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TOP MANAGEMENT AND INNOVATIONS IN BANKING: DOES THE COMPOSITION OF THE TOP TEAM MAKE A DIFFERENCE?

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The relationship between the social composition of top management teams and innovation adoptions was examined in a sample of 199 banks. The following characteristics of top management teams were examined: average age, average tenure in the firm, education level, and heterogeneity with respect to age, tenure, educational background, and functional background. In addition, the effects of bank size, location (state of operation), and team size were assessed. Results indicate that more innovative banks are managed by more educated teams who are diverse with respect to their functional areas of expertise. These relationships remain significant when organizational size, team size, and location are controlled for.

During the 1980s the ability of U.S. businesses to innovate has become a topic of national concern. Many observers believe that, to be successful in global competition, U.S. firms will need to continually revise and improve their products, services, and operations, and even their ways of managing human resources. In other words, continuous innovation in all areas of business is being called for. In this paper we examine how the characteristics of organizational leaders relate to their propensity to innovate.

The role organization leaders play in determining firm performance is under debate among organizational theorists. Some view leaders as products of their environments with little power to control structural and systemic factors that determine organizational actions (e.g., Aldrich, 1979; Perrow, 1970). Others view leaders as powerful decision-makers who consciously choose among diverse courses of action, and so determine the fates of their firms (e.g. Weiner and Mahoney, 1981). An intermediate position views leaders as bridging the external environment and their organization, thereby facilitating adaptation to the environment (e.g. Child, 1972; Andrews, 1971). This latter view acknowledges that contextual factors limit viable strategic choices, but assumes they are not fully deterministic.

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We assume leaders act as partially constrained decision-makers who shape and manage their organizations. The question we address is whether the personal characteristics of leaders affect their decision choices. Following Hambrick and Mason (1984), and in contrast to research that focuses on CEOs as solitary decision-makers, we focus on the top management *team* as the unit of analysis. We assume this dominant coalition acts as a decision-making unit for the organization. The decisions of particular interest are those related to innovation.

To date, research examining the relationship between leaders' personal characteristics and organizational outcomes has taken two different approaches. One approach is to directly assess the psychological attributes of decision-makers and examine their relationship to outcomes. This direct assessment approach has generally been used in studies of CEOs (e.g. Miller, Kets de Vries and Toulouse, 1982; Hage and Dewar, 1973).

Another approach is to assess demographic characteristics (such as age and education), making the assumption that such characteristics are related to cognitive abilities, attitudes, and expertise. When top management teams are the unit of analysis the demographic approach has

the advantage of being more practical than the direct assessment approach; the major disadvantage is that demographic characteristics do not covary perfectly with the psychological attributes of interest (Hambrick and Mason, 1984). This study uses the demographic approach.

INNOVATION

Organizational scientists do not yet agree on a single definition of innovation. Kimberly (1981) describes three usages of the term: innovation as a process; innovation as discrete items, including products, programs, or services; and innovation as an attribute of organizations (i.e. innovativeness). Conceptually, these three uses are compatible with each other. When a firm is described as 'innovative' it generally means that the firm frequently develops (or adopts) innovative products, programs, or services for its own use and/or to sell. In other words, the innovation 'process' culminates with innovation 'items', and firms that cycle through the process relatively frequently are described as 'innovative'.¹

In the present study innovation was operationalized as the number of innovation 'items' (products, programs and services) firms had adopted and/or developed. Because we were interested in differences among firms, we assumed a field-based frame of reference for judging innovativeness; that is, innovations were identified through reference to the state of the art in the industry. Both technical and administrative innovations were assessed (see Daft, 1978; Damanpour and Evan, 1984; Evan, 1966). Technical innovations pertain to products and services, as well as production processes and operations related to the central activities of the organization; such innovations are assumed to originate in the technical cores of organizations. Administrative innovations pertain to changes in the organizational structure and the people who populate the organization; these innovations are assumed to originate in the more peripheral, administrative cores of organizations. Presumably, decisions to invest resources in either technical or administrative innovations are made

by top management (Wilson, 1966; Hage and Dewar, 1973).

TWO PERSPECTIVES FOR PREDICTING A RELATIONSHIP BETWEEN TEAM COMPOSITION AND INNOVATION

Numerous models and descriptions of organizational decision processes exist (e.g. see Daft and Weick, 1984; Hage and Aiken, 1970; Myers and Marquis, 1969; Nutt, 1984; Van de Ven and Ferry, 1980; Zaltman, Duncan and Holbek, 1973). Although these models differ in detail, three general phases of the decision process are commonly represented: (1) problem identification and formulation; (2) exploration, formalization, and problem solving; and (3) decision dissemination and implementation. Personal characteristics of decision-makers may influence each phase of the decision process, but most theory and research relates to the effects of personal characteristics during the phases of problem identification and problem solving. During problem identification and formulation, team members are responding to ambiguous and complex stimuli. Each team member may attend to different cues and construct different understandings about a situation. Consequently, the composition of the decision-making team can determine the information available during problem identification and formulation and the meaning it is given. During the problem-solving phase team composition may influence the number, variety, and quality of solutions generated and considered, as well as the nature of the discussions about alternative solutions.

Specific hypotheses about the relationship between innovation and team composition can be developed using two rather different literatures, one being the psychological literature, which emphasizes the role of cognitive resources in group problem solving, and the other being the organizational demography literature, which emphasizes the role of cohort effects in organization processes.

Cognitive resources

Recent research on group problem solving clearly demonstrates that cognitive resources are a key

¹ Firms may also adopt innovations developed by others. In such cases the preceding process is one of deciding whether to adopt another's innovation.

determinant of group performance (Guzzo and Shea, in press; Yetton and Bottger, 1983; Bottger and Yetton, in press). Cognitive resources can differ in both degree and kind. Regarding differences in degree, the general conclusion is that groups composed of people with higher levels of knowledge and ability perform better on creative problem-solving tasks than groups with lower levels of these resources. Presumably, knowledge and ability facilitate the identification and formulation of problems, as well as the identification and evaluation of feasible solutions.

