TEAM COMPOSITION, LEADERSHIP AND INFORMATION-PROCESSING BEHAVIOR

A simulation game study of the locus-of-control personality trait*

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ABSTRACT

In this study, we relate the individual locus-of-control personality trait of team members to the team's information gathering and processing behavior. We adopt a team information-processing approach arguing that a team's information-processing capacity is a function of its composition with respect to the members' locus of control and the leadership structure of the group. We develop models that go beyond analyzing simple main effects of differences in team locus-of-control composition. We hypothesize that (a) the impact of the team locus-of-control mean depends on the within-group locus-of-control diversity, and (b) the effect of both the team locus-of-control mean and its standard deviation is contingent upon the leadership structure of the group. The hypotheses were tested on 44 teams participating in an elaborate international management simulation over six time periods. As predicted, we find that teams with a high average internal locus-of-control score collect more information and make more informed decisions when the within-team locus-of-control spread is low, and when the team operates without a leader. The opposite is the case for teams with a high average external locus-of-control score. In addition, locus-of-control diversity induces team information search only in the case when the team has no leader. We also show that team financial performance is comparably affected by our focal independent team variables. On a general level, our results offer strong support for recent pleas to study theoretically relevant individual traits, use proper aggregation models and include structural moderator variables in team composition research.

INTRODUCTION

More than 15 years ago Pfeffer (1983) and Hambrick and Mason (1984), independently, made a plea to open the black box of organizations in a systematic way by putting the individual and the distribution of characteristics of individuals within organizations in the picture again. These prominent organization scientists stressed the importance of the study of the demographic composition (e.g., in terms of age, education, gender and tenure) of the personnel of organizations and top management teams in order to increase our understanding of the functioning of organizations. Their argument is that organizations are, to a certain extent, a reflection of the characteristics of their members and/or the distribution of the members' traits. The potential importance of these contributions should not be underestimated because "they put the individual back into the predominantly macro-level organization theory" (Sørensen, 2000). Not surprisingly, both contributions inspired many management scholars to investigate the impact of the demographic composition of different kinds of teams, ranging from work groups to top management teams, on the functioning of these teams and, ultimately, organizations.

The early empirical studies in the field started to investigate, as a logical first step, main effects of team composition variables on team and organizational outcomes. Specifically, the focus has been on the composition of groups in organizations (especially top management teams) in terms of demographic characteristics such as tenure, age, functional experience, gender, and ethnic background (Priem et al., 1999; van Olffen, 1999; Williams & O´Reilly, 1998). Generally, researchers studied both the impact of the mean and the spread (i.e., diversity) of these characteristics on outcome variables such as turnover, team performance, innovation, diversification, and organizational performance. Note that the most frequently studied compositional variable in this respect is the tenure distribution (Carroll & Harrison, 1998). From these efforts we learned that team composition does indeed make a difference (Priem et al., 1999). However, as is now generally acknowledged, the relationship between team composition and outcomes appeared to be much more complex than originally thought. This is also witnessed by the many inconclusive and even contradictory findings in prior work. For instance, Bantel and Jackson (1989) found a positive relationship between team heterogeneity and innovation, whereas the research of O´Reilly and Flatt (1989) demonstrated a negative link. Williams and O´Reilly (1998) concluded after a thorough, exhaustive review of 40 years of team diversity research that "[t]here are no consistent main effects of diversity on organizational performance; e.g. that the impact of diversity goes well beyond simple main effects." The same conclusion can be made with respect to the impact of average team characteristics (van Olffen, 1999). Recent reviews of this past research made a plea to close three gaps in the current state of the art. These gaps result from the three as yet unanswered questions: What types of compositional variables can be distinguished?, Why is team composition important?, and When does it have an impact? (Lawrence, 1997; Priem et al., 1999; van Olffen, 1999; Williams & O´Reilly, 1998). In the past few years, a second stream of composition research has emerged addressing several aspects of these important questions empirically.

With respect to the what-question, scholars used to treat all compositional variables as having similar outcomes. For instance, many diversity researchers have relied on the argument that any type of diversity does increase conflict and, as a result, decrease group performance (Pelled et al., 1999). Pelled et al. (1999) argued, however, that a distinction should be made between job or task-related features (e.g., functional background) on the one hand and characteristics triggering emotional responses as a result of categorization and stereotyping on the other hand (e.g., gender and race). They found that functional background diversity is associated with task conflict and that emotional conflict is triggered by race and tenure heterogeneity. Both types of conflict, in turn, have different effects: task conflict increases cognitive task performance, whereas emotional conflict does not. In a similar vein, Jehn et al. (1999) distinguish three types of compositional variables: informational diversity as a result of differences in educational and functional background (cf. task-related diversity), social category diversity with respect to age and gender (cf. characteristics triggering categorization and stereotyping), and value diversity. Again, these authors found that these different types of diversity influence different outcome variables, such as group performance, group member satisfaction and group member morale in a predictable but complex way. Finally, Harrison et al. (1998) argued that an important distinction should be made between so-called deep-level characteristics (such as values) and more overt indicators of differences (such as age and gender). The reason is that time likely moderates the relative impact of overt *vis-à-vis* underlying diversity among work group members. Deep-level differences require time to be discovered by the group members, whereas the impact on perceptions and behavior of stereotyping based on overt characteristics tends to decrease with time as people acquire more information.

Additionally, several studies focused on providing answers to the second, i.e., why-question (Pelled, 1996; Jehn et al., 1999; Pelled et al., 1999; Jehn & Chatman, 2000; Jehn & Mannix, 2001). These efforts are aimed at opening the black box of team composition by systematically analyzing the mediating mechanisms underlying the relationships between team composition variables (mainly diversity) and group outcomes. As already touched upon above, a major mediating variable receiving a lot of attention is group conflict. A breakthrough in recent work is the fundamental distinction that has been made between affective (emotional) versus task conflict. Findings have revealed that both types of conflict are important mediator variables as they are: (1) distinctively related to team outcomes, such as team performance, and (2) are indeed triggered by different types of team diversity in a predictable way (Pelled, 1996; Jehn et al., 1999; Pelled et al., 1999; Jehn & Chatman, 2000; Jehn & Mannix, 2001).

Finally, although moderator variables received scant attention in past research, most studies nowadays include them in order to find out when team composition makes a difference. Four studies can ilustrate this observation. First, as discused above, Harrison et al. (1998) investigated the moderating role of time on the impact of deeply rooted versus overt diversity on group cohesion. Second, Jehn et al. (1999) found out that the positive impact of informational diversity (see above) on group performance was moderated by value and social category diversity, task complexity, and task interdependency. As expected, informational diversity increases performance especially when 'affective' diversity is low, and when tasks are complex and interdependent. Third, Pelled et al. (1999) found their relationships between team composition and outcome to be moderated by task routineness and group longevity. Fourth, Polzer et al. (2002) report support for their argument that interpersonal congruence moderates the effect of group diversity. That is, if the degree to which group members see others in the group as those others see themselves is high (low), then group diversity improves (deteriorates) creative task performance.

In the present paper, we follow the lead of this recent research stream by presenting more complex, realistic models of specific group outcomes as a function of team composition variables. The primary focus will be on explaining differences in the information-processing behavior of decision-making teams. We argue that decision-making teams can be regarded as information-processing entities, and that the team's information-processing capacity is a function of the composition of its members in terms of the locus-of-control[1] and the leadership structure of the group. Drawing on (individual) personality and social psychology theory, we hypothesize on the effects of both the mean and the standard deviation of the locus-of-control scores of the team members on the team's information-gathering and processing behavior. As we think that group composition processes are in general too complex to expect simple main effects of team compositional variables, we develop models focusing on two important, but previously neglected, contingency variables moderating the relationship between team composition and outcomes. For one, we argue that for most individual differences under study, including locus-of-control ones, the impact of the team average probably depends on the spread or diversity of that characteristic within the team, and *vice versa*. In addition, we also expect that the impact of both team characteristics (mean and spread) will depend on the social structure of the group. Specifically, we argue that the simple fact of having a leader or not matters a lot

[1] Locus of control is an important and well-documented personality trait that refers to individual differences in a generalized belief in internal versus external control of reinforcement (Rotter, 1966). People with an internal locus of control see themselves as active agents. They feel that they are masters of their fates, and they trust in their capacity to influence the environment. Conversely, those with an external locus of control see themselves as relatively passive agents, believing that the events in their lives are due to uncontrollable forces. We chose to study this particular trait because it indicates fundamental differences between individuals (Boone & De Brabander, 1993). Furthermore, control perceptions appear to be very salient in explaining effective management. Specifically, research into the relationship between Chief Executive Officer (CEO) locus of control and organizational performance consistently shows that firms led by internal CEOs perform better than firms headed by external CEOs, both in the short run as well as in the long-run (Miller & Toulouse, 1986; Boone et al., 1996 & 2000).

with respect to the impact of group compositional variables. We develop this line of argumentation in the present paper and show empirically that many team composition data are probably under-analyzed due to the omission of such basic contingency variables. The hypotheses are tested on a sample of 44 management teams that participated in a large-scale European management game in 1994.

The overall contribution of the present paper to the team composition literature is threefold. First, as we focus on potentially important moderator variables, going beyond simple main effects, our study contributes to answering the when-question discussed above. By making explicit the exact conditions under which we expect certain relationships to materialize, we hope to increase our insight into when team composition actually matters.

