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An Exploratory Investigation of Organizational Antecedents to New Product Success

The authors present a model that suggests that integration between marketing and research and development (R&D), managerial controls, and relational norms influences new product success. The model is tested with a sample of 115 engineers and marketing personnel involved in 19 new product projects for a multinational computer manufacturer. The results indicate that managerial controls influence integration, relational norms, and perceived effectiveness. Integration between marketing and R&D fosters stronger relational norms, perceived effectiveness, and new product success. Relational norms enhance perceptions of effectiveness, yet they have a negative influence on new product success. The authors conclude with a discussion of the implications of these findings for best practice in new product research and application.

Our purpose is to examine organizational processes that contribute to the success of new products. With 25% of corporations' sales coming from products introduced in the past three years (Mahajan and Wind 1991), it is critical to understand factors that increase the likelihood for new product success. We focus on the relationship between marketing and research and development (R&D) in new product development (NPD). The degree to which persons from these areas interact in the new product development process is referred to as integration (Galbraith 1973; Moenaert and Souder 1990). To varying degrees, R&D and marketing interact to generate ideas, establish product schedules, assess customer requirements, and evaluate competitive actions. We investigate the influence of integration on new product success while controlling for managerial actions and relational norms that influence performance.

Our investigation of new product success has three objectives. The first objective is to assess whether integration en-

hances new product success. Integration should ensure that persons holding different perspectives regarding product development and customer requirements interact with one another. Interaction and information sharing between R&D and marketing enable the product development group to provide technologically sophisticated products that meet customer needs. Our analysis complements prior studies of R&D-marketing integration (e.g., Souder 1981, 1988), because it analyzes the discrete influence of integration and relational norms on performance. In addition, we augment research linking integration to perceptual performance (e.g., Keller 1986; Ruekert and Walker 1987a, b) by focusing on relatively objective assessments of new product success.

The second objective is to assess the influence of relational norms on new product success. *Relational norms* refer to behaviors employed to maintain, enhance, and strengthen relationships (cf. Macneil 1980). Because working relationships within the firm develop over extended periods of time, relational norms should be particularly germane to intraorganizational relationships. Most previous marketing analyses (e.g., Heide and John 1992) have indicated that relational norms enhance interorganizational outcomes. In contrast, we present and test a model suggesting that norms can *confound* intraorganizational performance.

The third objective is to identify managerial controls (Pugh 1981) that influence R&D-marketing integration and relational norms. Although integration and norms may influence organizational outcomes, these issues are not directly controlled by management. Managerial controls and interpersonal processes together enable firms to enhance performance (Jaworski 1988; Ouchi 1979), but the coordination

of these control structures and interpersonal processes for enhancing performance has received limited attention. We illustrate how factors under the control of management—formalization of roles and distribution of decision-making authority—influence integration and relational norms. Our study complements Olson, Walker, and Ruekert's (1995) analysis of product development organizations. They suggest that centralization and formalization are used in tandem to influence performance. In contrast, we consider the independent influence of centralized decision making and role formalization on interdepartmental relationships. Examination of the independent influence of centralization and role formalization on integration and relational norms provides insight into factors that management can differentially employ to increase the likelihood for product success. In addition, we identify factors that management should monitor (integration, relational norms) to enhance performance.

MODEL AND HYPOTHESES

Our model of organizational antecedents to performance is grounded in control theory (Jaworski 1988; Ouchi 1979). Control theory is a framework that illustrates how environmental factors and controls influence organizational outcomes. Control structures are classified into formal and informal mechanisms. *Formal controls* refer to management-initiated written directives that are designed to guide employee action toward the accomplishment of objectives. Management-initiated directives are distinguished by the timing of the management intervention and include input, process, and output controls. Input controls regulate the allocation of resources prior to the implementation of a program (e.g., recruitment and training); output controls refer to the establishment, monitoring, and evaluation of performance standards; process controls are efforts taken by management to influence the means to achieve desired ends. For example, formalized procedures and concentrated decision making are process-based organizational controls (Pugh 1981).

Unwritten, worker-based mechanisms that are designed to influence individual and group behavior are referred to as *informal controls*. These controls are distinguished on the basis of the level of aggregation and include self, social, and cultural control. Self-controls are individual-based objectives. In contrast, cultural controls refer to values and patterns guiding behavior throughout an organization (Ouchi 1979). Social controls are "prevailing social perspectives and patterns of interpersonal interactions within subgroups in the firm" (Jaworski 1988, p. 27). The level of integration between R&D and marketing is a form of social control. Similarly, relational norms (Macneil 1980) guiding interpersonal interactions between and across groups are social controls that direct small group interactions toward common goals.

Jaworski (1988) suggests that controls can be combined in numerous ways to direct organizations toward desired outcomes (see also Ouchi 1979). The nature of NPD suggests that activities should be managed through informal social controls, yet the interdepartmental nature of the process suggests that formal process-based mechanisms should be employed. We present a model that describes the relationship between formal process-based managerial controls, informal social controls, and system outcomes. The relationships are depicted in Figure 1.