Regarding differences in kind, the general conclusion is that when solving complex, non-routine problems, groups are more effective when composed of individuals having a variety of skills, knowledges, abilities, and perspectives (Shaw, 1976; Wanous and Youtz, 1986). In other words, cognitive diversity is a valuable resource. The presence of people with differing points of view ensures consideration of a larger set of problems and a larger set of alternative potential solutions. The need to reconcile dissimilar solutions stimulates effective group discussion, prevents 'group-think', and leads to high quality and original decisions (Ghiselli and Lodahl, 1958; Hoffman, 1959; Hoffman and Maier, 1961; Janis, 1972; Hall, 1982; Nemeth, 1985). Indeed, generating such discussion is the primary purpose of structured problem-solving techniques such as devil's advocacy and dialectic inquiry.

Organization demography

Whereas the bulk of empirical evidence from psychological research on groups supports the general conclusion that team diversity is beneficial for groups engaged in complex problem solving, organization theorists have recently emphasized the potential costs associated with heterogeneity, especially heterogeneity with respect to organizational tenure and age. In particular, socialization and integration into the organization occurs as a result of an individual's cohort membership, defined by age and organizational tenure (McCain, O'Reilly and Pfeffer, 1983). People in different cohort groups have different organizational experiences and so may find it difficult to communicate (Roberts and O'Reilly, 1979), which limits the exchange of valuable information. In addition, groups that are heterogeneous in terms of cohort membership are likely to also be

heterogeneous with respect to attitudes and values, so these groups may experience more interpersonal conflict (cf. Byrne, 1961; McCain, O'Reilly and Pfeffer, 1983; Pfeffer 1983; Wagner, Pfeffer and O'Reilly, 1984) which, if left unchecked, could hinder the group's ability to function and make effective decisions.

While there is evidence that tenure heterogeneity is associated with turnover in organizations, to date there is very little empirical evidence showing that heterogeneity interferes with creative problem solving. Furthermore, it seems unlikely that there would be great enough diversity among members of top management teams to cause interference in group functioning, given the selection processes that determine membership on such teams. Nevertheless, the demography argument is relevant in that the decreased communication and increased conflict associated with heterogeneity could influence the decision-making process and outcomes of top management teams. Given that organization theorists have advanced arguments that are at times opposite to those that follow from psychological studies of group problem solving, it is appropriate to test for both possibilities in the present study. Therefore, in stating our hypotheses below, we present competing hypotheses when the group problem solving and organizational demography perspectives lead to different predictions.

HYPOTHESES RELATING TEAM COMPOSITION TO INNOVATION

Below we state specific hypotheses about the expected relationship between innovation and each of seven aspects of team composition. For each hypothesis we present a brief rationale and summary of related empirical findings, when they are available.

Age of team members

Average age

There are several reasons to expect younger managers to bring better cognitive resources to decision-making tasks. First, some cognitive abilities seem to diminish with age, including

learning ability, reasoning, and memory (Botwinick, 1977; Burke and Light, 1981). Second, younger managers are likely to have received their education more recently than older managers, so their technical knowledge should be superior. Third, younger managers have been found to have more favorable attitudes toward risk-taking (Vroom and Pahl, 1971).

Hypothesis 1: There will be a negative association between innovativeness and the average age of the members of the top management team.

Age heterogeneity

Age cohorts are likely to differ in their attitudes, values and perspectives for two reasons. A major reason is that different age cohorts experience different social, political, and economic environments and events, which have a fundamental role in shaping attitudes and values. In addition, perspectives change as a function of the developmental process of aging (Elder, 1975). Assuming that diversity of attitudes and values facilitates group creativity, teams composed of members of diverse ages should be more innovative. However, differences in values and attitudes could result in conflicts that hinder the development of team cohesiveness (see Pfeffer, 1983). Because these alternative lines of argument clearly lead to conflicting predictions about the relationship between innovation and age heterogeneity we will test two opposing hypotheses.

Hypothesis 2a: There will be a positive association between innovativeness and heterogeneity among team members with respect to age.

Hypothesis 2b: There will be a negative association between innovativeness and heterogeneity among team members with respect to age.

Organizational tenure

Age and organizational tenure are correlated in the real world and often confounded in research. It is important to separate the effects of age and tenure because explanations differ for why age and tenure might be related to innovation.

Average tenure

Whereas the average age of team members might affect the level of cognitive ability in a group, the average organizational tenure of team members is more likely to affect their attitudes toward innovation. More tenured executives may have more psychological commitment to the organizational status quo (Alutto and Hrebiniak, 1975; Staw and Ross, 1980; Stevens, Beyer and Trice, 1978) and to organizational values (Schmidt and Posner, 1983). Consequently, change, which is an inherent part of innovation, may be resisted. In addition, long tenure within the same organization may result in insulation and a narrowing of one's perspective (see Katz, 1981, and Pfeffer, 1983).

Hypothesis 3: There will be a negative association between innovativeness and the average organizational tenure of members of the top management team.

Tenure heterogeneity

Like cohort groups defined by age, cohort groups defined by organizational tenure are likely to differ with respect to their experiences and perspectives, as well as their attitudes and values. Again, these differences may benefit the team by adding cognitive diversity and stimulating discussion, and/or the differences may interfere with the communication process and cause dysfunctional conflict (Katz, 1982; Wagner, Pfeffer and O'Reilly, 1984; Pfeffer, 1983). Therefore, we pose two competing hypotheses.

Hypothesis 4a: There will be a positive association between innovativeness and heterogeneity of team members with respect to tenure.

Hypothesis 4b: There will be a negative association between innovativeness and heterogeneity of team members with respect to tenure.