Second, in their comprehensive review of top management team research, Priem et al. (1999) saw the tendency to sacrifice construct validity for reliable measurement as a major flaw of previous studies. That is, a few notable exceptions aside (e.g., Barrick et al., 1998), the emphasis has almost exclusively been on assessing the demographic characteristics of team members, not so much for substantive reasons but rather because of the availability and measurability of these 'observable characteristics'. This is the case both in top management team research (Hambrick et al., 1993) as well as in the broader social psychological field of intra-team functioning and effectiveness (Schruijer & Vansina, 1997; Barrick et al., 1998). However, a focus on more fundamental behavioral tendencies rooted in personality seems warranted because these are more directly linked to behavior and provide a more valid measurement of values and attitudes than do demographic variables (see also Hambrick & Mason, 1984; Hambrick et al., 1993). As a result, we think that the study of deep-level individual differences, such as those in terms of the locus-of-control personality trait, might increase the explanatory power of team composition research.

Third, the focus on more 'substantive' dimensions of individual differences such as locus of control provides us with the opportunity to study other important dependent variables outside the current domain of mainstream team composition research. In fact, Priem et al. (1999: 941) observed in the realm of top management team research that "[w]hereas many demographicsbased theories are typically altered very little if top management team heterogeneity is measured via age, or tenure, or functional specialization surrogates, it is unlikely that more substantive dimensions can seamlessly replace one another without a corresponding change in theory prescription." Because there is ample experimental and field evidence at the individual level of analysis that internals gather more information in the course of decision-making and are better at information processing *vis-à-vis* externals (Lefcourt, 1982), we chose to explain the information-gathering and processing behavior of different teams as a function of their locus-of-control composition. Clearly, the insight in the behavioral consequences of locus of control at the individual level provides us with ample ammunition to back up our hypotheses at the team-level of analysis (Boone et al., 1998). Another reason why we focus on information processing is that it is crucial for sound decision-making at both the individual and the team-level of analysis. As a result, differences in the team's capacity to gather and handle information are potentially important determinants of team effectiveness, and in the case of management teams, organizational performance.

THEORETICAL BACKGROUND AND HYPOTHESES

Mean-dispersion interaction

Before formulating our specific hypotheses, it is essential to recognize that team composition research is in fact multi-level research in which data from a lower level, i.e., characteristics of individuals, are used to establish higher-level constructs, i.e., team characteristics (Chan, 1998). It is clear that there are many different ways to derive higher-level constructs from lower-level data. In an insightful paper, Chan (1998) proposes a typology of composition models that specify the functional relationship between constructs at different levels of analysis. He also shows that the specification of adequate composition models is a critical component of good multi-level research (Chan, 1998). Unfortunately, in team composition research not enough attention is paid to the theoretical underpinnings of using certain elementary composition rules. That is, it is standard practice to aggregate data on individual characteristics, such as tenure, by computing the mean and the standard deviation or the coefficient of variation. In terms of Chan's typology, this implies that researchers implicitly use the additive and dispersion composition models, respectively. In the latter model, the meaning of the team construct derives from the dispersion or variance among lower-level units and is operationalized with measures of within-group variance. In team composition research, social-psychological theory on group functioning provides the basic background for hypothesizing on the effects of dispersion. Specifically, the majority of researchers of work group demography have relied on the argument that dispersion measures indicate the extent of heterogeneity among team members, which is assumed to hamper cognitive and behavioral integration and therefore ultimately team effectiveness (Shaw, 1981; McCain et al., 1983; Wagner et al., 1984; see Pelled et al., 1999: 20). Although the dispersion model has recently been extended to include differences in task and affective conflict (see, e.g., Pelled et al., 1999), it has been used with success in several studies. For instance, empirical research consistently shows that heterogeneous teams with respect to tenure have higher turnover rates (Carroll & Harrison, 1998), an important stylized fact in team composition research to date.

On the other hand, when averages are computed of lower-level data, one implicitly uses the additive model. In this model, the higher-level construct is just a summation of the lower-level units regardless of the variance among these units. The problem, however, is that the additive model is very inadequate for predicting team behavior because, theoretically, effects of mean composition can only be expected when dispersion is low. This is because hypotheses on the effect of the team means are invariably based upon what is known at the individual level of analysis. An example will illustrate our point. Consider the following statement: "A team with a high average age is unlikely to take risks because an old manager is equally unlikely to behave that way." This type of reasoning, in which individual characteristics are directly extrapolated to the team level, is only justified when team members resemble each other. Take, for example, the following two teams, one consisting of members of age 20, 40 and 60, and the other of three members of age 40. Although both teams have the same mean, it is clear that theories based on the individual level of analysis can only inform us on the behavior of the second team but not of the first. This inadequate use of the additive composition model might explain the many inconsistent findings, especially in the case of the effect of the mean of different demographic characteristics. It is important to note that the problem is not solved by statistically controlling for dispersion when testing for the effect of the mean (as often happens) because it is the subtle interaction between mean and dispersion that counts. In Chan's terminology, the appropriate composition model for testing individual-level theories at the group level is the direct consensus model. In this model, aggregation of individual level data is only justified when consensus or homogeneity is present. It is this model that we will adopt below in specifying hypotheses on the mean effect.

Information-Processing Behavior

Mean locus of control. In reviewing the findings on cognitive capacities of internals versus externals, Phares (1976: 78) concludes that internals "acquire more information, make more attempts at acquiring it, are better at retaining it, are less satisfied with the amount of information they possess, are better at utilizing information and devising rules to process it and generally pay more attention to relevant cues in the situation." All this provides strong support for the validity of the locus-of-control construct as it is indicative of a basic striving of the internal individual to actively engage in the seeking of relevant cues in his/her environment to determine and make sense out of his/her position, and to guide or adapt his/her behavior accordingly. Important for our purposes is that personality research makes clear that internal individuals have a larger information-processing capacity than external individuals (see also Govindarajan, 1988 & 1989), and therefore will gather more information and utilize it better in decision-making. One could easily extrapolate this finding to the team level of analysis to predict that internal teams have a higher information-processing capacity than external teams. In previous research, this hypothesis would be tested by estimating the main effect of the mean locus-of-control score of the team members. As explained above, it should, however, be recognized that in doing so one implicitly assumes that the so-called additive model is applicable, in which the higher-level construct (team-level locus of control) is just a summation of the lower level units (here individual team members) regardless of the variance among these units (Chan, 1998). However, the straightforward application of this model is inappropriate because this team-level hypothesis is based on individual-level personality theory. As a result, a fair test of it requires homogeneity of the personality of the team members. To summarize, we expect that the information-processing capacity of the team will increase if internal individuals are added to the (homogenous) team. In other words, accumulation of internals results in an "internal team". We expect, in turn, that teams with high information-processing capacity will gather more information and make more informed decisions than teams lacking this capacity. This discussion suggests

Hypothesis 1: Mean team internality increases the extent of team information search and informed decision-making especially when the locus-of-control standard deviation is low.[2]

Locus-of-control diversity. In traditional team composition research, social-psychological theory on group functioning provides the basic background for hypothesizing on the effects of dispersion. Specifically, dispersion measures indicate the extent of heterogeneity among team members, which is assumed to hamper cognitive and behavioral integration and therefore ultimately team effectiveness (Shaw, 1981; McCain et al., 1983; Wagner et al., 1984). As many social-psychological studies have shown, if team members have diverging frames of reference, attitudes and values, so-called process losses occur due to hampered communication (McCain et al., 1983; Zenger & Lawrence, 1989). This, in turn, increases the likelihood that conflicts, turnover (Wagner et al., 1984) and power struggles (Pfeffer, 1983) emerge, attracting attention away from the immediate tasks of the group. The consequence is that the operational efficiency of heterogeneous teams in performing their tasks is threatened because much time and energy are required to overcome power games and communication barriers. As mentioned earlier, scholars recently pointed to the important distinction between task and emotional conflict (Jehn et al.,

[2] Some researchers use the coefficient of variation instead of the standard deviation as a measure of diversity within a team. However, we think that the standard deviation is more appropriate because it measures distances between individuals irrespective of the mean. Consider two teams consisting of individuals with tenure 2, 4 and 8 years, and with tenure 4, 8 and 16 years, respectively. Although most would agree that the heterogeneity within the

1999; Pelled et al., 1999). This research shows that the alleged process losses are mainly the result of emotional conflict triggered by value and social category diversity. Task-related diversity, such as functional background, causes task-related conflict that tends to be beneficial for cognitive task performance as long as team integration can be achieved (Priem et al., 1995). Note in this respect that the previously mentioned stylized fact that tenure diversity increases turnover, might precisely be the result of the emotional conflict resulting from tenure differences. Indeed, Pelled et al. (1999) found a positive relationship between tenure diversity and emotional conflict.

So, emotional conflict, and associated communication problems and role conflicts (Harrison et al., 1998), appear to be triggered by deep-level differences, such as values and attitudes (Jehn et al., 1999). As locus of control is a deep-level characteristic, we expect that similar process losses will occur in teams with high locus-of-control diversity. Indeed, the attitude and behavior of internals *vis-à-vis* externals have been shown to be fundamentally different. Internals are proactive, oriented toward action, and are more inclined to take risks, compared to externals who are more reactive, passive and risk averse (Lefcourt, 1982; Boone et al., 1996). Due to these attitudinal differences, it is very likely that both will analyze, interpret and act upon the same decision situation in a different way. Previous research has shown that internal CEOs, for instance, are more inclined to pursue innovative and risky strategies than their external counterparts (Miller et al., 1982), even when they operate in the same market environment (Boone et al., 1996). In a Prisoner's Dilemma context, studies have revealed that externals are less inclined to play cooperatively then internals (Boone et al., 1999), and that they are slower learners of payoff-maximizing behavior (Boone et al., 2002). These differences in the way internals versus externals approach the same situation are likely to cause communication barriers and hamper team integration when internals and externals have to work together.