The Influence of Managerial Controls on Integration

Effective management of NPD relies on directing the behavior of R&D and marketing personnel toward the common goal of developing successful products. Integration enables persons from marketing and R&D to share information and coordinate key NPD activities (Gupta, Raj, and Wilemon 1985a, b). Such activities include setting product development schedules, establishing product goals, and generating product ideas. Responsibility for these tasks varies by project, and integration captures the extent to which R&D and marketing participate in these activities.

Management can take an active role in ensuring that integration emerges by implementing appropriate organizational structures. Gupta, Raj, and Wilemon (1986) suggest that the organizational structure for NPD is reflected in centralization and role formalization (cf. Zaltman, Duncan, and Holbek 1973). *Centralization* refers to the extent to which decision-making authority is concentrated within a few positions (John and Martin 1984). In high-volume production settings, centralization offers efficiency advantages over committee-based decision making (Hage 1980, p. 36). Nevertheless, centralization of decision making by one party suggests that counterparts in NPD do not need to be involved in making critical decisions. In addition, persons empowered with exclusive decision-making authority may determine that information held by other persons is not necessary for critical organization decisions. Thus, several NPD researchers report a negative relationship between centralization and integration (Gupta, Raj, and Wilemon 1987; Link and Zmud 1986).

The level of formalization also may influence R&D-marketing integration. *Formalization* refers to the "degree to which rules or standard operating procedures are used to govern the interaction between individuals" (Ruekert and Walker 1987b, p. 6). Formalized procedures can regulate the *tasks* people perform in the development process or the *role* responsibilities granted to specific persons in the NPD process. Both facets of formalization, regulation and role specification, may influence integration, but our analysis focuses on the latter. Prior research suggests that integration is associated with role formalization (cf. Bonnet 1986; Gupta, Raj, and Wilemon 1987; Moenaert and Souder 1990). Role formalization clarifies responsibilities for R&D and marketing and highlights the dependencies between them. Moreover, role specification calls to attention the information held by people from other departments and provides the opportunity to gain their involvement in the development process. Thus, the following hypothesis is proposed:

H₁: Integration between R&D and marketing is (a) constrained by centralized decision making and (b) raised by role formalization.

The Influence of Managerial Controls and Integration on Relational Norms

Persons and groups supplement managerial actions through interpersonal processes (cf. Ring and Van de Ven 1992). Interpersonal processes emanating from group-derived norms are a powerful form of behavioral control (Bettenhausen and Murnighan 1985). These relational norms enable people to internalize group values and mutual commitments, as well as guide interaction between parties to a relationship (Heide and John 1992; Macneil 1980).

Harmonious R&D and marketing interfaces are described by Souder (1981) as those in which relationships are coop-