Educational background

Average education level attained

Assuming attained education level is correlated with cognitive ability, higher levels of education should be associated with a team's ability to generate (and implement) creative solutions to complex problems. Their ability to generate

creative solutions may explain why people who are more educated have more receptive attitudes toward innovation (Kimberly and Evanisko, 1981; Rogers and Shoemaker, 1971). The association between education and both cognitive abilities and attitudes toward innovation suggests that more innovative firms should have more highly educated top management teams.

Hypothesis 5: There will be a positive association between innovativeness and the average education level attained by members of the top management team.

Major area of study

Considerable evidence shows that the educational curriculum choices people make correspond to their personalities, attitudes, and cognitive styles (Holland, 1976). Furthermore, educational curriculum is associated with job experiences throughout one's career (National Science Foundation, 1963; Miller, 1968). Thus, we would expect teams composed of members who completed dissimilar types of curricula to benefit from the diversity of perspectives team members bring to the problem-solving task.

Hypothesis 6: There will be a positive association between innovativeness and heterogeneity with respect to the education curricula (i.e. major fields studied) of team members.

Functional experience

Managers with differing histories of functional experiences are likely to differ in their attitudes, knowledge, and perspectives (Dearborn and Simon, 1958; Hambrick and Mason, 1984). Differences among managers from different functions may be due in part to differences in their educations, but work experiences in functional areas are likely to further shape cognitive and attitudinal perspectives. These can affect how managers behave at all stages of the innovation process: a person's functional background should affect which problems he or she identifies as important, how these problems are formulated, types of solutions generated, evaluations of alternative solutions, and involvement during the implementation phase. Because creativity and innovation require the combining of facts and

ideas in novel ways, cross-functional communication is generally acknowledged as an important precursor to innovation (Shrivastava and Souder, 1985; Rothwell and Zegveld, 1985).

Hypothesis 7: There will be a positive association between innovation and heterogeneity among team members with respect to their functional background experiences.

CONTROL VARIABLES RELEVANT TO INNOVATION

Before describing the methodology we used to test Hypotheses 1 through 7, we wish to emphasize that our intention is not to examine a complete model of innovation, but rather to examine the role of one potentially important variable—namely top team composition. In testing these hypotheses we acknowledge the role of other variables that may be correlated with innovation and need to be controlled for in this study. These are described next.

Business environment

The environments in which firms compete can differ greatly, with hostile environments generating more demands for innovation in some industries (Myers and Marquis, 1969). In this study we minimized differences among firms with respect to environmental demands for innovation by studying firms in a single industry, namely banking.

All firms in the present study were located within the midwestern region of the United States. Banks are regulated at the state level, and it is likely that the business environments differ significantly across states. For example, some states permit limited interstate banking arrangements, while others prohibit them. Such differences in their business environments probably have implications for the innovations banks develop or adopt. We had no theoretical or practical basis for making *a priori* hypotheses about which states would have the most innovative banks. However, we examine location (State of operation) as a potentially relevant factor to be controlled when testing the relationship between innovation and composition of the top management team.

Organization size

Organization size is generally found to be positively associated with innovation (e.g. Baldridge and Burnham, 1975; Cohen and Mowery, 1984; Rothwell and Zegveld, 1985), although the theoretical reasons for this relationship are not agreed upon. One explanation for the relationship is that innovation requires large investments, which larger firms can better afford. Another explanation is that large size necessitates innovation as a means for coping with the increased uncertainties that accompany growth (Kimberly and Evanisko, 1981). Yet another possibility is that the causal direction is reversed, such that innovation enables and facilitates growth. Although organization size is not of central interest in this study, it is assessed and treated as a control variable when we test the relationship innovation and team composition.

Team size

Finally, the third control variable included in this study was team size. Interestingly, the variable of team size has not received much theoretical attention. However, it is likely that team size is positively correlated with team heterogeneity. A positive correlation is particularly likely to exist when the teams of interest are all relatively small, as is the case in this study. This is because in small teams, an increase of one additional person substantially increases the maximum amount of heterogeneity that is possible within the group.

METHOD

Participants and procedures

The financial services industry, which is undergoing an 'innovation shift' from traditional to non-traditional technologies and markets in response to ongoing deregulation of the industry, was selected for study. The population selected included 460 state chartered and national banks located in six midwestern states (Michigan, Minnesota, Wisconsin, Ohio, Illinois, and Indiana). Only independent banks and main banks (no branch banks) with a minimum of \$50 million in total assets were contacted.

To encourage participation, the Bankers Association from each state was asked to send

CEOs of banks in the target population a letter of endorsement one week prior to the initial contact from the researchers. All six state associations agreed to send letters, although only five actually complied with this request. Following the endorsement letter, a letter stating the purpose of the study and two questionnaires were sent to the 460 CEOs. The CEO was asked to complete one questionnaire and return it to the researchers. The CEO asked the bank's human resources executive to complete a second questionnaire, which was also returned directly to the researchers. Follow-up letters were mailed after 10 days, yielding response rates in the six states that ranged from 29 percent (no endorsement letter) to 62 percent (researchers' home state). Response rates differed significantly by state ($\chi^2 = 6.60, p < 0.05$).

Measures

While developing measures for this study the authors relied upon the opinions of members of the banking industry at several points. Experts interviewed throughout the process included: four CEOs, two strategic planners, five marketing executives, four operations executives, and six human resources executives.

Team composition

Assessing the composition of the top management team involved two steps: *identification* of team members and *description* of their characteristics. Identification of the top team was done by CEOs, who were given the following instructions:

Please think about the members of your top management team and indicate their titles in the spaces below. List those actively involved in decisions pertaining to products & services, marketing, delivery systems & operations, and general management & administration. Only individuals involved in these decisions on an ongoing basis and who have had this role for at least one year should be listed. Please be sure that the titles designate one person only.