What is the impact of diversity in general and of locus-of-control heterogeneity in particular on team information-gathering and processing behavior? As team decision-making is a collective

second team is much larger, the coefficient of variation is identical. The difference is captured by the standard deviation, though, which is four times larger for the second team compared to the first.

effort, we expect that team diversity will increase the need for information in order to overcome both task and emotional conflicts, as well as communication barriers that result from individual differences. We argue that information gathering is one way to achieve cognitive, emotional and behavioral integration in a team. That is, extra information helps to reveal the objective specifics of the decision situation and therefore has the potential to close the gaps between diverging, subjective opinions and attitudes of team members resulting from individual differences. Gaining objective information might be even more important when differences are deeply rooted in attitudes and personality, and conflicts are therefore probably contaminated by affective responses. Note that the reasoning is similar to the classic contingency theory account of Lawrence and Lorsch (1967) with respect to differentiated structures at the organizational level of analysis. According to these authors, differentiation must be counterbalanced with integrative devices to achieve organizational effectiveness. *Mutatis mutandis*, heterogeneous (differentiated) teams need integration for effective functioning (see also Priem et al., 1995). We therefore expect that teams with a high locus-of-control diversity will gather more information than teams with low spread. As a side effect, decision-making will probably also be more informed in divers teams (i.e., backed up with information). Thus, we propose

> *Hypothesis 2: Locus-of-control diversity of a team increases the extent of team information-gathering behavior and informed decision-making.*

Team leadership. We expect that the impact of both the mean and the standard deviation of the locus-of-control scores on team information-gathering and processing behavior will depend on the structure of the group. Concerning the second moderator, few scholars would deny the importance of the way the team is structured with respect to the impact of team composition variables. Surprisingly enough, the moderating effect of team structure variables such as power distribution and role interdependencies are seldomly studied (Finkelstein &

Hambrick, 1996).[3] In the area of top management team studies, for instance, Finkelstein (1992) notes that the failure to take into account power differences between executives might lead to potentially misleading research findings. Obviously, the more decisional power is centralized in the hands of one or few influential team members, the less it makes sense to expect important effects of team composition variables. In the present study, we therefore take an important team structure variable on board, i.e., whether or not the team has a leader. Several scholars made a similar point. Mintzberg (1979), for instance, argued that it is too simple to assume that the impact of each member on team outcomes is equal. This assumption is in fact made when main effects of team composition measures are assessed. However, as argued by Finkelstein (1992) and by Finkelstein and Hambrick (1996), the predictive power of team composition measures could be increased considerably by taking into account the distribution of power within a team. In the present paper we take up this suggestion by focusing on a simple leadership moderator.

It is clear that the decision-making process will be quite different in teams with a leader compared to teams consisting of "equals" only. For one, decision-making in the former teams will be more centralized, implying a larger impact of the preferences of the leader as far as the content of decisions is concerned. In addition, in teams with a leader the flow of information between the members of the team will be more structured and dominated by vertical channels running from the member to the leader and *vice versa*. In decentralized teams, without a leader, information flows are less structured with horizontal channels connecting every member dyad of the team (Leavitt, 1951; Mackenzie, 1966 & 1978).

Having a leader or not is likely to moderate the impact of our team composition measures (i.e., mean and standard deviation) for two reasons. At a very general level, one can expect that team composition variables matter less when a team has a leader, in which case leader characteristics dominate over the characteristics of the other team members. In the present study there is another, more subtle, way to explain the potential moderating role of having a

[3] Note that the same is true for another potentially salient moderator. Pelled et al. (1999: 7) cite Jackson (1992: 155) who "observed that an important but as-yet-unanswered question is, 'Does the nature of the task moderate the

leader. Because leaders tend to structure the flow of information in a team, having a leader might increase the "vertical" information-processing capacity of the team (Galbraith, 1973; Daft, 2001). We suspect that especially external teams will benefit from this. Recall that we hypothesized that external (individuals and) teams have a relatively low inherent capacity to process information. Of course, this does not imply that such teams do not need information for effective decision-making. They will gather less information only because they lack the capacity to adequately deal with it. Adding a leader, and thus a vertical information system, to an external team probably compensates for this lack of information-processing capacity. Interestingly, previous research has shown that external individuals like to work in a structured environment, with clear leadership (Spector, 1982). Maybe this is precisely because of their lower information-processing capacity (Govindarajan, 1988). In any case, having a leader does not undermine the motivation of external members, on the contrary. Conversely, internal teams do not need a "vertical information-processing" system, as their information-processing capacity is already high. In addition, internal people like to direct themselves and tend to prefer working in decentralized settings (Spector, 1982). This leads to

> *Hypothesis 3: Having a leader increases the extent of team information-gathering behavior and informed decision-making especially when mean team externality is high.*

Additionally, we propose that having a leader moderates the relationship between locus-of-control diversity and team information-processing behavior. Specifically, the achievement of cognitive, emotional and behavioral integration in heterogeneous teams is probably facilitated when the team has a leader. This is because a leader centralizes decision-making and structures the flow of information in the team. Such behavior is likely to enhance the convergence of diverging member views and opinions, or at least reduces the potential

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impact of group composition?'"

negative consequences of the tension caused by this divergence. As a result, the high need for information associated with team diversity, as explained above (Hypothesis 2), is reduced for teams that have a leader. In other words, a leader serves as a team integration device, and therefore as a substitute for extensive information-gathering and processing behavior to achieve integration in differentiated teams. This gives

Hypothesis 4: The locus-of-control diversity of a team increases the extent of team information-gathering behavior and informed decision-making especially for teams without a leader.

Finally, if we assume that team information-processing behavior is an important determinant of decision quality, then the team compositional variables should relate to relevant measures of team performance in similar ways as they do to the information-processing variables. In this context, we focus on three team performance subhypotheses 5a, b and c that follow from Hypotheses 1, 2 and 3, respectively. In so doing, we offer a check of the substantiveness of our primary arguments as to information-processing behavior. This suggests

Hypothesis 5: Team performance is positively affected by (a) mean team internality if the team's locus-of-control standard deviation is low, (b) team locus-of-control diversity, and (c) having a leader if mean team externality is high.

METHODS

Simulation Setting and General Game Procedures

The data for this study are drawn from a large-scale management simulation, called the International Management Competition (IMC). In this game, teams from paricipating organizations lead a fictive firm that competes with four other firms in their industry. The objective is to maximize both current and future profitability, as well as market shares. The IMC is organized yearly by MCC International b.v., a Dutch commercial game developer. In

1994, the year our data were collected, the game was played by individuals in 167 teams / companies, throughout Europe, but mostly in the Netherlands. Over the past 20 years about 25,000 managers have participated in the game. The game was played in small teams (typically about four persons), composed of mainly young managers from commercial or public organizations. Participating costs about € 2,300 (in addition to time consumption), providing an incentive to play seriously. The participating firms generally use the game to train young managers, often as part of their management development program. The IMC is a very elaborate and realistic simulation of a multi-faceted business environment. Teams must find their way amid decisions on personnel and machine capacity, wage levels, efficiency improvements, promotion outlays, price levels, sales force volumes, dividend payments, borrowings, redemptions, quality and efficiency R&D and a host of information on their own results and the actions of competitors. It is the latter category of team decisions that is of focal interest in the current paper.

At the start of the game, groups of five teams are randomly formed by the game's management. Such a group of five teams is the game equivalent of an industry. The industry is where actual competition - with the other four industry members - takes place. The game is played in six 'decision periods', 1 to 6. Each decision period lasts two weeks. At the end of each two-week period, teams have to fax a decision form to the game's management, specifying their decisions for the upcoming period. Subsequently, game management provides a printed summary of a team's results for the current period. This feedback involves a large range of relevant areas, including market shares, profit rates, and financial and stock positions. Important for our current purposes is that it also specifies the specific information that a team has requested on its decision form. After finishing the game, teams are ranked according to their 'criterion score', being a composite measure of market share, profit and the projected sustainability of company results. This score therefore proxies short as well as long-run firm performance. The team with the highest final score wins a business trip to Japan. For a detailed description of the game settings and procedures we refer to van Olffen (1999).

Data Collection and Sample Characteristics

Game management provided us with all the decisions of all teams, as recorded on their decision forms, including the information they requested in each period. This enabled us to see exactly when and how much information was bought by which teams, and whether these information requests appeared to be related to specific decisions. In addition, personal and group structure data were collected through two questionnaires, mailed to all team contact persons who agreed to distribute them among team members. The first questionnaire, A, contained questions relating to the members' backgrounds in terms of age, education, tenure, former work experience and team member familiarity. It also included a validated psychological test, measuring locus of control (Rotter, 1966). After two reminders, we were able to collect data on a total of 273 individuals in 58 complete teams, out of the total of 167 that participated in the 1994 edition of the game. Three months after the start of the game, team members were asked to individually fill out a second questionnaire, B, regarding group processes such as decision rules, emergent leadership and relative participation within the team. The latter was first used to clean up our sample by removing non-active participants. Twenty-one individuals that did not participate according to at least two fellow team members were excluded from the sample. Second, to be able to reliably use the group structure data from questionnaire B, we screened teams for individual non-response and dropped 14 entire teams in which less than two people[4] returned questionnaire B. We thus ended up with a final sample of 44 complete teams (26 %), consisting of 193 'active' individuals. A total of 178 of these people (i.e., 92 %) returned questionnaire B.

