1965, pp. 123-132.
 26. Hambrick, D. C. and Mason, P. A., "Upper Echelon: The Organisation as a Reflection of Its Top Management," *Acad. of Management Rev.*, Vol. 9, 1984, pp. 193-206.
 27. Hatton, L. and Raymond, B., "Developing Small Business Effectiveness in the Context of Congruence," *Journal of Small Business Management*, Vol. 32, No. 3, 1994, pp. 76-89.
 28. Hoffman, J. J., Cullen, J. B., Cartr, J. B. and Hofacker, C. F., "Alternative Methods for Measuring Organisation Fit: Technology, Structure, and Performance," *Journal*

- of Management*, Vol. 18, No. 1, 1992, pp. 45-57.
29. Horwitch, M. and Thietart, R. A., "The Effect of Business Interdependencies on Product R&D-intensive Business Performance," *Management Science*, Vol. 33, No. 2, 1987, pp. 178-197.
 30. House, R. J., "A Path-Goal Theory of Leader Effectiveness," *Admin. Science. Quart.*, September, 1971, pp. 321-332.
 31. House, R. J. and Mitchell, T. R., "Path-Goal Theory of Leadership," *Journal. of Contemporary Business*, Autumn, 1974, pp. 81-98.
 32. Hrebiniak, L. G., "Job Technology, Supervision, and Work Group Studies," *Admin. Sci. Quart.*, Vol. 19, No. 3, 1974, pp. 395-410.
 33. Jago, A. G., "Leadership: Perspectives in Theory and Research," *Management Science.*, Vol. 28, No. 3, 1982, pp. 315-336.
 34. Keats, B. W. and Bracker, J. S., "Toward a Theory of Small Firm Performance: A Conceptual Model," *Amer. Journal of Small Business*, Spring, 1988, pp. 41-58.
 35. Kim, L. S. and Utterback, J.M., "The Evolution of Organisational Structure and Technology in a Developing Country," *Management Science*, Vol. 29, No. 10, 1983, pp. 1185-1197.
 36. KOMPASS, *Products and Services*, East Grinstead: Reed Information Services, 1994.
 37. Kuriloff, A. H., Hemphill, J. M., Jr. and Cloud, D., *Starting and Managing the Small Business*, Singapore: McGraw-Hill, 1993.
 38. Lawrence, P. R. and Lorsch, J. W., *Organisation and Environment: Managing Differentiation and Integration*, Homewood: Irwin, 1967.
 39. Leavitt, H. J., "Unhuman Organisation," *Harvard Business Review*, Jul.-Aug., 1962, pp. 90-98.
 40. Lee, J. J., *Contract Research and Its Utilisation in a Developing Country: An Analysis of Factors Influencing the Transfer of Industrial Technology from Korea Institute of Science and Technology (KIST) to Its Clients*, Ph. D. Thesis, Northwestern University, 1975.
 41. Miles, R. E. and Snow, C. C., "Fit, Failure and the Hall of Fame," *California Management Rev.*, Vol. 26, No. 3, 1984, p. 10.
 42. Miller, D. and Toulouse, J. M., "Chief Executive Personality and Corporate Strategy and Structure in Small Firms," *Management Science*, Vol. 32, No. 1, 1986, pp. 1389-1409.

