Abstract

We test whether demographic characteristics and team processes in top management teams predict the subsequent productivity and profitability of their companies in 42 UK manufacturing organisations. The results suggest that there are independent effects of both demographic characteristics and team processes. Team member mean educational level and team tenure both predict the subsequent productivity and profitability of the companies positively, while age diversity in the team is a negative predictor of company performance. Team processes (clarity of and commitment to objectives, participation, task orientation, and support for innovation) predict (positively) company performance. Only mean educational level, of the demographic variables, also predicts team processes, suggesting that the effects of demographic variables on company performance are not strongly mediated by team processes. The implications of these findings for the composition and development of top management teams are discussed.

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The Effectiveness of Top Management Groups in Manufacturing Organisations

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Introduction

How do the characteristics and processes of top management teams affect the performance of their organisations? A number of researchers have sought to answer this question from the orientation of upper echelons of theory (Hambrick and Mason, 1984). This proposes that the organisation is a reflection of its top executives and that the characteristics of these executives will have more influence upon the outcomes of the organisation than will the characteristics of the chief executive officer alone. The theory suggests that the top management team will have a considerable influence upon organisational outcomes, because of the decisional latitude and decision responsibility of its senior executives. Moreover, the theory proposes that the experiences and values of those senior top team members influence their decisions and their thinking, which in turn effect the outcomes of the organisation.

This theoretical orientation has led to a number of studies which have examined the relationships between top management team characteristics and organisational outcomes such as innovation (Bantel and Jackson, 1989; O'Reilly and Flatt, 1989), strategy and strategic change (Finkelstein and Hambrick, 1990; Michel and Hambrick, 1992; Grimm and Smith, 1991; Wiersema and Bantel, 1992), and organisational performance (O'Reilly and Flatt, 1989; Michel and Hambrick, 1992; Hambrick and D'Aveni, 1992; Smith *et al*, 1994). More recently the relationship between top team characteristics and firm competitive moves has been investigated (Hambrick, Cho and Chen, 1996).

The findings from these various studies have confirmed the importance of top team characteristics in relation to organisational outcomes, though the evidence is contradictory. Some evidence has suggested that young, short tenure, highly educated teams tend to promote innovation in their companies (Bantel and Jackson, 1989; O'Reilly and Flatt, 1989). But organisational tenure of top team members is also associated with low levels of change (Finkelstein and Hambrick, 1990; Grimm and Smith, 1991; Wiersema and Bantel, 1992). The area of greatest contradiction is in the role of heterogeneity of top team member characteristics. Bantel and Jackson (1989) suggested that heterogeneity in functional and educational backgrounds was associated with innovativeness in the banks in which they conducted their study. Eisenhardt and Schoonhoven (1990) found that top team heterogeneity in industry tenure was associated with higher growth rates.

The underlying argument for these heterogeneity effects derives from early (much neglected) research by Hoffman and Maier (1961) who suggested that diversity of background and orientation would lead to breadth of perspectives, a wealth of cognitive resources and overall problem-solving capacity in teams. However, in other research by O'Reilly and Flatt, heterogeneity has been associated with low levels of innovation. Here it is argued that the conflicting perspectives and orientations, consequent upon heterogeneity and the diverse background of team members, will lead to conflict in perspectives, gulfs, and schisms. This in turn will lead to wasted effort spent on managing conflict and create a need for control systems to ensure co-incidence of purpose among members of the top team.

The development of the upper echelons orientation in the study of top management teams, has been enriched by the work of Smith, Smith, Olian, Sims, O'Bannon and Scully (1994) who examined the relationship between top management team demography, processes and organisational outcomes. In this study the researchers made explicit via their operationalization of variables what had been implicit in previous research, that top management team characteristics influence top management team processes, which in turn impact upon decisions and organisational outcomes. They did this by specifically examining the relationship between top management team demography and team processes such as social integration and communication.