As the game originated in the Netherlands, almost all participants in our sample (93 %) are Dutch. In fact, in the 1994 edition of the game 88 percent of the total number of teams was Dutch, the remainder coming from such diverse countries as Belgium, Germany, Greece, Hungary, Slovakia and Switzerland. The sample includes only a small minority of women (13 %), and about 58 percent of team members hold a university degree. Participants' average age

[4] This cut-off point appeared to be an optimum in terms of number of teams retained in the sample and the individual response rate on questionnaire B within the team.

is about 34, ranging from 21 to 55, with modest variation. The typical game participant is therefore a young Dutch male executive with some (about 6 years) in-company business experience. People knew their fellow team members, on average, about two years and only one-fifth ever participated in a management game of this kind before. Teams had an average of 4.39 members (sd = 1.02), ranging from two to seven. A leader was present in 25 teams (57 %).

Dependent Variables

To evaluate the robustness of potential findings we constructed three dependent variables that measure different but related aspects of team information processing, as well as one offering a proxy for team performance. The first information-processing variable is the number of information items bought in each period**.** Teams could buy information on 14 issues each period by marking these items on the decision form. The requested information is subsequently printed on the results feedback form they receive from game management after processing all decisions. Then a new decision period starts. Teams could request so-called internal and external information. The former allows teams to assess the impact of their own actions, such as the consequences of product and process R&D on product quality and efficiency, respectively, and the *ceteris paribus* effect of advertising expenditures on market share. External information provides the team with knowledge of, for instance, competitors' prices, stocks and product quality, and forecasts of demand. We counted the total amount of information items teams bought in each period. In the last decision period (period 6), buying information is futile, as there is no upcoming period; the game ends after processing the period-6 decisions. We therefore only analyzed the number of information items bought in period 1 through 5, yielding 5 (periods) * 44 (teams) = 220 observations. We decided to analyze the number of information items bought instead of the teams' monetary outlays for information because the latter distribution is highly skewed, posing serious estimation problems due to outliers. As mentioned below, the number of items, however, could be analyzed by means of negative binomial regression estimation.

The second and third dependent variables relate to the degree of informed decision-making. The number of information items bought does not inform us about whether or not teams actually use information when making decisions. To assess how informed certain actions are we therefore also analyzed the information teams have at their disposal when they carry out a certain action. As a result, the unit of analysis becomes an observed action, and we are interested in how informed these undertaken actions are. That is, given that a certain manifest action is taken, we look whether or not relevant information was gathered prior to the action in order to support it; we explicitly link actions to prior information requests. We proceeded as follows. First, we selected a set of 16 important different actions in the game (such as decisions on price setting of products, on investment in product quality, on capacity expansion and on advertising outlays) for which very clear prior information requests exist to support them. Of course, in a complex environment like the one simulated in the game, many prior internal and/or external information requests can be used as input to an action. We selected only those that were connected most obviously and directly to certain actions. For instance, prior to an expansion of machine capacity, it makes perfect sense to inquire for the effect it has on the level of fixed costs (internal information request). Similarly, it is then quite obvious to request information on how much capacity competitors have installed (external information request). Several actions may require both internal and external information, others only either one of them. Note that the unit of analysis is an action in a certain decision area, irrespective of the period in which it is taken. We recorded that an action was taken when the respective field on the decision form was filled out. Throughout the game this resulted in a total of 1,076 decisions (actions) for which prior internal information could be relevant and a total of 1,268 decisions for which external information was very salient. The specific actions that were recorded are listed in the first column of the table in the Appendix.

Before we can move on to describe how we determined whether or not each of these specific actions were pre-informed, it is necessary to explain an important difference in the nature of internal versus external information. Internal information allows teams to assess the marginal effect of certain actions. By buying this information teams can estimate the underlying causal relationship between, e.g., advertising and market share. This means that once a few, say 3 or 4, points on the effect curve have been obtained, the team has a fair idea of how an instrument works, implying that more information does not add a lot. Note that the effect of various levels are fixed in time, i.e., the effect curves do not change during the game, so that internal information is additive: each new piece of information (i.e., each effect level) complements the information on effects that was received in earlier periods. Thus, the value of past information remains intact. This contrasts with external information because the latter's content changes each game period as competition develops. This means that only the information requested one period earlier (and received at the moment a decision is made) is relevant in taking a certain action. For instance, if a team raises its wage level, this action should ideally be supported by information on the current wage level of competitors, so they should have requested this information one period earlier. So, with internal information all previously requested information remains valid as input in new actions, whilst external information is only valid for one period and 'should' be updated (i.e., requested) at least each time an associated action is taken. As a result, the difference between the two types of information should be taken into account if we are to ascertain whether or not specific actions were backed up by previous information-gathering behavior. With external information we need to look only one period back in time; with internal information we need to look at all previous periods to see how much information was already gathered. We therefore measured two distinct dependent variables with respect to informed decision-making.

The second independent variable has to do with the degree decision-making is informed by internal information. To assess the degree to which an action is informed we counted the total number of previously (i.e., in any period) collected internal information items salient for a focal action/decision (see the second column of the Appendix' table for the match between actions and relevant information items). We divided this by the maximum possible amount of information items that could have been obtained by then. This division was made to control for an artificial positive dependency on time as the number of internal information items gradually builds up when the game proceeds. The resulting measure represents the percentage of the maximum obtainable information a team had in possession prior to a decision. This measure can theoretically range from 0 (no information at all) to 1 (all possible information in possession). The distribution of this 'continuous' variable departed, again, very strongly from a normal distribution. For analytical purposes, we therefore transformed this variable by coding an action as informed (= 1) if it was backed up by at least two-thirds of the maximum obtainable information at that point in time, and as 'uninformed' (= 0) otherwise. This allowed us to use more robust, logistic regression estimation techniques.

The third independent variable pertains to the degree decision-making is informed by external information. With externally informed actions, the procedure was much more straightforward. If we registered one of the actions, we looked whether ('1') or not ('0') that particular action was preceded one period earlier by the corresponding information request (see also the second column in the Appendix' table for the relevant information items).

Finally, the fourth dependent variable – a team's financial performance – is measured in terms of return of equity. This is an oft-used and straightforward profitability measure, in practice and research, which was central to game management's assessment of the teams' relative performance. Return on equity is measured in each period. According to standard accounting practice, return on equity is defined as profit after tax divided by balance sheet equity.

Independent Variables

Individual locus-of-control perceptions were measured with a Dutch translation of the well-known and widely used Rotter scale (Rotter, 1966). It contains 37 forced-choice items, 23 of those items measuring control expectancies and 14 being filler items. Respondents have to choose between an internal and an external control alternative. The following pair of statements provides an example: "Many times I feel that I have little influence over the things that happen to me" (external control alternative) and "It is impossible for me to believe that chance or luck plays an important role in my life" (internal control alternative). The total so-called 'Rotter score' is obtained by summing the number of external control alternatives chosen (with a minimum of 0 and a maximum of 23). As a result, a high Rotter score corresponds to an external locus of control, whereas a low score indicates an internal locus of control. The translated scale we used contains 14 filler items to make the purpose of the test more obscure. The reliability and validity of this Dutch translation were repeatedly demonstrated (Boone et al., 1990; Boone, 1992; De Brabander et al., 1992; Boone & De Brabander, 1993). Non-Dutch and non-Flemish teams received a version that was translated in English and checked by native speakers. Coefficient alpha of the scale in our sample was .68, which concurs with internal consistencies reported by Rotter (1966) and Robinson and Shaver (1973). Alpha's value is above the lower limits of acceptability (Nunnally, 1978). Two team composition variables were composed: the mean of the members' Rotter scores and the standard deviation of the scores within the team. For the sake of clarity with respect to interpreting the estimates of our coefficients (see below), the team average was centered around the sample's mean.

In order to identify whether or not team leadership was present within the team, we asked all team members (in questionnaire B) whether there was someone within the team who, perhaps unintentionally or informally, took the lead in the way the team decided about how to play the game. If yes, the initials of that team member were asked. Based upon these identifications we calculated for each individual the following ratio: # times identified as leader by other team members / maximum possible number of identifications (= team size – 1). Team members that scored at least 50 percent on this measure were identified as a leader. This procedure yielded unique leaders in 25 teams. This identification was further validated, using a check item in questionnaire B, by the fact that fellow team members rated leaders significantly higher than non-leaders on their (relative) influence on decisions within the team (measured on a five point scale ranging from 'no influence' to 'a lot of influence'). The average individual influence score equals 3.38 (sd = .64, n = 168) for non-leaders, and 4.13 (sd = .48, n = 25) for leaders [t-value(191) = 5.65, $p < .001$]. Note that leaders also appear to be significantly more internal than non-leaders. The average Rotter-scores are 8.08 (sd = 2.06, n = 25) and 9.71 (sd = 3.65, n = 168) for leader and non-leaders, respectively [t-value(191) =

3.26, p < .01]. The latter finding is consistent with earlier research showing that emergent leaders in groups tend to be more internal than non-leaders (Anderson & Schneier, 1978).