Figure 1
ANTECEDENTS TO NEW PRODUCT SUCCESS

MANAGERIAL
CONTROLS

INFORMAL
CONTROLS

SYSTEM
OUTCOMES
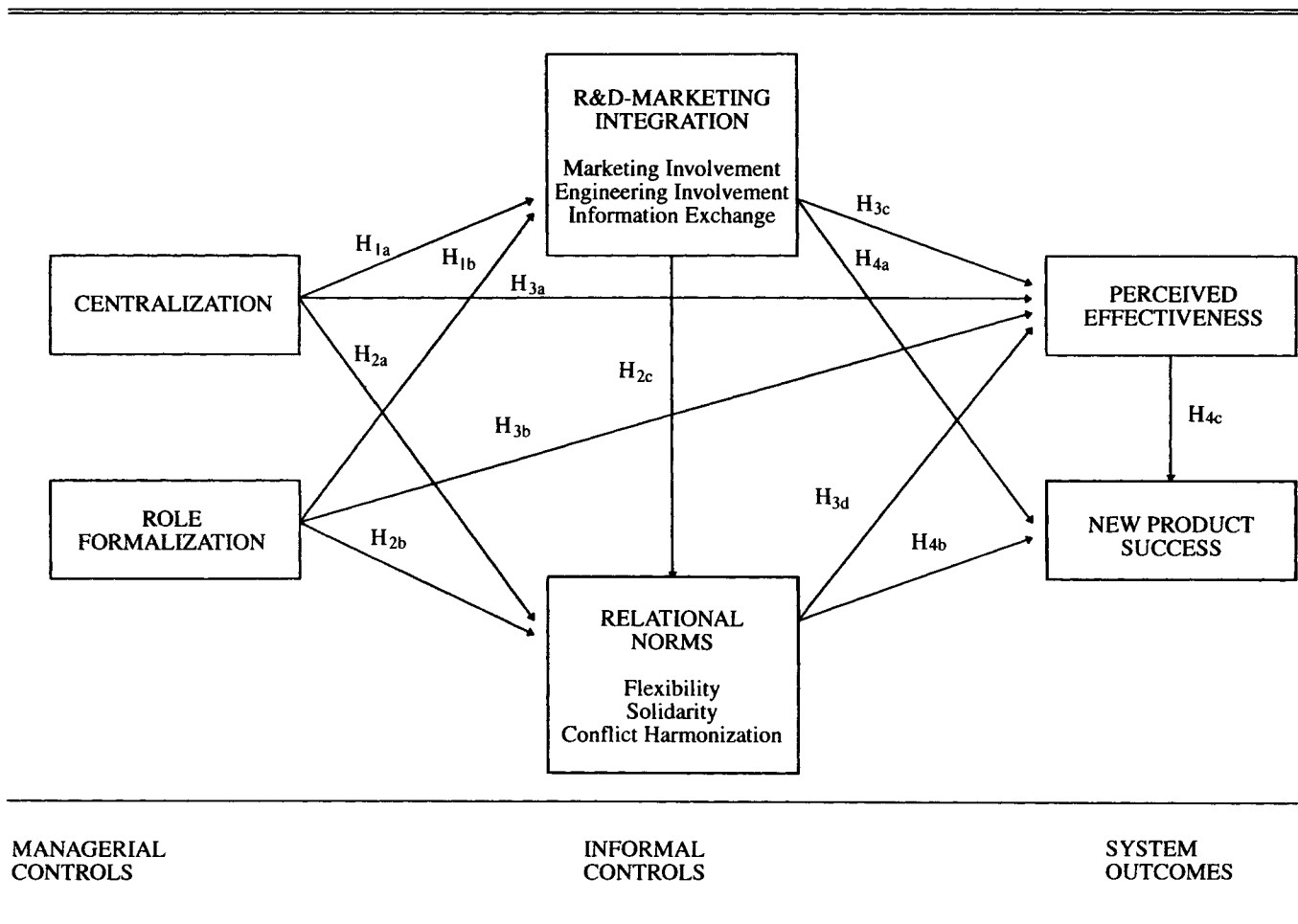
erative, all parties are mutually committed to the relationship, and parties express feelings of warmth for each other. These interfaces are not free from conflict, but when conflict does arise, the parties take action to resolve it. To augment research on harmony between marketing and R&D, we investigate solidarity, conflict harmonization, and flexibility. *Solidarity* refers to the treatment of problems as matters of mutual concern and is embodied in the belief that partners in a relationship will continue to want to depend on each other (Macneil 1980). *Conflict harmonization* enables people to resolve conflicts within a relationship without consulting other outside parties. Similarly, *flexibility* refers to the extent to which interacting parties are willing to adjust their behavior to cope with changing circumstances. Thus, relational norms emerge when parties are committed to the relationship and willing to adapt to alleviate conflict.

Managerial controls and integration should influence relational norms in NPD. Because relational norms are founded on cooperation and mutual commitment to the relationship, increasing levels of centralized decision making should impede their development. Centralized decision making does not provide the opportunity to identify and express points of conflict. Because conflicting opinions are unlikely to be presented, mechanisms for harmonizing conflict do not materialize. People with decision-making authority will have limited motivation to modify their interactions

(i.e., exhibit flexibility) to meet the needs of others in the product development process. Similarly, cooperation manifest in solidarity should be minimal when decision-making authority is concentrated.

Although centralized decision making should reduce relational norms, role formalization should have a contrasting influence on norms. When R&D and marketing personnel understand each other's roles in the development process, they become aware of points of contention and develop mechanisms to avert conflict. Similarly, they develop mechanisms enabling persons to remain flexible to the needs of others in the development process. Moreover, the specification of NPD roles enables people to gain an understanding of interdependencies between departments. When R&D and marketing personnel recognize their mutual dependencies and develop reputations for role performance, solidarity should emerge.

Integration also should enhance the relational norms. Seeking another's involvement and requesting information enables a person to identify points of conflict that rise in product development. Marketing and R&D respond to these potential conflicts by modifying demands (i.e., flexibility) and establishing routines for alleviating conflict. In addition, involvement and information sharing enable a trading partner to empathize with a counterpart's condition and strengthen commitments to the relationship. Thus, the following hypothesis is proposed:

H$_2$: Relational norms between R&D and marketing are (a) lowered by centralized decision making, (b) enhanced by role formalization, and (c) raised by integration.

Determinants of Perceived Effectiveness

The relationship between R&D and marketing is effective if the parties perceive it as worthwhile, productive, and satisfying (Ruekert and Walker 1987b; Van de Ven and Ferry 1980). This implies that parties to the relationship feel that joint goals of the relationship have been achieved or at least pursued to the satisfaction of the parties. When parties to a relationship are subject to high levels of centralization, they feel deprived of self-control and autonomy (cf. John 1984). These feelings result in alienation and disaffection with the relationship. In contrast, Ruekert and Walker (1987a) find that formalization is positively related to the perceived effectiveness. They conclude that formalization reduces confusion over roles and fosters productive relationships.