Smith *et al* presented three models for understanding the relationship between top management team characteristics, processes and organisational outcomes. The first, a demography model, mirrored previous research in suggesting that heterogeneity, team tenure, team size etc, would directly influence organisational outcomes (as had been established in previous research). The second approach argued that social processes within teams had an impact upon organisational outcomes. Smith *et al* argued that social psychological perspectives suggested that social integration and good communication would lead to better quality team decision making and therefore improved organisational performance. This orientation is consistent with much previous research in group decision making, suggesting that social integration is a necessary pre-condition for effective team functioning (see chapters in West, 1996). This second approach suggested that team processes would account for additional variance above and beyond that accounted for by demographic factors.

A third orientation, suggested by Smith *et al*, was that demography would have no independent effects upon organisational outcomes, separate from team processes. In other words, they suggested that an intervening model was more appropriate, in which demographics influence team processes that in turn influenced team outcomes. In their research with 53 high technology firms this was what they concluded, although some direct effects of team demography on performance were also found. In particular they found a direct effect of heterogeneous educational background upon return on investment and a direct effect on sales growth. Overall, Smith *et al*'s research suggested that there are both direct and indirect effects of demography on outcomes (the indirect effects via team processes). Thus, their research suggested that there was partial support for a model in which process is a mediator of the relationship between demography and performance and for the process model, in which demography and process variables each effect performance separately. They found little support for pure demography model, in which demography rather than process alone affects performance.

We sought to extend this previous research and describe the content and outcomes of our research in the present data.

In this study we examine a number of demographic characteristics including age diversity, team tenure and educational backgrounds. We examine age diversity because of the assumption that, if demographic factors are important in influencing team processes and thereby organisational outcomes, that a factor as fundamental as age will powerfully affect team processes. There is considerable evidence of differences in work attitudes and experiences as a function of age, and we therefore considered that age diversity would be likely to detrimentally affect team processes. Specifically, we propose that age diversity will be associated with higher levels of implicit or explicit conflict in teams, preventing agreement about objectives, reducing effective participation in the team, as well as support for innovation and the ability of the team to engage in constructive self appraisal. Other critical variables we examined in relation to diversity included gender and ethnicity, but we abandoned our study of these factors since the teams we examined had very few women members or members of ethnic groupings other than white English people.

We also examined team tenure since there is considerable evidence that team tenure can play an important part in team processes.

Katz (1982) has argued that project newcomers represent a novelty enhancing condition, challenging and improving the scope of existing methods and accumulated knowledge. He suggests that the longer groups have been together, the less they communicate with key information sources, scan the environment, and communicate within the group externally. Katz proposes that group longevity is associated with a tendency to ignore and become increasingly isolated from sources that provide the most critical kinds of feedback, evaluation and information. However, other researchers suggest that the longer team members have worked together, the more effective they become at managing social and interaction processes within the team. Pfeffer (1983) suggested that team performance would be enhanced the longer teams have been together because team members will have '…overcome some initial naiveté' and learned '…. the ropes and local practices'. Similarly Katz (1982) argued that longer group tenure will be associated with stability and reduced conflict (which will be destructive to group performance). Smith *et al* (1994) found no relationship between team tenure and performance, but this may have been a consequence of the volatile environment of high technology firms in which they conducted their research. Nevertheless, experience, theory and intuition suggests that longer team tenure at top team level will be associated with greater learning and therefore greater effectiveness.

But of most importance to team functioning at this level in the firm we believe is the educational level of team members. The ability to learn and to manage complex concepts in an ambiguous environment is central to effective senior management. Effective teamwork at the level of the top management team involves a subtle and demanding balancing process between the needs of members' individual departments or functions and the needs of the top team and organisation as a whole. Managing team processes in a group of people who are likely to be ambitious and successful in their individual enterprises will make real demands upon the intellectual and emotional resources of team members. Moreover, managing organisations requires considerable intellectual resources and domain-relevant knowledge, skills and attitudes. We therefore propose that the educational level of the team will predict the performance of the organisation. Indeed, it is surprising that this variable has not been investigated before in studies of the relationship between team demographics, processes and organisational outcomes.