43. Miller, E. J. and Rice, A. K., *Systems of Organisation*, London: Tavistock,, 1967.
44. Mintzberg, H., "Strategy Making in Three Modes," *Acad. of Management Rev.*, Vol. 6, 1978, pp. 44-58.
45. Mintzberg, H., "Structure in 5's: A synthesis of the research on organisation design," *Management Science*, Vol. 26, No. 3, 1980, pp. 322-341.
46. Mintzberg, H., *The Structuring of Organisations*, Englewood Cliffs: Prentice-Hall, 1979.
47. Mohr, L. B., "Organisational Technology and Organisational Structure," *Admin. Sci. Quart.*, Vol. 16, No. 4, 1971, pp. 444-459.
48. Nunnally, J., *Psychometric Theory*, New York: McGraw-Hill, 1967.
49. OECD, *Technology and the Economy: The Key Relationships*, Paris: Publication Service, 1992.
50. Pearson, A. W. and Davies, G. B., "Leadership Styles and Planning and Monitoring Techniques in R&D," *R&D Management*, Vol. 11, No. 3, 1981, pp. 111-116.
51. Peter, J. P., "Reliability: A Review of Psychometric Basics and Recent Marketing Practices," *Journal of Marketing Res.*, Vol. 16, 1979, pp. 6-17.
52. Randolph, A. W., Sapienza, H. J. and Watson, M. A., "Technology-structure Fit and Performance in Small Businesses: An Examination of the Moderating Effects of Organisational States," *Entrepreneurship Theory and Practice*, Fall, 1991, pp. 27-41.
53. Raymond, L., "Computerisation as a Factor in the Development of Young Entrepreneurs," *Int'l Small Business Journal*, Vol. 11, No. 1, 1992, pp. 23-34.
54. Raymond, L., Julien, P. A., Carriere, J. B. and Lachance, R., "Managing Technological Change in Manufacturing SMEs: A Multiple Case Analysis," *Int. Journal of Technology Management*, Vol. 11, No. 3/4, 1996, pp. 270-285.
55. Rinholm, B. L. and Boag, D. A., "Controlling New Product Development in the Small Technology-based Firm," *Amer. Journal of Small Business*, Summer, 1987, pp. 37-49.
56. Robinson, R. B., Jr., "The Importance of 'Outsiders' in Small Firm Planning and Performance," *Acad. of Management Journal*, Vol. 25, No. 1, 1982, pp. 80-93.
57. Robinson, R. B., Jr. and Pearce, J. A., "Research Thrusts in Small Firm Strategic Planning," *Acad. of Management Rev.*, Vol. 9, 1984, pp. 128-137.
58. Robinson, R. B., Jr. and Pearce, J. A., "The Impact of Formalised Strategic Planning on Financial Performance in Small Organisations," *Strategic Management*

- Journal*, Vol. 4, 1983, pp. 197-207.
59. Robinson, R. B., Jr., Salem, M. Y., Logan, J. E. and Pearce, J. A., "Planning Activities Related to Independent Retail Firm Performance," *Amer. Journal of Small Business*, Vol. 11, No. 1, 1986, pp. 19-26.
 60. Schollhammer, H., Internal Corporate Entrepreneurship, In Kent, C. A., Sexon, D. L. and Vesper, K.H.(eds.), *Encyclopedia of Entrepreneurship*, Englewood Cliffs: Prentice-Hall, 1982.
 61. Scott, P., Jones, B., Bramley, A. and Bolton, B., "Enhancing Technology and Skills in Small-and Medium-sized Manufacturing Firms: Problems and Prospects," *Int'l Small Business Journal*, Vol. 14, No. 3, 1996, pp. 85-99.
 62. Shrivastava, P. and Souder, W.E., "The Strategic Management of Technological Innovations: A Review and a Model," *Journal of Management Studies*, Vol. 24, No. 1, 1987, pp. 25-41.
 63. Silverberg, G. and Soete, L., *Technical Change and Economic Theory*, London: Pinter Publishers, 1988.
 64. Stanworth, J. and Gray, C.(eds.), *Bolton 20 Years On: The Small Firm in the 1990s*, London: Paul Chapman, 1991.
 65. Stegall, D. P., Steinmetz, L. L. and Kline, J. B., *Managing the Small Business*, Homewood: Irwin, 1976.
 66. Steinhoff, D. and Burgess, J. F., *Small Business Management Fundamentals*, Singapore: McGraw-Hill, 1993.
 67. Stoner, C. R., "Distinctive Competence and Competitive Advantage," *Journal of Small Business Management*, April, 1987, pp. 33-39.
 68. Szilagyi, A. D. and Wallace, M. J., *Organisational Behaviour and performance (OBP)*, Glenview: Scott, Foresman & Co., 1983.
 69. Tannenbaum, R. and Schmidt, W. H., "How to Choose a Leadership Pattern," *Harvard Business Review*, May.-June., 1973, pp. 162-180.
 70. Thompson, J. D., *Organisations in Action*, New York: McGraw-Hill, 1967.
 71. Utterback, J. M. and Abernathy, W. J., "A Dynamic Model of Product and Process Innovation," *Omega*, Vol. 3, No. 6, 1975, pp. 639-656.
 72. Van De Ven, A. H., Delbecq, A. L. and Koenig, R., "Determinants of Co-ordination Modes within Organisations," *Amer. Sociological Rev.*, Vol. 41, No. 2, 1976, pp. 322-338.
 73. Wilkinson, A., "Corporate Strategy as a Source of Ideas," *R&D Management*, Vol.

17, No. 1, 1937, pp. 51-67.

74. Woodward, J., *Industrial Organisation: Theory and Practice*, London: Oxford University Press, 1965.