Integration in the form of interdepartmental involvement and information sharing also should enhance perceptions of effectiveness. Gaining the involvement of counterparts from other departments provides the opportunity to coordinate development for mutual satisfaction. Marketing personnel that seek R&D's input into product screening and customer need analysis are able to nurture effective working relationships with R&D. Similarly, R&D personnel who seek marketing's input into idea generation and product development scheduling are able to foster high levels of satisfaction in working relationships with marketing. The dialogue between R&D and marketing is further enhanced by information that marketing shares concerning the legal context, customer requirements, and competitive action. When this information is passed on to R&D, marketing and R&D are able to gain an understanding of the constraints faced by both departments, and effective working relationships emerge.

Marketing and R&D personnel recognize the importance of cooperative efforts for successful NPD (Gupta, Raj, and Wilemon 1985b). Relational norms foster cooperative behavior and high levels of interdepartmental effectiveness. Solidarity ensures that people are committed to enhancing the quality of working relationships between departments. When the parties to a relationship are committed to relational quality, perceptions of effectiveness should be high. Similarly, marketing and R&D personnel that develop mechanisms to resolve conflicts should have strong working relationships. Flexibility also contributes to effectiveness by enabling people to cope with the demands of personnel from other departments. Thus, the following hypothesis is proposed:

H$_3$: Effective relationships between R&D and marketing are (a) lowered through centralized decision making, (b) enhanced through role formalization, (c) raised by integration, and (d) increased by relational norms.

Antecedents to New Product Success

We anticipate that managerial controls influence success through their influence on integration and relational norms. The amount of interaction between R&D and marketing should directly enhance the likelihood of new product success. To the extent that marketing passes along information regarding customer needs, legal restrictions, and competi-

tive actions, R&D gains greater insight into factors that enhance the likelihood of new product success. Interdepartmental involvement also should raise new product success. Each party (R&D and marketing) possesses critical skills and information that must be joined to develop successful new products. The greater the interaction between these parties, the more likely that the necessary exchange and blending of skills and information will occur. The result should be higher levels of product success.

Two perspectives have been advanced concerning the influence of relational norms on performance (cf. Souder 1988). For example, Noordewier, John, and Nevin (1990) illustrate that relational norms enhance interorganizational performance when uncertainty is high. Relational norms implemented to strengthen and nurture relationships establish a context in which creative dialogue can flourish. By providing a context conducive to discussion, relational norms facilitate the flow of information that enables people to present contingencies that may jeopardize performance. Flexibility provides the opportunity to make adjustments that increase the market value of new products. Conflict harmonization and solidarity enable people to resolve disputes that may prolong development. As a consequence, products that meet customer needs are brought to market quickly.

Although relational norms have been linked to performance in some settings, we suspect that strong relational norms will reduce the potential for new product success (cf. Webb 1993). Case studies at NeXT computers and General Electric (Aircraft Engine Group) indicate that cohesiveness can be high, yet products may not achieve commercial success (Rosenthal and Tatikonda 1992). Despite the interpersonal benefits drawn from cohesiveness and solidarity, relational norms may prompt the NPD team to seek concurrence at the expense of performance.

The tendency to seek unanimity while discounting alternative courses of action is referred to as groupthink (Janis 1983, p. 9). Groups enacting groupthink tend to minimize arguments, conform to majority views, and shield the organization from adverse information. Souder (1980, 1988) uses the "too-good friends" syndrome to describe similar activity in R&D-marketing relationships. People operating within the too-good friends syndrome maintain high regard for one another and have strong social relationships. These relationships have established strong mechanisms to thwart conflict. In addition, these relationships are marked by considerable flexibility. The tendency to be flexible to the demands of colleagues may prevent people from expressing contingencies at odds with the opinions of presumed experts. Although these relational qualities yield high levels of satisfaction, professional disagreements and disputes may not be presented that are critical to product success. The desire to retain harmony precludes people from presenting viewpoints that are contrary to opinions expressed within the group. Because adverse opinions are not expressed, design features are not implemented that could increase the product's technological sophistication and marketplace desirability. Thus, relational norms should limit the likelihood for commercial success.

Finally, it is expected that the two organizational outcomes will be related. When the relationship between R&D and marketing is perceived as effective, the products pro-

duced by the relationship should be successful. Effective working relationships enable R&D and marketing to collaborate to develop successful new products. Thus, the following hypothesis is proposed:

H_4: New product success is (a) enhanced by integration, (b) lowered by relational norms, and (c) raised by effectiveness.

METHOD

Research Setting

The setting for this study is 19 NPD projects of a major U.S. computer manufacturer. The products came from four divisions (printers, printer supplies, typing stations, and input devices) and included successful (12) and failed (7) projects. Divisional managers identified respondents for each project, and a central facilitator ensured that there was no overlap in respondents. The respondents were R&D and marketing personnel directly involved in NPD.