Four critical team processes were measured which included clarity of and commitment to team objectives, participation within the team, levels of task orientation (extent to which the team monitors and critically analyses its own performance) and support for innovation. These four team processes are derived from a model of team innovation developed by West, 1990 (see also West and Anderson, 1996). The most consistently important factor in determining group effectiveness is the existence of group goals or objectives (Pritchard, Jones, Roth, Stuebing, and Ekeberg, 1988; Guzzo and Shea, 1992). The clarity or specificity of goals has also been shown to predict group performance outcomes (Weldon and Weingart, 1993). In order to combine efforts effectively, group members have to understand collectively what it is they are trying to achieve. Much research also indicates that involvement in goal setting fosters commitment to those goals (Latham and Yukl, 1975; Locke, 1968; Maier, 1963; Vroom and Yetton, 1973) and consequently better group performance (Weldon and Weingart, 1993). Because of the demonstrated importance of objectives and goals in predicting performance at work (Latham and Yukl, 1975; Locke, 1968; Locke, Shaw, Saari, and Latham, 1981; Guzzo, Jette, and Katzell, 1985; Tubbs, 1986), and in relation to work group performance in particular (Pritchard *et al*, 1988; Weldon and Weingart, 1993), the proposition is well justified.

The second factor of central theoretical and empirical concern in the study of group performance is the notion of participation. Research on participation in decision making has a

long history in both social and industrial/organisational psychology, revealing that participation tends to foster greater effectiveness and commitment (Bowers and Seashore, 1966; Coch and French, 1948; Lawler and Hackman, 1969; Wall and Lischeron, 1977). There are good reasons for supposing that this factor will also be of importance in top team performance. To the extent that information and influence over decision making are shared within teams and there is a high level of interaction amongst team members, the cross fertilization of perspectives which can spawn effective decision making is more likely to occur. More generally, high levels of participation in decision making are associated with less resistance to change and therefore greater likelihood of change being implemented (Bowers and Seashore, 1966; Coch and French, 1948; Lawler and Hackman, 1969; Wall and Lischeron, 1977). When people participate in decision making through having influence, interacting with those involved in the change process, and sharing information, they tend to invest in the outcomes of those decisions (Kanter, 1983; King, Anderson and West, 1992).

A central theme in the innovation and creativity literatures is that divergent thinking and the management of competing perspectives are important processes in the generation of effective decision making. Such processes are characteristic of task-related team conflict and controversy. They can arise from a shared concern with excellence of quality of task performance in relation to shared objectives — what has been termed 'task orientation' (West, 1990). Task orientation may be evidenced by appraisal of, and constructive challenges to, the group's objectives, strategies, processes and performance; and by concern with high standards of performance. Tjosvold and colleagues (Tjosvold, 1982; Tjosvold and Field, 1983; Tjosvold and Johnson, 1977; Tjosvold, Wedley and Field, 1986) have argued similarly that constructive controversy in groups improves the quality of decision making (Tjosvold, 1991). Constructive controversy is characterised by full exploration of opposing opinions and frank analyses of task-related issues. Constructive controversy occurs when decision-makers believe they are in a co-operative group context, where mutually beneficial goals are emphasised, rather than in a competitive context; where decision makers feel their personal competence is confirmed rather than questioned; and where they perceive processes of mutual influence rather than attempted dominance. Such processes, it is proposed, will lead to top team effectiveness.

In the highly competitive world of manufacturing we also propose that top teams are most likely to be effective where there is support for innovation, or innovative attempts are rewarded rather than punished (Amabile, 1983; Kanter, 1983). It is therefore proposed that support for innovation will be a group process predictor of top team effectiveness and therefore of company productivity and profitability. Support for innovation is defined as the expectation, approval and practical support of attempts to introduce new and improved ways of doing things in the work environment (West, 1990). Within groups, new ideas may be routinely rejected or ignored, or they may find both verbal and enacted support. A wealth of social psychological and organisational research suggests that such group processes have a powerful influence in shaping individual behaviour (for reviews see eg, Brown, 1988; Hackman, 1992). It is consistent with these literatures to conclude that team processes supporting innovation will encourage members of top management teams to introduce innovations in their organisations, thereby encouraging the profitability and productivity of their organisations.

To assess company economic performance we measured organisational productivity and organisational profitability. We predict that top team demographics and processes will better predict organisational profitability than productivity since the latter is more under the control of the members of the whole organisational workforce whereas profitability is more likely influenced by the decisions regarding strategic choices of the top management team.

For the purposes of this paper, we present a summary of both the analyses and the key findings.