Control Variables

We controlled for team size by counting the total number of active participants in a team. Additionally, game period dummies were used in order to control for between-period variation in the dependent variables. Finally, as information-processing behavior could be related to team differences in prior knowledge, experience and motivation, we inserted the following proxies in our models in order to control for these potential alternative explanations: (1) a dummy indicating whether or not the team is composed on a voluntary basis (i.e., dummy is coded 1 if 75 % or more of the members indicate that the team is composed on a voluntary, and 0 otherwise), (2) the average number of years that team members are acquainted, (3) the average number of hours worked together as a team in each decision period, (4) the proportion of team members having experience in playing similar games, and (5) the proportion of team members with a university degree.

Estimation Procedure

With respect to the dependent variable # of information items, the structure of the data is a pooled cross section and time series as the teams could buy information in each round (n = 220; 44 teams * 5 periods). The widely used fixed-effect estimator cannot be applied because our main independent variables do not change over time. In addition, the dependent variable is not normally distributed. Inspection of the frequencies shows that this count variable follows a Poisson distribution with overdispersion (i.e., the variance is larger than the mean). In that case, a common solution is to estimate a negative binomial model. Following Baron et al. (2001) we used the method of generalized estimating equations (GEE) developed by Liang and Zeger (1986), which generalizes quasi-likelihood estimation to the panel-data context. Pooled data generally exhibit autocorrelation as the same entities (in this case teams) are observed several times. GEE allows one to take into account different autocorrelation structures, requiring us to specify a so-called working correlation matrix. In our analyses presented below, we assume first-order autocorrelation. We also estimated models assuming other autocorrelation structures, e.g., by specifying a completely unstructured working correlation matrix (not shown here). The results of these models are almost exactly the same as the ones reported here. Because the observations within the teams cannot be assumed to be independent, we also report robust standard errors, using the so-called sandwich estimators developed by Huber (1967) and White (1982) (see also Baron et al., 2001). Models were estimated using the XTGEE routine of version 6.0 of STATA (StataCorp, 1999).

The level of analysis of the other two information-processing dependent variables (i.e., internally informed decision-making and externally informed decision-making) is the decision and actually not the team (n = 1076 and n = 1268 decisions, respectively).[5] The appropriate technique to analyze these binary dependent variables is standard logistic regression, predicting the likelihood that a decision is either (internally or externally) informed or not. We used the LOGIT routine of the same statistical package to estimate the coefficients (StataCorp, 1999). Again, because the team observations cannot be assumed to be independent, the standard errors of the coefficients are corrected for clustering on the teams by using the Huber/White sandwich estimator of variance.

Finally, we ran the same models as those presented above on the pooled return on equity time series of the teams (n = 264; 6 periods * 44 teams). As return on equity is a continuous, normally distributed variable, we could apply the widely used Feasible Generalized Least Squares (FGLS) estimator (Kmenta, 1986). Specifically, the coefficients of the model were estimated by means of Ordinary Least Squares on the data corrected for first-order autocorrelation and heteroscedasticity among panels [XTGLS routine of version 6.0 of STATA (StataCorp, 1999)]. Because of these corrections, R-squares cannot be reliable interpreted (Kmenta, 1986). We therefore used and report Wald-chi-square statistics, which compare the goodness of fit of the specific models with a model containing only a constant.

[5] Note that because teams take several decisions in a given period, the usual pooled-data estimation techniques cannot be applied.

RESULTS

The descriptive statistics of the variables under study are reported in Table 1. The teams consist of four members, on average, and show considerable variation in terms of their locus-of-control composition (both mean and standard deviation). The variance of the dependent variables is large, too, making it interesting to try to explain the differences.

INSERT TABLE 1 ABOUT HERE

In Tables 2, 3 and 4 the regression estimates of the three information-processing dependent variables – # of information items, internally informed decision-making, and externally informed decision-making – are presented. In each table four models are presented: Model 1 shows main effects only, Model 2 includes the interaction of mean locus of control with its standard deviation, in Model 3 the interactions with team structure (i.e., having a leader) are inserted, and Model 4 contains the three interaction effects simultaneously.

INSERT TABLES 2, 3 AND 4 ABOUT HERE

Looking at the three Models 1 first, we see that neither any of the main effects of the locus-of-control mean nor those of their standard deviations are significant. If we stopped here, we would have to conclude that team composition in terms of locus of control does not matter with respect to information-gathering and processing behavior. However, the other models show that this conclusion is much too precarious as each and every interaction effect appears to be significant. As the findings of Models 2, 3 and 4 are very similar, we focus on the most comprehensive Model 4 in the remainder of our discussion. Note in advance that the findings for the three information-processing dependent variables are almost exactly the same, lending robustness to our results and conclusions.

Hypothesis 1 is clearly confirmed as the regressions of Model 4 on each of the three information-processing dependent variables show: (1) a significant negative effect of the mean locus-of-control variable (*Avloc*), and (2) a significant positive effect of the product of the mean and the standard deviation (*Avloc * Sdloc*; see Tables 2, 3 and 4). Note that the coefficient of *Avloc* estimates the impact of the mean locus of control when the team standard deviation is zero and the team has no leader. So, internal homogeneous teams with no leader gather more information and are more inclined to make internally and externally informed decisions. However, this effect shrinks as the standard deviation increases. This follows from the positive and significant effect of the product term *Avloc * Sdloc*. To illustrate the nature of this interaction, we plotted the predicted value of the *number of information items* requested as a function of mean locus of control for different values of the team standard deviation in Figure 1.[6] The estimates of Model 4 are used for this purpose.

INSERT FIGURE 1 ABOUT HERE

Figure 1 reveals that the estimated interaction between *Avloc* and *Sdloc* is non-monotonic. That is, an increase in the within-team standard deviation lowers the number of information items requested by teams with a low mean (i.e., internal teams). The opposite appears to be the case for teams with a high mean (i.e., external teams). This pattern is consistent with our argument that adding external individuals to internal teams, which *ceteris paribus* increases the teams' standard deviation, reduces their information-processing capacity. Conversely, it follows that adding internal individuals to external teams does increase the team's information-processing capacity.

Hypothesis 2 predicted a positive main effect of locus-of-control diversity on information-gathering behavior and informed decision-making. However, as already mentioned above, no significant main effects were detected (see Model 1 in Tables 2, 3 and 4). So we have to reject Hypothesis 2.

Do external teams benefit more from having a leader than internal teams, as predicted in Hypothesis 3? The results are, again, the same for each of the three information-processing dependent variables. Specifically, Model 4 shows that having a leader is positively related to information-gathering behavior and informed decision-making (the coefficient of the variable

[6] The predicted values are calculated at the mean of the other independent variables. The pattern for the two *informed decision-making* variables is similar, and therefore these figures are not reported here. The same two remarks apply to Figures 2 and 3 we present below. To compare teams of low, medium and high locus-of-control average or locus-of-control diversity we calculated the standard deviation of the 44 teams' scores on locus-of-control average and locus-of-control diversity. These standard deviations were 1.59 and 1.23, respectively (see Table 1). "Low" ("High") scores in the figures refer to a value of one standard deviation below (above) the team's locus-of-control average or locus-of-control diversity.

Leader is significant and positive[7]). This finding is consistent with our argument that a leader increases the vertical information-processing capacity of a team. Important for Hypothesis 3 is the significant and positive effect of *Avloc * Leader*, indicating that the impact of having a leader is larger for external teams. So, Hypothesis 3 is clearly confirmed. In Figure 2, we graphically represent the impact of having a leader on the predicted *number of information items* for different values of *Avloc*. It shows that especially teams with a high average locus-of-control score (i.e., external teams) gather more information when having a leader.

INSERT FIGURE 2 ABOUT HERE

As expected, we also find a significant interaction between locus-of-control diversity and having a leader (Hypothesis 4). This is, again, the case for each of the three information-processing dependent variables. The effect of the standard deviation (*Sdloc*), evaluated at the sample's average *Avloc* and for teams without a leader, is significantly positive (see the coefficient of *Sdloc* in Model 4 of Tables 2 and 4). Thus, heterogeneous teams do gather more information and make more informed decisions based on external information when there is no leader. However, the coefficient of *Sdloc * Leader* is negative and very significant, implying that the need for information in heterogeneous teams apparently drops when the teams have a leader. Hence, Hypothesis 4 is clearly confirmed. The effect of locus-of-control diversity on the *number of information items* requested for teams with and without a leader is illustrated in Figure 3.

INSERT FIGURE 3 ABOUT HERE

Figure 3 shows that the interaction between *Sdloc* and *Leader* is non-monotonic. As expected, the impact of locus-of-control diversity follows the line of our prediction in Hypothesis 2 for teams without a leader, i.e., the standard deviation in this specific case is positively related to the number of information items requested. However, the opposite is the case for teams with a leader, which is difficult to explain. Apparently, heterogeneous teams do not need, or at least collect less, information than homogeneous teams when they do have a leader. The latter

[7] Note that this coefficient estimates the effect of having a leader for teams with an average mean-locus-of-control score (as *Avloc* is centered around the sample's average), and for teams with zero heterogeneity (*Sdloc* = 0).

interesting finding also implies that having a leader only stimulates information gathering in homogeneous teams. Maybe this is because it might be more difficult for leaders to structure information processing in heterogeneous than in homogeneous teams.