This list was forwarded by the CEO to the human resources executive, who provided descriptions of the team members based upon personnel documents. For each team member the following information was collected: (a) year the person

joined the bank; (b) current age; (c) the functional area in which the person had the most experience; (d) education level attained; and (e) major field of study for highest degree earned.

Responses to parts (c), (d), and (e), were made using fixed categories. For (c), functional area, 12 categories were provided (e.g. accounting, sales, information systems, trust). These categories were chosen based upon pretest interviews with bank executives. For (d), education level attained, six categories were provided ranging from 'high school' to 'doctorate'.

For (e), education curriculum (major field of study), a total of 17 categories were provided. Of these, 10 were specific to business (e.g. accounting, finance, information systems) and seven were non-business fields (e.g. social science, law, engineering). Pilot interviews had suggested that bank officers were more likely to have majored in business than in other fields. Therefore, we used a categorization scheme that treats differences between any two business-related topics as equivalent to differences between any particular business major and a major outside of business.

Innovation

In accordance with a dual-core conceptualization of innovation (Evan, 1966; Daft, 1978), two categories of innovation were assessed: technical and administrative. An industry-specific measure of innovation was used. Items were developed based upon interviews with 21 bankers. During these interviews, innovation was defined as a program, product, or practice that was in the early stage of acceptance and use in the industry. Interviewees were asked to generate a list of innovations and then indicate their perceptions of (a) the percentage of banks who had adopted the innovation, (b) customer acceptance, and (c) financial investment required. Innovations that these bank executives believed were extremely rare, or extremely common, or had major drawbacks such as poor customer acceptance or requiring very large financial investments, were excluded. The interviews generated a total of 55 innovation items (see Appendix).

Technical innovation items included innovations in the areas of products/services (10 items), marketing (6 items), computerized retail customer applications (5 items), delivery systems

and operations (6 items), and office automation (7 items). The CEO checked (0 = no; 1 = yes) those which were in use at his bank. An index of technical innovation was formed by summing across the 34 items ($\alpha = 0.87$).

Administrative innovation items covered the areas of staffing (2 items), attitude assessment (2 items), planning (4 items), compensation (10 items), and training (3 items). Because these items involve human resource practices, they were completed by the human resource executive. Again, an index was formed by summing across items ($\alpha = 0.79$). Technical and administrative innovation were correlated in this study ($r = 0.55$).

Finally, a measure of *total innovation* was created by summing across all 55 items ($\alpha = 0.91$). For all analyses we report results for each of these three innovation indices.

Bank size

During pilot interviews, bank executives were asked their opinions about the most appropriate way to assess organizational size in the banking industry. The consensus opinion was to use total assets and liabilities. Using public information sources, banks were classified as one of the following: (a) \$5 billion or more (1.1 percent); (b) \$1 to 4.9 billion (3.7 percent); (c) \$500 to 999 million (10.7 percent); (d) \$300 to 499 million (9.1 percent); (f) \$100 to 299 million (55.6 percent); (g) \$50 to 99 million (19.8 percent). The lower bound values of these categories were used to represent the sizes of banks.

Team size

This was the total number of top team members the CEO listed.

Location

The states in which banks were operating were coded as dummy variables.

Heterogeneity measures

Homogeneity-heterogeneity has been assessed in a number of ways (e.g. Blau, 1977; Taagepera and Ray, 1977; Teachman, 1980). For interval data, Allison (1978) provides a review and

observes that the coefficient of variation (the standard deviation divided by the mean) provides a direct method for obtaining a scale invariant measure of dispersion. It is appropriate for interval level variables with a theoretically fixed zero point and is used here for age and tenure. For the categorical variables, Blau's (1977) index of heterogeneity ($1 - \sum p_i^2$) is used, where p is the proportion of group members in a category and i is the number of different categories represented in the team.²

RESULTS

Descriptive statistics

The top management teams of these banks ranged in size from three to eight members, with average size being 6.30 ($SD = 1.64$). The average age of the 1220 executives on the teams was 45.42 years ($SD = 4.30$). They had been employed at their current firms 14.79 years on average ($SD = 5.57$), and they had an average of 19.79 years of experience in the banking industry. Three types of functional backgrounds were predominant: accounting/finance (18.3 percent), operations (23.2 percent), and lending (34.0 percent). Education levels attained varied considerably, as follows: high school (17.8%), some college (17.8 percent), college degree (31.4 percent), some postgraduate work (10.3 percent), masters degree (20.2 percent), and doctoral degree (2.4 percent). As expected, most of these executives had educations that emphasized a business curriculum (78.7 percent), especially general business (41.8 percent), accounting (12.1 percent), and finance (14.9 percent). The means, standard deviations, reliability coefficients and intercorrelations are presented for all variables in Table 1.

Analyses conducted to test hypotheses 1 through 7

In conducting our analyses we used two alternative models, which we refer to as Model 1 and Model 2. Regression results from these two

² In exploratory analyses we examined the correlations among several alternative indices of heterogeneity, including the coefficient of variation, Blau's (1977) index of heterogeneity and Gini index. Intercorrelations among the different indices were all above 0.95.

models can be thought of as providing estimates of the maximum (Model 1) and minimum (Model 2) amount of variance in innovation that is due to each predictor. For Model 1 analyses, innovation was regressed on the predictor (or set of predictors) of interest only. This analysis procedure is appropriate if one assumes that the predictor(s) of interest is causally prior to all other predictors. For Model 2 a two-step regression analysis was used: all variables except the predictor(s) of interest were entered on the first step and then the predictor(s) of interest was entered on the second step. This analysis procedure is appropriate if one assumes that the predictor of interest (entered on step 2) is causally dependent upon all other correlates of innovation (entered on step 1). Because the design of our study does not allow us to draw conclusions about the causal relationships among predictors of innovation, we present the results for two opposing models. Most likely, 'truth' lies somewhere between the conclusions suggested by these two extremes.