The overall aims are to:

- determine which team demographic and process factors explain most of the variation between companies in subsequent economic performance and innovation.
- determine which of the three models described by Smith *et al*, is most appropriate for the context of the organisations we study (the demographic model, the process model and the intervening model).
- develop a more extended model of the upper echelons perspective as it applies specifically to top management teams.

The setting that we chose for this research was manufacturing, because it is a key sector in UK economy, and has been relatively neglected by researchers examining top management team functioning in other studies. Moreover, the increasing level of global competitiveness and innovation in manufacturing places particular pressure on the individuals who work within this sector.

2. Method

The research reported here draws from the work of the Sheffield Organisational Effectiveness ProGrimme based jointly at the Centre for Economic Performance, London School of Economics and the Centre for Organisation and Innovation at the University of Sheffield[1]. This ten year longitudinal study (1990-2000) examines market environment, organisational characteristics and managerial practices in over 100 UK manufacturing companies. The principal aim of the research proGrimme is to identify determinants of manufacturing company effectiveness.

Data are gathered from a variety of sources:

- Economic performance data is gathered annually from 1990 to 2000.
- Every two years senior managers in these companies are re-interviewed on site for a period of one to two days. Areas covered in the interview include: organisational structure, market environment, competitive strategies, production technology, work design, quality emphasis, Just-In-Time practice, human resource management, and Research and Development (R&D).
- Over half of the companies participated in employee attitude surveys in the first wave of data collection. Questionnaires are distributed to all or a large sample of staff (Patterson, Lawthom, West, Maitlis and Staniforth, 1997). These explore employee attitudes to 17 areas of company functioning including for example, innovation, training, employee welfare, performance pressure, formalization and flexibility as well as measuring employee job satisfaction, mental health and organisational commitment (Patterson, Lawthom, West, Maitlis and Staniforth, 1999).
- Measures of top management team composition and functioning are also administered every two years.
- Finally, every two years an innovation survey of the companies is conducted (West, Patterson, Pillinger and Nickell, 1999).

[1] The Economic and Social Research Council, who we gratefully acknowledge, supported this research.

Manufacturing companies in the UK (including Northern Ireland, Wales, Scotland and England) were identified from sector databases. In addition, local Chambers of Commerce and Trade Associations identified a number of companies. Companies from four manufacturing sectors were approached: engineering, plastics and rubber, electronics and electrical engineering, food and drink and a small number of companies from other sectors were included in a miscellaneous category.

Assessing economic performance

Two main sources of information are used to determine company performance:

- **Company financial accounts**: balance sheets, profit and loss accounts, and flow of funds statement. Each company is required by law to make public these pieces of information.
- **Company management accounts**: companies are not obliged to produce these and there is no standard to which companies that produce them should adhere.

The following measures are used:

Labour productivity

This is defined as value added over employment. Value added refers to the value added by the firm to the raw materials and components available at the beginning of the production process. This calculated by adding to pre-tax profits, labour costs, (wages and salaries, bonuses, National Insurance contributions) and capital costs (depreciation of assets**,** interests payments on loans).

Profitability

This is simply profit over sales.

Top management team survey

In order to gather data on top management team demography and processes, we contacted the Chief Executive Officer (CEO) of each of the manufacturing companies and asked them to identify the members of their top management teams. We also asked them to provide us with details of their team members' functions. The CEOs were also asked to indicate how long the management team had existed in its present form, giving us a measure of *top team tenure*. Subsequently, we sent questionnaires to all identified members of these teams and asked them to provide information about their own demographic characteristics and their perceptions of team processes.

They were asked to give their function in the organisation and their age, *tenure in the top team*, organisational tenure, and industry tenure (all in years). They were also asked to indicate their *highest educational qualification* (treated as a continuous variable on a seven-point scale from high school graduation through to postgraduate qualification).

The following scales were used to assess team processes and are identical to those described by Anderson and West (1998):

(1) Team objectives

11 prompts were used to elicit information about team members' views on the clarity of team objectives, and their and other team members' commitment to the team's objectives. Items included "How clear are you about what your team's objectives are?" and "To what extent do you think they are useful and appropriate objectives?". The 5-point response scale ranged from **strongly disagree** to **strongly agree**. Cronbach's alpha for the eleven items was .94.