Measures

Centralization and formalization. Centralization and formalization are managerial controls employed to guide interaction toward productive ends. The scale for centralization consisted of five seven-point Likert-type items that were adapted from Gupta, Raj, and Wilemon's (1987) and Spekman and Stern's (1979) studies. *Formalization*, which represents the extent to which management explicitly states a person's role responsibilities, was measured on a four-item, seven-point Likert-type scale that was adapted from John and Martin's (1984) study.

Marketing and R&D integration. Integration is defined as the extent of information sharing and involvement across functional areas (R&D and marketing). Ten seven-point Likert-type items were adapted from Gupta, Raj, and Wilemon's (1985a) study. The ten items can be broken into three categories: marketing's involvement with engineering in front-end NPD activities, the extent of information provided by marketing to engineering with regard to NPD activities, and engineering's involvement with marketing in various NPD activities. These categories represent specific integration factors that together represent integration between R&D and marketing.

Relational norms. Relational norms refer to the extent to which people seek to maintain and enhance interpersonal relationships. It is a second-order construct that is manifest in norms of solidarity, flexibility, and conflict harmonization (cf. Macneil 1980). These norms approximate the harmonious R&D and marketing relationship described by Souder (1988). Nine seven-point Likert-type items were constructed on the basis of the scale developed by Heide and John (1992).

Perceived effectiveness. Relationship effectiveness is defined as the perception that interactions with personnel from another functional area are worthwhile, productive, and satisfying. A six-item scale was adapted from the work of Ruekert and Walker (1987b).

New product success. New product success refers to the extent to which a project met its commercial objectives. Divisional managers chose projects they considered to be clear successes or failures, based on commercial objectives. The measure is a dichotomous variable: (0) unsuccessful and (1) successful.

Data Collection

For each of the 19 projects in this study, approximately seven project members were selected (five R&D and two marketing). A questionnaire booklet was distributed to each respondent. The booklet included a cover letter describing the purpose of the research along with appeals for cooperation and assurances of anonymity. All the questionnaires were identical except that marketing personnel responded about their relationship with R&D, and vice versa. The respondents also received a memo from their divisional managers detailing the project for which responses were sought. One hundred thirty-two booklets were distributed, and 115 usable surveys were returned for a response rate of 87% (32 marketing and 83 R&D).

Nonresponse bias was assessed by comparing early and late responses (Armstrong and Overton 1979). No significant differences were found on several variables, including centralization, formalization, integration, and relational norms. On the basis of these results and the response rate, nonresponse bias does not appear to be a significant issue.

Construct Validity

Construct validity was assessed with the guidelines outlined by Churchill (1979) and Gerbing and Anderson (1987). Because the measures have been modified from previous studies, we examined item-to-total correlations and the factor structure (through principal components) for each scale. No items were deleted from the measures on the basis of this analysis, and the composite reliabilities all exceeded (.70).

The items were then subjected to confirmatory factor analysis via EQS/Windows (Bentler and Wu 1993). Because of the sample size and number of items, we assessed the scales in four phases. We ran confirmatory factor analyses for (1) formalization and centralization, (2) integration (engineering involvement, marketing involvement, and information exchange), (3) relational norms (solidarity, conflict harmonization, and flexibility), and (4) effectiveness. The scale items, along with factor loadings and fit statistics, are provided in the Appendix. No items were deleted from any scale on the basis of the confirmatory factor analysis. Although it is possible to enhance the fit of the models by eliminating some items (e.g., the factor loading for one centralization item is modest at .28), we retained the items to capture the breadth of the constructs.

We assessed discriminant validity by running a model with all measures set to load on the appropriate traits and by allowing the traits to correlate. This model was compared with a series of models in which intertrait correlation was set to unity. In each case discriminability was evidenced by the statistically significant chi-square difference between the models. For example, the test of discrimination between formalization and centralization is significant ($\chi^2(2) = 36.85, p < .001$).

We also analyzed the data to examine whether there were discrepancies between projects and between marketing and R&D reports. The mean interrater consistency across projects was .62. No systematic differences in the consistency ratings were uncovered on the basis of the analysis of marketing and engineering reports. We also employed a procedure outlined by Morrison (1967, p. 252) to test the null hypothesis that informant reports (R&D, marketing) were equivalent. The test

statistic (χ^2 = 44.10, d.f. = 45, p < .01) indicates that it is reasonable to treat the R&D and marketing reports as equivalent. Together the validity assessments suggest that the data are of acceptable quality to test the hypotheses.

TESTS OF HYPOTHESES

Structural equation modeling using EQS/Windows (Bentler and Wu 1993) was employed to assess the hypotheses. EQS/Windows uses a two-step procedure to analyze categorical variables (Lee, Poon, and Bentler 1992). The first phase computes maximum likelihood estimates and the asymptotic covariance matrix. The second phase uses this matrix to estimate the model through arbitrary generalized least squares (AGLS). The AGLS estimation is summarized in Table 1.