The relationship between top team characteristics and innovativeness

Team composition

The correlation coefficients in Table 1 show that the innovation measures are significantly correlated with six of the seven team composition variables. These correlations are consistent with past research. Innovation is negatively correlated with both average age and average tenure, and it is positively correlated with average education level. As predicted from research on group problem solving, innovation is positively correlated with team heterogeneity with respect to age, education, and functional experience. Only tenure heterogeneity is not significantly correlated with innovation.

Regressing innovation on the full set of seven composition variables, yielded significant ($p < 0.01$) R^2 values of 0.31, 0.27, and 0.26 for total, technical, and administrative innovation, respectively. This is the Model 1 analysis strategy, and it indicates that team composition and innovation are fairly strongly associated. Functional heterogeneity and education level were consistently the most powerful predictors of

Table 1. Means, standard deviations, reliabilities, and intercorrelations for variables assessed in this study

Variables	Means	Standard deviations	Reliabilities	Intercorrelations for variables								
				1	2	3	4	5	6	7	8	9
1 Total innovation	26.36	10.06	0.91									
2 Technical innovation	8.48	4.36	0.87	88								
3 Administrative innovation	18.68	7.11	0.79	88	55							
4 Average age	45.42	4.30	n.a.	-31	-26	-28						
5 Age heterogeneity	0.50	0.31	n.a.	18	11	18	-38					
6 Average tenure	14.79	5.57	n.a.	-27	-23	-25	64	31				
7 Tenure heterogeneity	0.43	0.39	n.a.	02	02	04	-16	16	-31			
8 Education attained	4.01 ^a	0.87	n.a.	42	42	32	-11	-07	-17	-03		
9 Education heterogeneity	0.44	0.17	n.a.	29	28	25	-06	09	-08	12	33	
10 Functional heterogeneity	0.32	0.14	n.a.	31	21	36	-11	10	-13	08	13	27
11 Organization size ^b	1473	508	n.a.	29	30	21	-17	07	-06	-03	32	13
12 Team size	6.30	1.64	n.a.	29	24	29	-21	21	-17	03	08	31
												27

Note: d.f. = 198. Decimals omitted for correlation coefficients. For coefficients greater than 13, $p < 0.05$.

^a Equivalent to a 4-year college degree.

^b Assets, in millions of dollars.

innovation in these analyses: or functional heterogeneity, beta = 0.22, 0.14, and 0.28, for total, technical and administrative innovation, respectively; for education level, beta = 0.31, 0.34, and 0.19, respectively (all p values <0.05). The beta weights for age heterogeneity, average tenure, and tenure heterogeneity were non-significant ($p > 0.50$) in all three equations.

Next, we examined the relationship between team composition and innovation after controlling for other potential predictors of innovation. In this analysis, which is the Model 2 procedure, the control variables of state of operation, organization size, and team size were entered on the first step and the seven composition variables were entered on the second step. One regression equation was computed for each measure of innovation. Detailed results of these analyses are shown in Table 2. In contrast to the Model 1 analysis, this analysis suggests a more modest association between team composition and innovation, with the percentage of variance in innovation ranging from 7 percent for technical innovation to 10 percent for administrative innovation. As reflected by the beta weights shown in Table 2, only education level and functional heterogeneity are significantly associated with innovation.

Table 2. Results of regression analyses estimating the relationship between innovation and top management team composition

Predictors	Total innovation (Beta ^a)	Technical innovation (Beta)	Administrative innovation (Beta)
<i>Step 1: Control variables</i>			
Location (three vectors)	0.14/-0.18/-0.13	0.15*/-0.04/-0.10	0.09/-0.27*/-0.14 ^b
Organization size (log)	0.30**	0.34**	0.19**
Team size	0.07	0.07	0.04
ΔR^2 step 1	0.37**	0.33**	0.27**
<i>Step 2: Team variables</i>			
Average age	-0.07	-0.01	-0.13
Age heterogeneity	0.00	-0.04	0.01
Average tenure in firm	-0.11	-0.14 ⁺	0.01
Tenure heterogeneity	-0.05	-0.05	-0.04
Average education level	0.18**	0.21**	0.10
Heterogeneity of educational specialities	0.07	0.06	0.07
Heterogeneity of functional backgrounds	0.17**	0.06	0.25**
ΔR^2 step 2	0.09*	0.07*	0.10*
R^2 total	0.46*	0.40**	0.37**

* $p < 0.05$; ** $p < 0.01$.

^a Beta weights are for the final equation, after all variables have been entered. These values are the same regardless of whether Model 1 or Model 2 is used to determine the order in which variables are entered.

^b Three betas are shown, one for each vector representing a state of operation.

The relationship between size and innovativeness

Past research has sometimes found that the relationship between organizational size and innovation is curvilinear (e.g. Kimberly and Evanisko, 1981), so we analyzed our results to test for this possibility. Following the procedure of Kimberly and Evanisko, we used a log transformation of organization size. Our data confirm the presence of a positive curvilinear relationship between size and innovation. Significance tests of the differences between the correlations for the linear and curvilinear versions of the size variable indicated significant differences ($p < 0.05$) for each of the three measures of innovation, with the curvilinear relationship being stronger in each case ($r = 0.29$ vs. 0.51, 0.30 vs. 0.51, and 0.21 vs. 0.39, for total, technical, and administrative innovation, respectively). Therefore, in all regression analyses reported, we use the log of size as the predictor variable.