(2) Team participation

Team participation was measured using 12 items to which respondents were asked to respond on a 5-point **strongly disagree** to **strongly agree** scale. Cronbach's alpha = .86. Items included "We have a 'we are in it together' attitude" and "We share information generally in the team rather than keeping it to ourselves".

(3) Task orientation

This 5-item scale was used to measure the extent to which team members interacted in order to promote excellence in the team's work. It included items such as "Does the team critically appraise potential weaknesses in what it is doing in order to achieve the best possible outcome?" and "Are team members prepared to question the basis of what the team is doing?". The 7-point response scale ranged from **to a very little extent** to **a very great extent**. Cronbach's alpha was 0.92.

(4) Support for innovation

Eight items were used to measure support for innovation including the extent to which time, co-operation, verbal support and resources were given by team members to implement new ideas and proposals. Responses were on a 5-point **strongly agree** to **strongly disagree** scale. Cronbach's alpha was 0.92. Items included "This team is always moving toward the development of new answers" and "Team members provide practical support for new ideas and their application".

Responses from 42 teams are used in the analyses below. These included responses from any teams which returned three or more responses and for which we had details of company economic performance for a period of three to four years before data collection took place and for a period of up to one year after. For most analyses the four team process variable scores were averaged since they were highly intercorrelated and since this also enabled a more powerful analysis which gave more degrees of freedom. This gave eight study team and company level variables:

Age diversity
Educational background
Team tenure
Team processes
Prior productivity
Subsequent productivity
Prior profit
Subsequent profit

3. Results

Tables 1 and 2 show the means, standard deviations, minimum and maximum values for the 42 top management team characteristics and demographics.

Table 3 shows the correlations for the eight study variables. The results relating top management team characteristics and processes to company productivity and profitability are then presented in terms of the three hypothesised models.

Tables 4 and 5 report the results of two series of hierarchical regression analyses with productivity and profitability as the dependent variables, used to assess the direct effects of team demography on performance. In each case a control model is entered first including measures of company size (the log of the number of employees), industry sector (dummy variables), and prior company productivity (or profitability). Effectively we are testing the strength of team age diversity, tenure and educational level in predicting change in company performance. This change is from the time we measured prior productivity over three to five

years before our surveys of the top teams, to the time up to one to two years after we conducted the top team survey. The data clearly show that age diversity accounts for an additional 9.1% of the variance in productivity (above that accounted for by the control model) and 17.2% of the variance in profitability. Educational level of the top team accounts for 11.4% and 19.4% respectively; team tenure accounts for an additional 14.8% of variance in company productivity. All these effects are significant. When the three demographic variables are entered together they account for an additional 17.8% of the variance in productivity (in addition to the 43.2% of the variance accounted for by the control model). When the three variables are entered together in a model explaining subsequent profitability they account for an additional 37.4% of the variance above the 12.6% of the variance accounted for by the control model. Clearly, top team demographic factors do predict company performance, providing strong support for the demographic model.

Table 6 then shows the results of regressing our composite measure of team processes on to all the demographic variables we measured in the study. Age diversity does not predict team processes, and neither does team tenure. However, mean educational level does emerge as a significant predictor of team processes accounting for an additional 15.8% of variation in team processes (controlling for company size and prior productivity). This suggests that only educational level of the team members could be affecting organisational outcomes through its effects on team processes. This is a possibility we consider below.

Tables 7 and 8 show the results of analyses using top management team demographic data to predict organisational outcomes of productivity and profitability, with team processes as a mediator. These tables reveal that team processes account for an additional 8.6% and 16.2% of the variance in these outcomes after sector, prior performance and company size are controlled for. This provides clear support for a process model in which team processes account for an additional significant proportion of variance in organisational outcomes after demographic variables have been entered as predictors in equations.

These tables also show that when a second model is tested in which control variables and process variables are entered, followed in a subsequent step by demographic variables, we see that age diversity and educational background account for additional variance in subsequent productivity. All three demographic variables account for an additional 11.4% of variance above and beyond control and process variables. Similarly, age diversity, educational background and team tenure individually account for additional variance in subsequent profit, and together account for an additional 26.6% of variance in subsequent profitability. These results confirm that the effects of top team demographic factors predict organisational performance and that the effects of team educational level are not simply mediated by team processes.