H_1 suggests that centralization and formalization influence the level of integration between R&D and marketing. The equation explains 12.0% of the variance in integration. Centralization (γ_{11} = –.167, T = –4.46) reduces and role formalization (γ_{12} = .303, T = 6.43) enhances integration. Thus, H_{1a} and H_{1b} are supported.

H_2 suggests that centralization, formalization, and integration influence relational norms. Together these factors account for 56.2% of the variance in relational norms. Consistent with H_{2a}, centralization reduces relational norms (γ_{21} = –.376, T = –7.97). H_{2b}, which maintains that role formalization directly enhances relational norms, is not supported (γ_{22} = .048, T = 1.05). Relational norms emerge, however, because of integration between R&D and marketing (β_{21} = .574, T = 7.33). Thus, H_{2c} is supported.

The third hypothesis (H_3) examines the determinants of perceived effectiveness. Managerial and informal controls account for 61.9% of the variance in effectiveness. Contrary to H_{3a}, centralization (γ_{31} = .332, T = 2.39) raises the level of effectiveness. Role formalization (γ_{32} = .045, T = .42), however, does not influence perceived effectiveness. Thus, H_{3b} is not supported. H_{3c} and H_{3d} are supported, because integration (β_{31} = .339, T = 1.97) and relational norms (β_{32} = .579, T = 2.92) raise the level of perceived effectiveness.

The fourth hypothesis (H_4) focuses on the antecedents to new product success. The model accounts for 15.2% of the variance in new product success. H_{4a} and H_{4b}, which suggest that integration (β_{41} = .332, T = 2.42) and relational norms (β_{42} = –.540, T = –5.13) influence new product success, are supported. Perceived effectiveness, however, is not related to new product success (β_{43} = .149, T = 1.09). Thus, H_{4c} is not supported.

To validate the results we reanalyzed the data in a binomial logit model using split-half sampling. The model for the calibration sample was statistically significant ($\chi^2(3)$= 12.11, p < .01; pseudo R^2 = .15). The logit function was then applied to the retest sample. Sixty-six percent of the sample was accurately classified, which exceeds the 55% percent proportional chance criterion (T= 2.23, p < .02). Thus, the results indicate that informal controls influence new product success.

DISCUSSION

We seek to identify organizational processes that contribute to new product success. Our results, which indicate that integration between R&D and marketing enhances new product success and perceived effectiveness, support the central importance of integration to product development. Our analysis also indicates that relational norms are negatively associated with product performance. These results suggest that participants in NPD operate within a groupthink orientation (Janis 1983). High levels of solidarity and conflict harmonization apparently fuel consensus seeking and shield the firm from responding to objections and counterarguments, which contribute to new product failures. Finally, our findings illustrate that centralized decision making and role formalization differentially influence interpersonal interactions. Centralized decision making inhibits interfunctional integration and reduces the level of flexibil-

Table 1
PARAMETER VALUES FOR THE STRUCTURAL EQUATION MODEL

Hypothesis	Proposed Path	Expected Relationship	Structural Model Parameters	Coefficient	T-Value
H_{1a}	centralization to integration	negative	γ_{11}	–.167	–4.46
H_{1b}	formalization to integration	positive	γ_{12}	.303	6.43
H_{2a}	centralization to relational norms	negative	γ_{21}	–.376	–7.97
H_{2b}	formalization to relational norms	positive	γ_{22}	.048	1.05
H_{2c}	integration to relational norms	positive	β_{21}	.574	7.33
H_{3a}	centralization to effectiveness	negative	γ_{31}	.332	2.39
H_{3b}	formalization to effectiveness	positive	γ_{32}	.045	.42
H_{3c}	integration to effectiveness	positive	β_{31}	.339	1.97
H_{3d}	relational norms to effectiveness	positive	β_{32}	.579	2.92
H_{4a}	integration to success	positive	β_{41}	.332	2.42
H_{4b}	relational norms to success	negative	β_{42}	–.540	–5.13
H_{4c}	effectiveness to success	positive	β_{43}	.149	1.09

Summary Statistics

χ^2	34.77
d.f.	27
p-value	.14
Comparative fit index	1.000
Root mean square residuals	.05
Goodness-of-fit index	.999

ity, conflict harmonization, and solidarity. In contrast, role formalization directly raises the level of integration between marketing and R&D.

Limitations

The single company design facilitated in-depth investigation of integration and control processes and allowed for the study of multiple new products from the perspective of R&D and marketing. Moreover, executive cooperation provided a relatively objective measure of commercial success. Despite the advantages gained from a single company study, the organizational form limits the generalizability of the study. Replications that modify the conceptual and substantive domain by evaluating other organizational structures provide the opportunity to verify, extend, and delimit the findings in this research (McGrath and Brinberg 1983).