When considered as the sole predictor of innovation, organization size explains significant amounts of variance in total, technical, and administrative innovation (ΔR^2 values = 0.26, 0.26, and 0.15, respectively). However, organization size is also significantly correlated with four

of the seven team composition variables. When organization size is regressed on the team composition variables, the association between size and composition is fairly large ($R^2 = 0.30$, $p < 0.01$). Larger banks have top management teams that are younger (beta = -0.35, $p < 0.01$), more tenured (beta = 0.21, $p < 0.05$), more educated (beta = 0.37, $p < 0.01$), and more heterogeneous with respect to their functional backgrounds (beta = 0.15, $p < 0.05$). Organization size is associated with state of operation also, as described below. Because of the correlation between size and other predictors of innovation, the Model 2 analysis procedure reveals that size explains less variance in innovation when it is entered last in the regression analyses (ΔR^2 values = 0.04, 0.05, and 0.02, respectively). Nevertheless, the beta for organization size is significant for each regression equation shown in Table 2.³

Like organization size, team size is correlated with both innovation and several aspects of team composition. It is also related to organization size, with larger banks having larger top management teams (see Table 1). However, unlike organization size, the betas for team size are not significant when team size is included in the full regression equations (see Table 2), suggesting that team size is neither beneficial nor detrimental to innovation.

Differences in innovativeness as a function of location

Five dummy variables were created to represent the six states included in this study (for an explanation of dummy variable coding, see Cohen and Cohen, 1975, Chapter 5). Results of the Model 1 analyses revealed that, when used as predictors of innovation, the five state vectors accounted for 13 percent of the variance in total innovation, 9 percent of technical innovation, and 12 percent of administrative innovation. For these three regression analyses, two vectors

consistently had non-significant beta coefficients and three vectors consistently had significant beta coefficients, indicating that differences in innovation due to state of operation (location) could be accounted for using only three of the five vectors. In particular, banks in one state were significantly higher on innovation and banks in two states were significantly lower on innovation. Because almost identical amounts of variance in innovation could be accounted for using only the three vectors with significant betas, we used only these three vectors in analyses that include location as a predictor variable.

Several explanations for the observed relationship between innovation and location are possible. One relevant to this study is the possibility that, due to differences in the social climates among states, there are differences in the compositions of top management teams. If this is the case, the variance explained by state location should be less when the state vectors are entered into the regression equation after the team composition variables. Regression analyses revealed that location accounts for only slightly less variance in innovation when entered after the team composition variables (ΔR^2 values = 0.09, 0.06, and 0.09 for total, technical and administrative innovation, respectively) compared to when only location is entered as a predictor of innovation. Therefore, we conclude that differences among states with respect to innovation are not due to large interstate differences in the team characteristics.

Another possible explanation for the location effects is that different states have banks of different average sizes. Analysis of variance revealed a significant relationship between organization size and location, $F(5,189) = 4.80$, $p < 0.01$. These analyses suggest that differences in team organizational size account for some of the association between location and innovation. Nevertheless, when the state vectors are entered as the final step in regression equations containing the full set of predictor variables, location explains some unique variance in innovation (ΔR^2 values = 0.05, 0.03, and 0.08, for total, technical, and administrative innovation, respectively).

Summary of analysis results

Table 3 summarizes the results of the regression analyses conducted using Models 1 and 2. The

³ Readers should be cautious in extrapolating from our results to conclusions about the general relationship between size and innovation. In particular it is important to recognize the limited range of bank sizes included in this study. Extremely small banks were intentionally excluded, as were subsidiaries of bank holding companies (which may be somewhat larger than average). Sampling banks from a broader range of sizes may have led to different conclusion about the relationship between size and innovation.

Table 3. Percentage of variance in innovation explained (ΔR^2) by team composition, organization size, and bank location using two alternative analytic procedures

Focal predictors	Model 1			Model 2		
	Total innovation	Technical innovation	Admin innovation	Total innovation	Technical innovation	Admin innovation
(1) Seven aspects of team composition	0.31**	0.27**	0.26**	0.09*	0.07*	0.10**
(2) Organization size (log)	0.26**	0.26**	0.15**	0.04**	0.05**	0.02*
(3) Location (three vectors)	0.13**	0.09**	0.11**	0.05*	0.03	0.08*

Note: For Model 1 the innovation score (total, technical, or administrative) was regressed on the variable(s) in the focal predictor set [(1), (2), or (3)] only. For Model 2 the innovation score was regressed on all variables, with the focal predictor set entered on the last step. Values shown are ΔR^2 values for the focal predictors.

* $p < 0.05$; ** $p < 0.01$.

results shown in this table clearly illustrate that the two analytical procedures lead to different conclusions about the power of organization size, location, and team composition as predictors of innovation. It is worth noting, however, that regardless of whether one focuses on results from Model 1 or Model 2, innovation is more strongly associated with team composition than with either organization size or location. However, as is clear from Table 2, not all aspects of team composition are equally predictive of innovation. Most important are education level and functional diversity.

DISCUSSION

In this study we looked at seven aspects of team composition. We found that innovation was greater in banks headed by more educated managers who came from diverse functional backgrounds. These results support the cognitive resources perspective on group functioning and are consistent with laboratory studies of group problem solving, which show that both level and diversity of expertise are beneficial for complex problem solving. Our results do not support those arguments from the information processing perspective taken in the demography literature, which predict that team heterogeneity interferes with communication processes and creates dysfunctional conflict. This may be because the dysfunctional effects of heterogeneity occur only when extremely high levels of diversity exist, and

such extreme diversity is less likely among members of top management teams.⁴ This study also replicated the positive association often found between organization size and innovation.

The cognitive resources and demographic perspectives for understanding the effects of group or cohort heterogeneity suggest an interesting paradox. On the one hand, heterogeneity has a positive effect on innovative and creative decision-making. On the other hand, heterogeneous (and thus, innovative) groups are subject to higher turnover, presumably because members find the increased conflict and decreased communication to be stressful. Thus, organizations might have difficulty keeping their most creative groups together. This study found evidence to support the first effect of heterogeneity. An interesting follow-up study would examine the second effect more directly by examining both the internal group processes and the turnover rates for homogeneous and heterogeneous top management teams.