Finally, to check the substantiveness of our findings, we estimated models explaining the return on equity attained by the differently composed teams in each period (Hypothesis 5). The results are reported in Table 5.

INSERT TABLE 5 ABOUT HERE

Interestingly, the pattern of findings with respect to the impact of the team compositional variables is almost identical to the one presented above (compare Model 4 of the Tables 2 to 5). This suggests that, in the present game setting, information-processing behavior – with its assumed impact on decision quality – lies at the hart of the observed relationships between team locus-of-control composition and performance in terms of return on equity, as one would expect. From Model 4 in Table 5 it follows that internal teams outperform other teams especially when the standard deviation (*Sdloc*) is low. In addition, especially external teams appear to benefit from having a leader. All this is in line with Hypothesis 5.

Note that with respect to the impact of team locus-of-control diversity and its interaction with *Leader*, the coefficients have the same signs as reported in Tables 2 to 4, but are not significant. We can think of two reasons for this finding. First, team financial performance is a more distal dependent variable – determined by many additional factors, such as the behavior of competitors, outside the team's control – than information-processing behavior. Second, we argued that the main benefit of gathering information or having a leader in heterogeneous teams resides in their impact on enhancing convergence of diverging views and attitudes. As both mechanisms mainly serve the purpose of achieving cohesion, they do not necessarily need to improve the quality of decision-making, and ultimately team performance. This might explain why the effect of locus-of-control diversity (and its interaction with *Leader*) on return on equity is not significant. To check the plausibility of these assertions we performed two tentative, exploratory post-hoc analyses. In questionnaire B we asked every team member to indicate whether or not the prevailing method used to make team decisions during the game was by means of consensus. We created a variable *Consensus* indicating teams in which 75 % or more of the members agreed that the consensus method was used. As the teams are composed of professional managers, it is not surprising to find that a large majority of teams actually used the consensus method (average of *Consensus* = .82, and n = 44). Despite this restriction in range we nevertheless checked whether or not having information or a leader increases the likelihood of using the consensus method, especially in heterogeneous teams. We ran two logistic regressions with *Consensus* as the dependent variable. The independent variables are *Sdloc*, the average number of requested information items (*Info*) and *Sdloc* * *Info* in Equation 1, and *Sdloc*, *Leader* and *Sdloc* * *Leader* in Equation 2. In both regressions we controlled for *team size* [due to the limited number of observations (i.e., 44) we did not insert other control variables]. Important for the present discussion is that the coefficients of both interaction terms are positive (i.e., B = .05, sd = .05, ns for *Sdloc* * *Info*, and B = 1.99, sd = 1.11, $p < .05$ for *Sdloc* * *Leader*), implying that gathering information or having a leader tends to increase the likelihood of reaching consensus when teams are heterogeneous with respect to locus of control. These tentative findings are at least consistent with the assertion that both mechanisms are important ways to reach convergence despite diversity.

DISCUSSION AND APPRAISAL

The aim of this study was to contribute to the recent stream of group composition research by explicitly recognizing and modeling the complexity of the relationships between team characteristics and outcomes. Specifically, we followed the plea articulated in recent reviews to explicate the exact conditions under which the impact of group compositional variables will emerge. By doing so, this study contributes to understanding the fundamental, but poorly understood question as to <u>when</u> group composition actually matters. We focused on the locus-of-control composition of decision-making teams, including two important interaction effects: (1) the interaction of the team's mean and standard deviation, and (2) the interaction of both the mean and the standard deviation with the leadership structure of the group. The importance of these moderators was illustrated by testing hypotheses on data obtained from 44 management teams in a business game environment. In this specific case we adopted an information-processing view of team decision-making, and argued that the information-processing behavior of teams depends on their composition in terms of the locus-of-control trait of the team members. The main findings and contributions of our study can be summarized as follows.

On a general level, the empirical results clearly confirm the necessity to go beyond simple main effects of compositional variables. In fact, analyzing main effects only would have led us to conclude that team composition does not matter. Including the basic moderator variables, however, significantly and consistently increased the explanatory power of our models. The findings underscore the importance of carefully considering the aggregation rules one uses to derive team composition variables (Chan, 1998). Specifically, when theories describing behavior at the individual level are invoked to predict outcomes at the team level, one needs to recognize that the mean of a certain characteristic is not adequate to predict team behavior. In fact, the impact of the mean will depend on the diversity of that characteristic within the team (and, as interactions are symmetric, also *vice versa*). Additionally, the findings confirm that the impact of the team composition variables delicately depends on the leadership structure of the group. Taken together, we conclude that team composition data are probably under-analyzed. It is likely that many non-significant findings in previous research are due to the omission of important moderators. In addition, 'hidden' moderators might also account for the many inconsistencies that have been found in prior work. This is nicely illustrated by our finding that diversity in locus of control increases information-search behavior for teams without a leader, but decreases it when teams have a leader.

As the present study is one of the very few that focuses on team composition in terms of locus of control, our main findings also contribute to locus-of-control research (in a team context) in two ways. First, the well-documented fact that internal individuals are better at information processing than external individuals appears to be true at the group level of analysis as well. Specifically, adding internals to a team (without increasing the standard deviation) increases the information-processing capacity of the team, resulting in more information-gathering behavior and better-informed decision-making. Second, the findings show that a leader might serve as a substitute for the relatively low information-processing capacity of external teams. In fact, external teams clearly benefit from having a leader, in terms of both information processing and team performance. These findings have interesting implications for managerial practice because they suggest the importance of fitting group processes and structure with the personality of the team's members. Analogous to traditional contingency theory, there does not seem to be a best way to organize the structure of a team. With respect to locus of control, it is important to create within-group settings that naturally fit with the needs and capacities associated with the deep-level characteristics of team members. When members have an internal locus of control, self-organization is likely to lead to superior team performance. If, however, most members have an external locus of control, the structuring of the task and decision situation seems to be very important. As a result, an important road to improved team effectiveness appears to be the design of what could be called 'natural' team configurations – natural in the sense that external members actually like to work in structured situations, while internals prefer uncertainty and individual agency. Building such configurations might lead to the achievement of a remarkable equilibrium outcome in which team effectiveness, member well-being and satisfaction overlap. Note that all this also suggests that managers do have more degrees of freedom with respect to enhancing team effectiveness than originally follows from team composition research. That is, the difficult task of composing optimal teams by means of the careful selection of members with specific characteristics can be circumvented by designing team structures that fit with a given team composition.

Finally, our study contributes to team diversity research. Recent studies have suggested that especially differences with respect to deep-level characteristics might undermine team performance because they tend to trigger affective conflicts not instrumental for effective task performance (Harrison et al., 1998; Jehn et al., 1999). In addition, conflicts resulting from deep-level differences, contrary to those resulting from overt characteristics triggering stereotyping, probably do not disappear with the passage of time (Harrison et al., 1998). However, our finding that team locus-of-control diversity probably increases the need for information especially in teams without a leader, suggests two important ways to alleviate the potential problems resulting from deep-level diversity. Specifically, either providing objective task information to or appointing a leader in heterogeneous teams might help to close the gaps between the members.

We also want to point to some interesting avenues for further research. First, the promising findings of the present study indicate that the plea of Priem et al. (1999) to stop sacrificing construct validity for reliable measurement of demographic characteristics is clearly justified. Future research would, therefore, do well to focus on other substantive personality characteristics and underlying values of team members in order to increase the explanatory power of team compositional models. Many interesting deep-level characteristics have not yet been studied in a team context, such as sensation seeking (Zuckerman, 1979), self-monitoring (Snyder, 1974) and fundamental value orientation (Schwartz & Bilsky, 1990). Differently composed teams in terms of these fundamental characteristics are likely to produce different outcomes. It is clear, however, that the outcomes under study should carefully be selected and adapted to the chosen characteristics in a meaningful way. As Priem et al. (1999) have put it: a focus on substantive dimensions requires adaptations in theory prescription. Team processes are probably far too complex to build general theories with respect to the impact of team compositional variables.

Second, in those cases where past researchers incorporated moderator variables in their design, they mainly focused on external contingencies. For instance, studies have tested whether or not the benefits of team diversity are larger in dynamic compared to stable industries (see, for instance, Bantel & Jackson, 1989; Halebian & Finkelstein, 1993; Hambrick et al., 1996). Surprisingly enough, the number of studies focusing on internal (to the team) contingencies, such as in the present study, is extremely limited. Our findings, however, illustrate the saliency of this type of moderators. Many other important basic internal contingencies, which directly impinge on the needed distribution of attitudes, skills and knowledge in a team, deserve more attention, such as the characteristics of the task (see, e.g., Jehn et al., 1999), the distribution of power within the team (Priem et al., 1999) and the division of labor within the team. To illustrate the importance of such variables we give an example of the latter. We expect that an organization with a functional type of departmentalization would benefit a lot from being managed by a top management team with high functional background diversity. However, a multidivisional organization might benefit from having many general managers, each responsible for a business unit, in its top management team, implying low functional background diversity. We think team composition research would benefit a lot from such an approach because its value for managerial practice, which is considered to be low for the moment (Priem et al., 1999), would clearly increase. This is because variables such as team structure and division of labor are amenable to managerial design. Systematic studies of this kind would help managers build sustainable team configurations for effective performance.