The dichotomous measure does not capture the extent to which a product succeeded or failed to meet corporate objectives, nor does it consider the knowledge gained from failed projects. These measurement issues can be reduced in further work by using continuous variables and broadening the elements of success to include manufacturing and engineering perspectives.

Consistent with the contingency perspective (Lawrence and Lorsch 1986), control theory suggests that performance emerges because of appropriate fit between control mechanisms and the environment. Product development is susceptible to macroenvironmental contingencies that are associated with industry regulation and technology. Suppliers and customers in the task environment and internal constraints associated with market position and financial well-being are also sources of environmental uncertainty (Jaworski 1988). Moreover, the level of uncertainty associated with each of these environmental factors is likely to vary by project. Because these sources of uncertainty can influence performance, environmental factors should be incorporated into future analyses of product development.

We present a model in which managerial controls precede interpersonal interactions, and together these control processes influence organizational outcomes. The static data collection process, however, does not provide an opportunity to trace the development of organizational performance and its antecedents. Further research could augment our study by longitudinally tracking the influence of managerial controls and interpersonal interactions on new products success.

Implications for Best Practice in Research

Our results support the use of control theory to determine organizational antecedents to new product success. Jaworski's (1988) model of organizational control maintains that formal and informal control mechanisms affect marketing outcomes. Similarly, Ouchi (1979) indicates that bureaucratic and clan-based mechanisms influence organizational performance. Both authors recognize that controls can be used in tandem to realize synergy in operation, yet they suggest that the combined use of these controls has received little empirical attention. Our study augments research in control theory by illustrating how formal controls are related to informal control processes. Moreover, we indicate how formal and informal controls influence organizational outcomes. Further studies should continue to examine the rela-

tionship between these controls and their influence on performance. Analysis of formal controls should not be limited to bureaucratic mechanisms but also should incorporate input controls (e.g., training, team development). Similarly, investigation of informal controls should be broadened to include corporate cultural controls. Simultaneous analysis of formal and informal controls provides a refined understanding of organizational antecedents to performance.

We incorporated groupthink rationale (Janis 1983) into our model to illustrate how relational norms can impair success. Although relational norms can foster cooperation and dialogue, we indicate that strong relational ties also can be associated with poor marketplace performance. In contrast, prior studies (e.g., Noordewier, John, and Nevin 1990) suggest that relational norms can raise performance. Additional research should investigate the existence of a threshold in the influence of relational norms on success. Identification of the conditions under which relational norms begin to constrain performance provides insight into the limits of clan-based control. In addition, recognition of conditions under which relational norms limit performance provides the opportunity to take corrective action.

The design of our study illustrates the merits of using separate mechanisms for assessing marketplace performance and organizational factors. Most empirical studies (e.g., Gupta, Raj, and Wilemon 1985a), however, rely on reports of process and performance collected with the same instrument. Simultaneous collection of integration and performance data may lead the informant to make inappropriate causal attributions regarding the relationship between integration and performance. Top management ratings of new product success, along with project participant evaluations of integration, enabled us to reduce bias associated with single informants. To reduce the potential for causal attributions between organizational performance and its antecedents, further research should continue to use separate informants to assess organizational properties and outcomes.

Implications for Best Practice in Application

Our findings indicate that as the amount of interaction between R&D and marketing personnel on a NPD project increases, the likelihood of that project's success also increases. However, when R&D and marketing personnel become too good of friends, the likelihood of new product success decreases. The desire to retain harmony precludes people from presenting viewpoints that are contrary to other opinions expressed within the group. Because adverse opinions are not expressed, design features may not be implemented that could increase the product's technological sophistication and marketplace value.

These findings present managers with a dilemma. How can work environments be designed in which R&D and marketing personnel interact frequently and cooperatively, yet are encouraged to challenge each other's opinions in an effort to improve the product? Managers must create work environments that encourage interaction yet overcome groupthink and complacency. Clearly specifying who is responsible for which activities in an NPD project enables participants to see how their individual actions fit with others' actions to achieve the overall goals of the project. This recognition of interdependencies should result in increased interaction between R&D and marketing participants. Managers

can formalize roles by clearly defining areas of responsibility and inter-relationships among NPD participants.

When decision-making authority is in the hands of the NPD project participants, they are more likely to interact. However, such decentralization of decision-making authority was found to encourage the detrimental too-good-friends–type relationships described previously. Managers must find ways to push decision-making authority down to the project level, while preventing participants from consensus building, which is aimed at minimizing conflict. Managers can accomplish this by delegating decision-making authority to the project level whenever possible and by tying individual rewards (and punishments) to project outcomes.

CONCLUSIONS

Our purpose has been to examine organizational processes contributing to the success of new products. We incorporated control theory to illustrate how managerial controls and interpersonal interactions influence system outcomes. Our results indicate that product success is raised by integration, yet lowered by relational norms. Perceived effectiveness, however, emerges through centralization, integration, and relational norms. Together these findings illuminate the delicate balance management must strike between interpersonal interactions and system outcomes. We hope that our study provides insight for project development managers and stimulates additional research into new product performance.