An unexpected finding in this study was the relationship between bank size and composition of the top management team ($R^2 = 0.30$). In comparison to smaller banks, larger banks were more likely to be headed by top teams composed of younger, slightly more tenured managers who

⁴ Some readers may wonder whether a curvilinear relationship exists between innovation and team heterogeneity. We explored the possibility of curvilinear relationships and found no significant curvilinear relationships between innovation and the various aspects of team composition examined in this study.

were also more educated and more diverse with respect to their functional backgrounds.

There are two consequences of the associations among size, composition, and innovation. The first is that controlling for size lessens the strength of the relationship between team composition and innovation. Used as the sole predictors of total innovation, seven team composition variables account for 31 percent of the variance observed in this sample of banks, but when team composition is added as the final step in a regression equation that includes organization size, state of operation, and team size, team composition accounts for only 11 percent of the variance in total innovation. The second consequence is parallel to the first one: when size is used as the sole predictor of total innovation it accounts for 26 percent of the variance, but when size is added in the final step of the regression, size accounts for 4 percent of the variance in total innovation. (The consequences are similar using technical and administrative innovation in place of total innovation.) These findings suggest that the often-found relationship between firm size and innovation may be due, in part, to the fact that organization size is related to the type of top management team likely to be making decisions.

The relationship between size and team composition might arise in several ways. For example, firm size may determine team composition. Recent changes in the banking industry demand that top managers have up-to-date technical training in order to survive as deregulation removes barriers to interstate competition. Smaller banks (e.g. those in the rural areas of the states we studied) may be insulated from these pressures, and less responsive to them. Feeling little pressure to change, such banks are likely to continue the standard practice of promoting tried-and-true employees into upper management positions. In comparison, larger banks may feel the need to break from the status quo and recruit younger, more educated managers in the belief that such people are likely to be effective in pursuing strategies that require innovative responses to the changing environment.

The above explanation assumes that smaller banks *prefer* not to bring in new talent. Another possibility is that smaller banks are simply less *able* to compete for younger, more educated,

and more innovative managers. When recruiting, larger banks may have a competitive edge over smaller banks for a variety of reasons, including their ability to pay, promotion opportunities, and a perception on the part of managers that their creative energies will be more fruitfully spent in larger firms.

It is possible that bank size 'causes' differences in the composition of top management teams, but equally plausible is the reverse scenario, namely that team composition 'causes' size. Much of the interest in innovation follows from an assumption that innovative solutions to technical and administrative problems are *effective*. It is generally accepted that effective organizations grow faster than do ineffective organizations. Therefore, size and team composition may be correlated because team composition leads to innovation, which in turn facilitates growth.

The unique contribution of size as a predictor of innovation

In our discussion above, we have emphasized the shared variance among size, team composition, and innovation. But the reader is reminded that size explained significant amounts of unique variance in innovation. The nature of the relationship between size and innovation has not been resolved in the innovation literature. Both theory and empirical results can be used to argue for a positive linear relationship between these two variables, a negative relationship, or a positive curvilinear one (e.g. see Thompson, 1967; Kimberly and Evanisko, 1981). Our results are consistent with those who posit a positive curvilinear relationship between size and innovativeness.

Size may create uncertainties and complexities that require innovative solutions. For example, a large and diverse customer base is likely to be a stimulus for generating a 'customer information file system', one type of technical innovation. As the structure of an organization increases in complexity, subtasks are more likely to be handled by specialists with high levels of expertise. Such specialists may be more likely to generate unique solutions to technical problems. Complexity might also create conflicts over resources, which may lead, in turn, to developing innovative solutions related to administration, such as the

use of focus groups for identifying in-house problems.

The reverse causal scenario is equally plausible: innovation may promote growth. Assuming this interpretation of the relationship between innovation and size, our results indicate that technical innovation may be somewhat more effective than administrative innovation. Finally, we note that different causal models may apply to the two types of innovation.

The unique contribution of team composition as a predictor of innovation

Investigating the relationship between the composition of top management teams and innovativeness was the primary purpose of the present study. In formulating our hypotheses we distinguished between the level of cognitive resources a team (i.e. high versus low cognitive skills, knowledge and ability) brings to the decision-making process and the diversity of views represented. Our results suggest support for the cognitive resources perspective, which posits that both resource level and diversity are important for innovation. The relatively objective nature of the team composition variables means that these correlations cannot be explained away as methodological artifacts. Furthermore, innovation is more strongly associated with team composition than with either organization size or location. Thus, our results should provide encouragement to other researchers to continue to pursue this line of study.

The findings in this study lend support to the 'upper echelons' perspective (Hambrick and Mason, 1984) in that an organizational outcome—innovation—has been shown to be associated with the demographic characteristics of the top management team. An interesting question that arises, given our results, is whether team characteristics are more predictive of organizational innovation than are CEO characteristics. In a supplemental analysis we examined this question and found that team characteristics were more strongly related to innovation than were CEO characteristics. Specifically, neither CEO age nor CEO tenure were significantly correlated with total innovation (r values = -0.08 and 0.10, respectively), whereas team age and tenure were both significantly correlated with innovation (r values = -0.27 and -0.31, respectively). Both

CEO and team education level were significantly correlated with total innovation, but team education level was more strongly related to innovation than was CEO education level (r values = 0.42 and 0.24, respectively).

Although we did not assess all possible aspects of team composition in our study, the inclusion of several different aspects of team composition was an important feature. It enabled us to statistically take into account the fact that several potential predictors of innovation are correlated. Research designs that include several correlated predictor variables are generally considered superior to those that include only one or a few predictors. But the inclusion of multiple predictors in a regression analysis does not mean that the results lead to clear conclusions. In this study the intercorrelations among innovation, organization size, and several aspects of team composition result in a situation where different conclusions can be drawn depending upon which analytic strategy one chooses. This is highlighted in Table 3.

There are no easy solutions to these interpretative ambiguities. Preferences for different analysis strategies depend in part upon theoretical perspectives and in part upon preferences regarding the avoidance of type I versus type II errors of inference. For these reasons, readers are encouraged to consider the results from both Model 1 and Model 2 analyses as plausible representations of reality.