Finally, we like to end the paper with mentioning a limitation of the present study. We acknowledge that our conclusions are based on data obtained from a business simulation game, which inevitably reduces the external validity of our findings. We nevertheless opted for this approach as a first step for pragmatic reasons. First, personality data of entire teams are difficult to collect in the field, especially in the realm of (top) management teams. This is probably why so few studies exist in this area focusing on deep-level characteristics. Second, the simulation environment allowed us to map the information-processing behavior to actual decisions in a detailed way, which is in all likelihood undoable in a field setting. We believe, however, that the advantages of having team personality data and detailed objective information on actual team behavior outweigh the disadvantage of reduced external validity. In this respect, we agree with the observation of Plott (1988) that an experiment (in the present case a simulation) is always a fair test of a theory because if the theory is correct it should also hold in a laboratory setting. Conversely, if it is falsified in relatively controlled settings, there is surely something wrong with the theory. Notwithstanding these disclaimers, we are currently collecting field data in order to test the usefulness of the present approach in real top management teams.

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APPENDIX

Actions and associated preceding information requests

Action taken at t*	Preceding internal information request(s) on t<t*
1. Product quality improvement expenditure 2. Efficiency improvement expenditure 3. Expansion of machine capacity 4. Promotion expenditure on • Market 1 • Export market • Market 2 • Market 3	1. Effects of product quality improvement on market share lead 2. Effects of efficiency improvement on product costs and raw materials use per unit 3. Effects of expansion on fixed costs 4. Effects of promotion expenditure on • Market 1 share lead • Export market share lead • Market 2 share lead • Market 3 share lead

Action taken at t*	Preceding external information request(s) on t*-1
1. Price change on all markets 2. Maximum allowable price change on any market 3a. Expansion of machine capacity (1) 3b. Expansion of machine capacity (2) 4. Promotion expenditure on any market 5. Product quality improvement expenditure 6. Expansion of sales groups 7. Improvement of working conditions 8. Wage raise	1. Competitor price levels 2. Competitor price levels 3a. Competitor installed machine capacity 3b. Estimated future market demand 4. Competitor promotion outlays 5. Competitor quality levels 6. Competitor number of sales groups 7. Competitor working conditions 8. Competitor wage levels

Table 1: Descriptive statistics

Variables	Mean	SD	Minimum	Maximum	# of observations
Controls					
Team size	4.39	1.02	2	7	44
Team voluntarily composed	.80	.41	0	1	44
Average # of years acquainted	2.02	1.63	.28	7.33	44
# of hours worked as a team per period	3.13	1.54	.92	8.50	44
Proportion of team members with game experience	.22	.26	0	1	44
Proportion of team members with university degree	.60	.35	0	1	44
Independents					
Team average Loc	9.43	1.59	5.5	12.25	44
Heterogeneity Loc	3.34	1.23	0	6.08	44
Leader (0-1)	.57	.50	0	1	44
Dependents					
# of information items	5.00	3.55	0	14	220
Informed decision (internal information; 0-1)	.21	.41	0	1	1076
Informed decision (external information; 0-1)	.43	.50	0	1	1268
Return on equity	1.45	4.05	-9.97	14.38	264

Table 2: Negative binomial regression estimates of the number of information items requested in each period (1 to 5)[a, b, c]

Variables	Model 1	Model 2	Model 3	Model 4
Constant	1.84* (.84)	1.11# (.68)	.42 (.80)	.06 (.73)
Period 2	-.27** (.08)	-.28** (.09)	-.29** (.08)	-.29** (.08)
Period 3	-.27** (.11)	-.28** (.12)	-.32** (.11)	-.32** (.12)
Period 4	-.40** (.09)	-.40** (.09)	-.41** (.09)	-.41** (.09)
Period 5	-.46** (.10)	-.47** (.10)	-.50** (.10)	-.50** (.10)
Team size	.05 (.11)	.13# (.10)	.12# (.09)	.17* (.08)
Team voluntarily composed	-.03 (.21)	-.03 (.19)	-.19 (.18)	-.21 (.18)
Average # of years acquainted	-.11# (.07)	-.07 (.07)	-.07 (.06)	-.04 (.06)
# of hours worked as a team per period	-.008 (.06)	-.007 (.05)	-.04 (.05)	-.06# (.04)
Proportion of team members with game experience	.31 (.33)	.33 (.36)	.56* (.28)	.59* (.27)
Proportion of team members with university degree	-.42# (.28)	-.11 (.27)	-.22 (.25)	-.02 (.24)
Team average Loc (deviation around sample mean; Avloc)	-.02 (.08)	-.44** (.16)	-.17# (.11)	-.49** (.14)
Heterogeneity Loc (Sdloc)	.02 (.09)	.06 (.09)	.36** (.12)	.36** (.11)
Leader (0-1)	.32* (.18)	.15 (.17)	2.24** (.52)	1.95** (.43)
Avloc * Sdloc		.12** (.04)		.10** (.02)
Avloc * Leader			.39** (.13)	.34** (.13)
Sdloc * Leader			-.60** (.15)	-.56** (.13)
Model Wald Chi-square	47.13**	52.10**	136.23**	181.29**

[a] The General Estimating Equation (GEE) method is used to estimate the parameters of the General Linear Models (GLM). First-order autocorrelation is assumed within *i* (i.e., within-panel serial correlation).
[b] Robust standard errors are reported in parenthesis (based on the Huber/White/sandwich estimator of variance to take into account that the observations within the teams cannot be assumed to be independent).
[c] # p < .10, * p < .05 and ** p < .01 (one-sided); N = 220 (5 periods (1-5) * 44 teams).

Table 3: Logistic regression estimates of the likelihood of informed decision making (internal information)[a, b, c]

Variables	Model 1	Model 2	Model 3	Model 4
Constant	1.84 (2.25)	-3.77 (2.01)	-1.07 (1.99)	-2.99# (2.10)
Period 3	-2.39** (.37)	-2.73** (.39)	-3.09** (.41)	-3.34** (.51)
Period 4	-2.22** (.43)	-2.48** (.43)	-2.80** (.44)	-3.00** (.49)
Period 5	-3.47** (.40)	-3.85** (.49)	-4.27** (.46)	-4.59** (.61)
Period 6	-5.07** (.51)	-5.51** (.58)	-6.08** (.45)	-6.41** (.58)
Team size	-.29 (.33)	.01 (.32)	.02 (.34)	.26 (.36)
Team voluntarily composed	1.27# (.97)	1.04 (.89)	.12 (.88)	.14 (.75)
Average # of years acquainted	-.99** (.27)	-.99** (.27)	-.74** (.24)	-.72** (.25)
# of hours worked as a team per period	-.28# (.18)	-.48** (.18)	-.54** (.21)	-.63** (.18)
Proportion of team members with game experience	5.37** (1.41)	6.60** (1.56)	7.07** (1.28)	7.87** (1.49)
Proportion of team members with university degree	.75 (.88)	1.87* (1.00)	1.91* (1.01)	3.01** (1.20)
Team average Loc (deviation around sample mean; Avloc)	-.39# (.25)	-1.93** (.48)	-1.31** (.36)	-2.71** (.64)
Heterogeneity Loc (Sdloc)	-.06 (.29)	.22 (.24)	.49# (.37)	.61* (.36)
Leader (0-1)	-.06 (.60)	-.97# (.66)	5.46** (1.73)	3.90** (1.42)
Avloc * Sdloc		.43** (.12)		.40** (.12)
Avloc * Leader			1.98** (.49)	1.96** (.49)
Sdloc * Leader			-1.64** (.49)	-1.41** (.39)
Model Log likelihood	-342.56	-312.24	-289.98	-269.89
Pseudo R-square	.39	.44	.48	.52

[a] Logistic regression estimates are reported.
[b] Robust standard errors are reported in parenthesis (based on the Huber/White/sandwich estimator of variance to take into account that the observations within the teams cannot be assumed to be independent).
[c] # p < .10, * p < .05, and ** p < .01 (one-sided); N = 1076 (total # of team decisions for which internal information could be collected).

Table 4: Logistic regression estimates of the likelihood of informed decision making (external information)[a, b, c]

Variables	Model 1	Model 2	Model 3	Model 4
Constant	.17 (1.45)	-.59 (1.26)	-1.36 (1.36)	-2.03# (1.29)
Period 3	-.23# (.15)	-.23# (.16)	-.25# (.16)	-.25# (.16)
Period 4	.23# (.17)	.20 (.17)	.21 (.18)	.19 (.18)
Period 5	.02 (.17)	.02 (.18)	-.04 (.18)	-.03 (.18)
Period 6	-.23 (.18)	-.22 (.18)	-.31# (.19)	-.30# (.19)
Team size	-.05 (.19)	.07 (.18)	.03 (.17)	.12 (.16)
Team voluntarily composed	-.02 (.37)	-.10 (.35)	-.33 (.35)	-.36 (.34)
Average # of years acquainted	-.18# (.12)	-.15 (.12)	-.11 (.11)	-.08 (.11)
# of hours worked as a team per period	-.06 (.11)	-.09 (.11)	-.12 (.10)	-.14# (.09)
Proportion of team members with game experience	1.34* (.68)	1.41* (.71)	1.80** (.64)	1.75** (.64)
Proportion of team members with university degree	-.63 (.51)	-.33 (.51)	-.50 (.51)	-.22 (.50)
Team average Loc (deviation around sample mean; Avloc)	-.05 (.14)	-.68* (.33)	-.31# (.20)	-.83** (.28)
Heterogeneity Loc (Sdloc)	.07 (.16)	.12 (.14)	.47** (.19)	.52** (.18)
Leader (0-1)	.31 (.33)	.05 (.31)	3.16** (.96)	2.92** (.88)
Avloc * Sdloc		.18** (.08)		.16** (.06)
Avloc * Leader			.68** (.27)	.63** (.27)
Sdloc * Leader			-.87** (.27)	-.86** (.24)
Log likelihood	-834.48	-819.36	-801.89	-791.53
Pseudo R-square	.04	.06	.08	.09

[a] Logistic regression estimates are reported.
[b] Robust standard errors are reported in parenthesis (based on the Huber/White/sandwich estimator of variance to take into account that the observations within the teams cannot be assumed to be independent).
[c] # p < .10, * p < .05 and ** p < .01 (one-sided); N = 1268 (total # of team decisions for which external information could be collected).