4. Discussion

The results of our research into the relationship between top team characteristics and organisational performance in manufacturing reveal that demographic factors and team processes both predict company performance. Age diversity negatively predicted performance, while educational level of team members and team tenure were positive predictors of both profitability and productivity. Team processes also independently and significantly predicted company performance.

It is striking that top team characteristics accounted for more of the variance in subsequent profitability than variance in subsequent productivity of companies. This is in contrast to our research which has shown that employees attitudes (taking the aggregate of the whole workforce of an organisation) are better predictors of productivity of companies than of

profitability (Patterson and West, 1999; West and Patterson, 1999). This makes sense. Employees generally have more direct control over productivity as a result of their own efforts and actions than they do over company profitability which will be far more affected by the strategic and operational decisions of members of the top management team.

Our results show that team processes directly predict organisational performance, accounting for an additional 8.2% of the variance in productivity above and beyond a control model and an additional 16.2% of the variance in profitability after the effects of prior profitability, firm size and sector have been accounted for.

The data provide little support for an intervening model of top team demographics and processes influencing company performance. Our data suggest that age diversity and team tenure do not predict team processes. However, team member educational level is a direct predictor of team processes but it is also independently a predictor of organisational productivity and profitability. There is thus no support for a model in which the effects of demographic factors on performance are entirely mediated by team processes.

This is curious. We can understand that the effects of the mean educational level of team members will influence company performance directly. In the complex, volatile world of commerce it is advantageous to have a group of people who can draw on their knowledge and skill to make good strategic decisions which in turn will affect company productivity and profitability. However, the direct effects of team age diversity upon performance and not upon team processes is a puzzling finding. Striving to find an explanation for why top team age diversity directly affects company performance but not via team processes is a desperate enterprise. Our prediction was that age diversity would lead to conflicting perspectives within the team which in turn would be reflected in poor clarity about and commitment to team objectives; low levels of participation, task orientation and support for innovation. However age diversity did not predict team processes. We speculate that team processes are affected by age diversity but that we have simply failed to measure those processes most affected. In particular we believe that age diversity of the top team will lead to higher levels of implicit or explicit conflict — variables we did not operationalise in this study.

The fact that team tenure emerges as a predictor both of company productivity and profitability (though not of team processes) confirms the importance of this variable. It can be interpreted as the effects of social capital. Team members develop the skills and social capital to manage working in the team and to draw upon the loyalty and trust created by a long period of time of co-working. Moreover, the knowledge and skills consequent upon a long period of time spent working together can be deployed in the effective strategic management of the organisation, ensuring long term profitability.

Overall, these findings indicate the importance of both demographic characteristics as well as team processes in top teams in influencing company performance. The findings suggest that the intellectual capital of the team (for example educational level of team members) will be a very important factor influencing both team outcomes and team processes. Indeed, one aspect of our findings that deserves careful consideration is the implication that intellectual capital (measured by intellectual attainment) is necessary for effective team functioning at this level. The task of working effectively in teams at senior level demands a high level of intellectual skill, because of the complexities of managing objectives, roles, processes and contexts. The easy prescriptions of management texts on team working are blind to the realities of the complexities of managing the team interaction processes which occur on a daily basis and challenge team members continually in real teams in real organisations.

The findings from this study have implications for top team selection and for the development of top teams. There are straightforward implications that, *ceteris paribus*, highly educated and age homogeneous teams produce better organisational performance than less highly educated and more age diverse teams. The findings should not be over-interpreted

however. There are undoubtedly examples of successful teams that do not have the characteristics the findings recommend. Nevertheless, the magnitude of the associations between these variables and organisational productivity and profitability alert us to their importance and to that of executive selection processes (Sessa, Kaiser, Taylor, and Campbell, 1998).