Comparisons between technical and administrative innovation

As operationalized in this study, technical innovativeness referred to innovations in the design and delivery of products and services, marketing, and office operations. Administrative innovativeness referred to innovations related to general management issues such as staffing and employee surveys, strategic planning, compensation systems, and training programs. In general, the variables included in this study proved to be slightly better predictors of technical innovation than of administrative innovation. It is interesting that two other studies that operationalized innovation according to the dual-core conceptualization (Daft, 1978; Kimberly and Evanisko, 1981) reported a similar result, namely that more

variance in technical (versus administrative) innovation was associated with their predictors.

The results shown in Table 2 indicate that differences in the explained variance for technical and administrative innovation may be due primarily to the stronger association between technical innovation and size. The stronger association between technical innovation and size may reflect the fact that technical innovations are likely to require more resources to implement compared to administrative innovations.

Table 2 also shows that different aspects of team composition are important for technical versus administrative innovations. The beta weight for education level is significant for technical innovation, but not administrative innovation. Conversely, the beta weight for functional heterogeneity is significant for administrative innovation but not technical innovation.

Possible reasons for the stronger association between technical innovation and education level are interesting to speculate about. If technical innovations are initiated within the technical core, then the association between education and technical innovation may simply reflect a greater acceptance of technical innovation by more highly educated managers. It is also possible that the more educated management teams are more proactive in initiating the development of technical innovations. Another possibility is that banks whose top managers are more educated are also likely to employ more highly educated people in their technical cores. In this case the stronger relationship between education and technical innovation could be viewed as spurious.

Directions for future research

As our discussion to this point reveals, this study leaves many interesting questions unanswered. One question regards generalizability. It is obvious that replicating this study in other industries would increase our confidence in the results. Especially desirable would be a study examining top teams in an industry that has more diversity (with respect to education, age, and tenure, but also sex, race, national origin) in the types of people chosen for top management positions. The relatively high degree of homogeneity among midwestern, U.S. bankers may mean that the effects of team composition are underestimated in the present study. It may also

have limited our ability to identify any adverse consequences of extremely high levels of diversity.

More difficult than assessing the generalizability of the results from this study will be clarifying the causal relationships among the variables and specifying the processes that underlie the causal relationships. Longitudinal studies using large samples may be helpful in identifying causal relationships, but intensive case studies, and even field experiments, may be required to inform us about the processes involved. Such research may offer excellent opportunities for, and benefit greatly from, cooperation among researchers interested in the heretofore poorly integrated topics of creativity, group dynamics, leadership, human resource management, organization design and strategy.

A third interesting question for future research is whether different types of heterogeneity among team members have different consequences. Our results indicate that functional heterogeneity facilitates innovativeness, but heterogeneity with respect to age, tenure, and educational major do not. There are a variety of composition variables that we did not consider, which might also facilitate (or perhaps hinder) innovativeness, including sex, race, ethnicity, socioeconomic background, and career profiles. Firm conclusions about the effects of team heterogeneity should not be drawn until such variables are examined.

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APPENDIX: ITEMS USED TO ASSESS ORGANIZATIONAL INNOVATIVENESS

Organizational innovativeness was assessed by asking respondents to indicate whether their bank offers or uses each of the following items. CEO's responded to items related to technical innovation and human resource managers responded to items related to administrative innovation.

Technical innovation items

Services and products

ATMs linked to state-wide network

Combined account statement (two or more accounts on same statement)

Self-directed IRA

Sweep (asset management) account

Discount brokerage services

Financial planning/counseling services

Mortgage equity accounts (second mortgage financing)	Administrative innovations
Insurance products (through insurance company agents)	<i>General management</i>
Terminal based corporate cash management	Decentralization of product management/sales into line departments
Equipment leasing	Hiring marketing managers from outside commercial banking industry
<i>Marketing</i>	Employee attitude assessment (on such issues as organizational culture and morale) and management response feedback
Customer educational/information seminars	Focus groups for in-house problem identification
Customer 'focus' groups for feedback	
Telephone surveys for customer feedback	
Packaged accounts/services for target markets	
Market segmentation: specific products designed for segments	
Use of external data sources to complement internal customer/market data	
<i>Computerized customer (retail) applications</i>	
Customer information file	<i>Planning</i>
Profitability analysis by client (across services)	Corporate strategic planning integrated with line department strategic planning
Customer marketing model (e.g. reports on customers within certain profile)	Corporate strategic planning integrated with human resource planning
Identification of valued customers	Corporate strategic planning integrated with information systems planning
Cross-selling analysis	Succession planning: specially designed career paths for high achievers
<i>Delivery systems/operations</i>	
On-line teller terminals	<i>Salary/benefits</i>
Check truncation/safe-keeping	Loan officers: incentive compensation for business development
Automated statement processing/bulk-filing	Trust officers: incentive compensation for business development
Productivity measurement system	Middle-level management: incentives based on attainment of strategic goals for area
Facsimile loan application processing	Retail cross-selling incentive plans
Automated loan document preparation	Group productivity incentive plans
<i>Office automation</i>	Computerized job evaluation process tied to market comparison data
Corporate-wide word processing system	Flexible (cafeteria-style) employee benefits
Electronic mail	Child care benefits (e.g. reimbursement for child care expense)
Integrated data base management system	Wellness programs (e.g. smoking cessation programs)
Information center (professionals, managers, and analysts access data from mainframe for managerial reporting)	Employee assistance programs (e.g. substance abuse counselling services)
Loan tracking system (retail)	
Asset/liability management system (e.g., 'what-if?' analysis)	
Balance sheet modeling (e.g. capital adequacy analysis)	
	<i>Training</i>
	Training programs to achieve 'relationship banking'
	Evaluation of training programs based on effectiveness criteria
	Assessment of managers by subordinates (on such issues as management style)