Table 5: Feasible Generalized Least Square estimates of return on equity after each period (1-6)[a, b]

Variables	Model 1	Model 2	Model 3	Model 4
Constant	-2.37# (1.58)	-3.15* (1.52)	-1.89 (1.74)	-3.09* (1.76)
Period 2	-.45 (.47)	-.40 (.47)	-.47 (.47)	-.38 (.47)
Period 3	3.91** (.53)	4.00** (.52)	3.89** (.52)	3.97** (.52)
Period 4	4.44** (.54)	4.44** (.53)	4.43** (.53)	4.47** (.52)
Period 5	4.60** (.54)	4.68** (.53)	4.60** (.53)	4.69** (.53)
Period 6	4.88** (.54)	4.97** (.53)	4.89** (.53)	5.01** (.53)
Team size	.35# (.24)	.47* (.23)	.44* (.23)	.54** (.22)
Team voluntarily composed	-.02 (.46)	-.19 (.44)	-.82* (.49)	-.73# (.48)
Average # of years acquainted	-.09 (.16)	-.01 (.15)	.00 (.15)	.02 (.33)
# of hours worked as a team per period	-.10 (.16)	-.26* (.14)	-.16 (.15)	-.33* (.15)
Proportion of team members with game experience	-.37 (.99)	-.11 (.96)	.08 (.95)	.61 (.95)
Proportion of team members with university degree	.03 (.81)	1.17# (.80)	-.04 (.78)	.93 (.80)
Team average Loc (deviation around sample mean; Avloc)	.06 (.17)	-1.44** (.47)	-.42* (.23)	-1.65** (.48)
Heterogeneity Loc (Sdloc)	-.04 (.23)	-.01 (.22)	-.16 (.35)	.01 (.35)
Leader (0-1)	.35 (.47)	-.42 (.48)	1.56 (1.67)	1.37 (1.59)
Avloc * Sdloc		.43** (.12)		.37** (.12)
Avloc * Leader			1.11** (.34)	.92** (.34)
Sdloc * Leader			-.35 (.48)	-.50 (.46)
Model Wald Chi-square	180.46**	202.39**	199.54**	216.97**

[a] FGLS estimates are reported with correction for first-order autocorrelation (common to all panels) and heteroscedasticity among panels.
[b] # $p < .10$, * $p < .05$ and ** $p < .01$ (one-sided); N = 264 (6 periods * 44 teams).

Figure 1

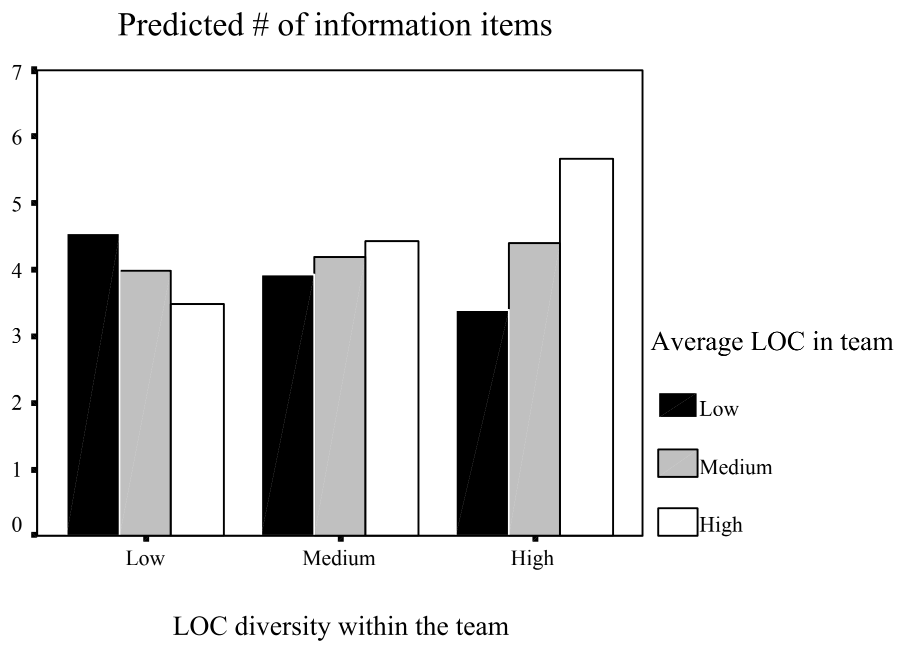


Figure 2

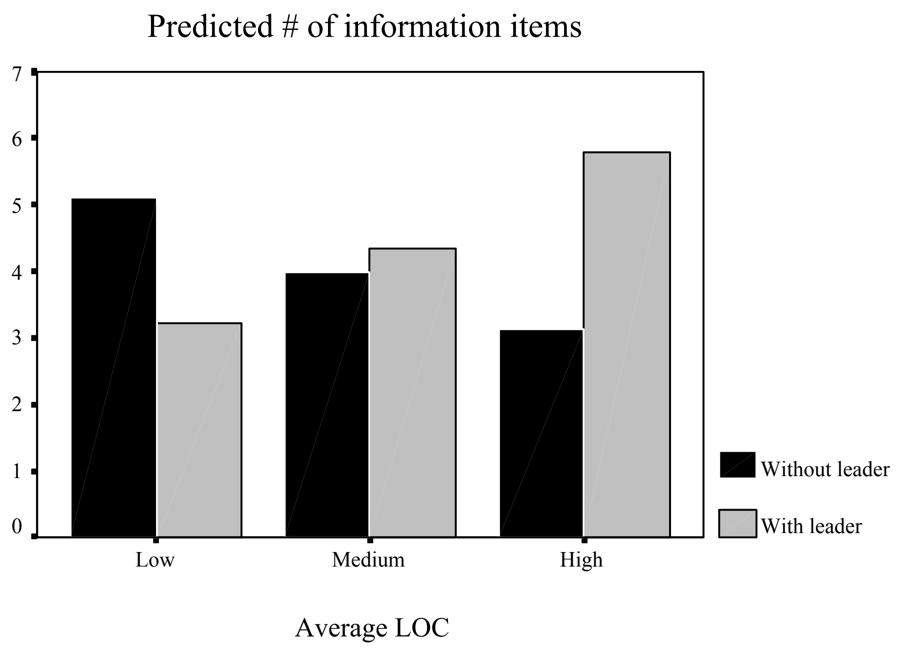
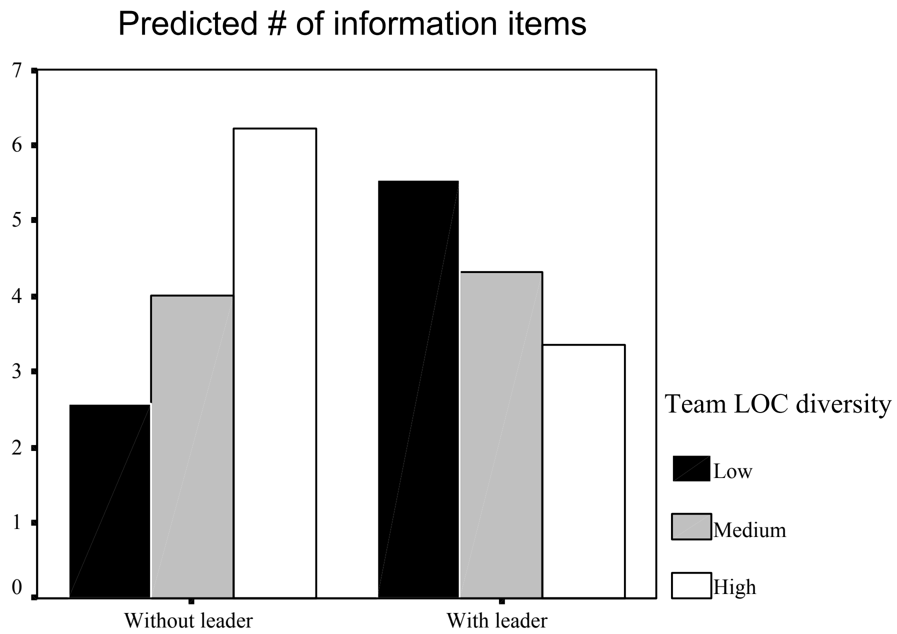


Figure 3


Predicted # of information items
7
6
5
4
3
2
1
0
Without leader
With leader
Team LOC diversity
Low
Medium
High