At the same time, the findings show that team processes are predictors of company performance, independent of demographic factors. Team member clarity about and commitment to, team objectives, along with relatively high levels of team participation (team member interaction, influence over decisions, and information sharing) are associated with company productivity and profitability. Task orientation (a team focus on effective task performance) and support for innovation are also predictors of company performance. Interventions can also be targeted at improving these team processes (Tannembaum, Salas, and Cannon-Bowers, 1996) with likely benefits for company performance. It is not necessary to rely on top team selection and composition alone as strategies for improving top team performance. Both selection and process improvement strategies are likely to be effective, and those charged with the development of top teams can select either or both.

It is perhaps simplistic to assume that patterns of factors, which influence the performance of teams, will be consistent across contexts. Educational level of team members is likely to be very important in contexts that are demanding, ambiguous and volatile. Such is the context of top management teams. Indeed, even top management teams may be subject to quite different influencing factors across industrial and organisational contexts. The challenge we believe is to develop theories which can account for these contextual variations by developing models with a sufficient level of generality and conceptual power which nevertheless reflect the true complexity of human interaction in group working.

Table 1
Descriptive Statistics for Top Management Team Characteristics

Variable	Mean	Std Dev	Minimum	Maximum	N
Size of team	7.21	2.57	4.00	15.00	42
Age – mean	45.59	3.93	38.50	53.50	42
Age – diversity[1]	0.19	0.06	0.05	0.32	42
Time in TMT (months) - mean	76.65	43.35	7.67	160.00	42
Time in TMT - diversity[1]	0.71	0.33	0.03	1.57	42
Time in organisation (months) - mean	133.27	71.26	7.67	296.67	42
Time in organisation - diversity[1]	0.69	0.23	0.25	1.23	42
Time in industry (months) - mean	187.74	84.03	32.00	377.80	42
Time in industry - diversity[1]	0.69	0.23	0.17	1.51	42
Team tenure	25.29	24.77	1.00	101.00	42
Professional background - diversity[2]	0.62	0.15	0.00	0.82	42
Educational background[3] - mean	5.64	0.63	4.14	6.75	42
Educational background - diversity[2]	0.19	0.11	0.00	0.50	42
Percentage males	96.25	7.72	66.70	100.00	42
Gender - diversity[1]	0.06	0.12	0.00	0.44	42
Percentage white, UK	95.83	7.73	71.40	100.00	42
Ethnicity - diversity[1]	0.07	0.12	0.00	0.41	42
Frequency of meetings[3]	4.00	1.23	1.00	6.00	42

[1] Diversity of continuous variables measured by the coefficient of variation (standard deviation÷mean)

[2] Diversity of categorical variables measured by Blau's index: $\left(1-\sum p_i^{\,2}\right)$ where the p_i are the proportions in each category

[3] Educational background (1-7) and frequency of meetings (1-6) treated as continuous scales

Table 2
Descriptive Statistics for Top Management Team Processes

Variable	Mean	Std Dev	Minimum	Maximum	N
Processes - mean	3.64	0.33	2.82	4.37	42
Participative safety	3.65	0.39	2.75	4.62	42
Support for innovation	3.49	0.39	2.46	4.29	42
Team objectives	3.94	0.39	3.06	4.68	42
Task orientation	3.51	0.36	2.83	4.29	42

Table 3
Pearson Correlations between Top Management Team Demographic Variables, Team Processes and Company Performance

	1.	2.	3.	4.	5.	6.	7.	8.
1. Age – diversity	1.00							
2. Educational background	-0.24	1.00						
3. Team tenure	-0.19	0.06	1.00					
4. Processes	-0.15	0.36**	0.09	1.00				
5. Prior productivity	-0.11	0.23	0.07	-0.14	1.00			
6. Subsequent productivity	-0.30*	0.46***	0.08	0.17	0.59***	1.00		
7. Prior profit	0.13	0.13	0.05	-0.06	0.69***	0.17	1.00	
8. Subsequent profit	-0.26*	0.29*	0.34**	0.38**	0.27*	0.74***	0.14	1.00

* $0.05<p<0.10$ ** $0.01<p<0.05$ *** $p<0.01$

Table 4
Using Top Management Team Data to Predict Subsequent Performance Models Explaining Subsequent Productivity