Appendix
MEASUREMENT MODELS

MANAGERIAL CONTROLS	
Please indicate your level of agreement with the following. (7 = strongly agree, 1 = strongly disagree)	Λ–First-Order Loadings
Centralization (α = .75)	
When product-related decisions had to be made for which no rules or procedures existed, I had authority to make the decision. (reverse-scored)	.751*
When a product-related problem arose, I had to refer the problem to someone higher up in the organization for the answer.	.707 (6.55)
When an unusual product-related situation was encountered, I generally went ahead without checking with my supervisor. (reverse-scored)	.284 (2.72)
Very few actions were taken without the help of a supervisor.	.731 (6.70)
Even small matters had to be referred to someone higher up for a final answer.	.643 (6.04)

Formalization (α = .85)

	Λ–First-Order Loadings
My responsibilities were clearly defined.	.911 (10.50)
My role in the company was clearly defined.	.817*
Management clearly outlined those areas for which I was responsible.	.776 (9.12)
I did not know my role in the organization. (reverse-scored)	.567 (6.19)

Summary Statistics

χ^2	60.09
d.f.	26
p-value	.01
CFI**	.912
Percentage of standardized residuals > |2.0|	0.0

INTEGRATION		
Please indicate your level of agreement with the following. (7 = strongly agree, 1 = strongly disagree)	Λ–First-Order Loadings (t-values)	Φ–Second-Order Loadings (t-values)
Marketing Involvement (α = .86)		.825*
Product planners were involved with engineers in:		
Setting the new product goals and priorities.	.728*	
Establishing the new product development schedule.	.712 (7.15)	
Generating the new product idea.	.843 (8.34)	
Screening the new product idea.	.806 (8.05)	
Information Exchange (α = .81)		.802 (3.86)
Product planners provided information to engineers on:		
Customer requirements for the new product.	.896*	
Regulatory and legal restrictions on product performance and design.	.622 (6.69)	
Competitor actions.	.758 (8.21)	
Engineering Involvement (α = .70)		.506 (2.83)
Engineers were involved with product planners in:		
Screening the new product idea.	.443*	
Designing communication strategies for the customers of the new product.	.681 (4.38)	
Analyzing customer needs.	.937 (4.11)	

Summary Statistics

$\chi2$	72.00
d.f.	32
p-value	.01
CFI	.918
Percentage of standardized residuals > |2.0|	0.0

INFORMAL CONTROLS

Please indicate your level of agreement with the following. (7 = strongly agree, 1 = strongly disagree)	Λ–First-Order Loadings (t-values)	Φ–Second-Order Loadings (t-values)
Flexibility (α = .76)		.661*
Flexibility in response to requests for change was a characteristic of this relationship.	.813*	
The parties expected to be able to make adjustments in the ongoing relationship to cope with changing circumstances.	.845 (7.82)	
When some unexpected situation arose, the parties preferred to work out a new deal rather than hold each other to the original terms.	.545 (5.54)	
Solidarity (α = 76)		.891 (4.70)
Problems that arose in the course of the relationship were treated by the parties as joint rather than individual responsibilities.	.698*	
The parties were committed to improvements that benefited the relationship as a whole and not only the individual parties.	.753 (6.78)	
The parties did not mind owing each other favors.	.703 (6.43)	
Conflict Harmonization (α = .75)		.965 (5.04)
When conflicts arose in the relationship, it was expected that a higher level manager was needed to resolve the dispute. (reverse-scored)	.779*	
It was expected that the parties would act in good faith manner when resolving disputes.	.676 (6.65)	
When conflicts arose in the relationship, it was expected that the parties directly involved would resolve the dispute.	.692 (6.79)	

Summary Statistics

$\chi2$	49.21
d.f.	24
p-value	.01
CFI	.935
Percentage of standardized residuals > |2.0|	0.0

EFFECTIVENESS

Please indicate your level of agreement with the following. (7 = strongly agree, 1 = strongly disagree)	Λ–First-Order Loadings
Effectiveness (α = .93)	
To what extent did you have an effective working relationship with product planners?	.875*
To what extent did product planners carry out responsibilities and commitments to you?	.828 (11.82)
To what extent did you carry out responsibilities and commitments to product planners?	.546 (6.38)
To what extent did you feel that the relationship between yourself and product planners was productive?	.945 (15.26)
To what extent was the time and effort spent in developing and maintaining the relationship with product planners worthwhile?	.858 (12.67)
Overall, to what extent were you satisfied with the relationship between yourself and product planners?	.865 (12.88)

Summary Statistics

$\chi2$	35.68
d.f.	9
p-value	.01
CFI	.954
Percentage of standardized residuals > |2.0|	0.0

*Fixed parameter.
**CFI = comparative fit index.

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