Control measures: Sector, prior productivity, size of firm

	B (standard error (B))	*b*	R^2	Change in R^2 from control model
Control model only			43.2%	
Age (diversity)	-1.938 (0.752)	-0.321	52.3%	9.1%**
Educational background	0.236 (0.080)	0.390	54.6%	11.4%***
Team tenure	0.003 (0.002)	0.212	46.7%	3.5%
All 3 together			61.0%	17.8%***
- Age (diversity)	-1.409 (0.728)	-0.234		
- Educational background	0.191 (0.078)	0.316		
- Team tenure	0.002 (0.002)	0.120		

* $0.05<p<0.10$ ** $0.01<p<0.05$ *** $p<0.01$

Table 5
Models Explaining Subsequent Profit

Control measures: Sector, prior profit, size of firm

	B (standard error (B))	*b*	R^2	Change in R^2 from control model
Control model only			12.6%	
Age (diversity)	-40.273 (13.737)	-0.455	29.9%	17.2%***
Educational background	4.451 (1.407)	0.501	32.1%	19.4%***
Team tenure	0.099 (0.037)	0.437	27.4%	14.8%**
All 3 together			50.0%	37.4%***
- Age (diversity)	-27.298 (12.461)	-0.308		
- Educational background	3.396 (1.284)	0.382		
- Team tenure	0.073 (0.033)	0.321		

* $0.05<p<0.10$ ** $0.01<p<0.05$ *** $p<0.01$

Table 6
Using Top Management Team Data to Predict Group Processes Models Explaining Overall Team Processes

Control measures: Prior productivity, size of firm

	B (standard error (B))	R^2	Change in R^2 from control model
Control model only		2.8%	
Size of team	-0.006 (0.022)	3.1%	0.2%
Age - mean	0.013 (0.013)	5.2%	2.3%
Age - diversity	-1.003 (0.846)	6.3%	3.5%
Time in TMT - mean	-0.001 (0.001)	3.8%	0.9%
Time in TMT - diversity	-0.304 (0.154)	11.9%	9.0%*
Time in industry - mean	-0.001 (0.001)	10.7%	7.9%*
Time in industry - diversity	0.182 (0.203)	4.9%	2.0%
Team tenure	0.001 (0.002)	3.4%	0.6%
Professional background - diversity	0.050 (0.389)	2.9%	0.0%
Educational background - mean	0.216 (0.080)	18.6%	15.8%***
Educational background - diversity	-0.604 (0.510)	6.3%	3.5%
Frequency of meetings	-0.009 (0.044)	3.0%	0.1%

* $0.05<p<0.10$ ** $0.01<p<0.05$ *** $p<0.01$

Table 7
Using Top Management Team Data to Predict Subsequent Productivity, with Team Processes as Mediator

Control measures: Sector, prior productivity, size of firm

R^2 with control model only: 43.2%
R^2 with control model and processes: 51.7%
Change in R^2 due to processes: 8.6%**

	With control model:		With control model and processes			
	R^2	Change in R^2	R^2	Change in R^2	Total change in R^2	Shared R^2
Age - diversity	52.3%	91.0%**	58.3%	7.6%	15.1%	1.5%
Team tenure	46.7%	3.5%	54.8%	3.1%	11.6%	0.4%
Educational background - mean	54.6%	11.4%***	57.1%	5.4%	13.9%	6.0%
Group of 3	61.8%	17.8%***	63.2%	11.4%	20.0%	6.4%

* $0.05<p<0.10$ ** $0.01<p<0.05$ *** $p<0.01$

Table 8
Using Top Management Team Data to Predict Subsequent Profit, with Team Processes as Mediator

Control measures: Sector, prior profit, size of firm

R^2 with control model only: 12.4%
R^2 with control model and processes: 28.6%
Change in R^2 due to processes: 16.2%***

	With control model:		With control model and processes			
	R^2	Change in R^2	R^2	Change in R^2	Total change in R^2	Shared R^2
Age – diversity	29.7%	17.3%***	41.3%	12.7%**	28.9%	4.6%
Team tenure	27.3%	14.9%**	42.3%	13.7%***	29.9%	1.2%
Educational background – mean	31.9%	19.5%***	37.8%	9.2%**	25.4%	10.3%
Group of 3	50.0%	37.4%***	55.2%	26.6%***	42.8%	10.8%

* 0.05<p<0.10 ** 0.01<p<0.05 *** p<0.01

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