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An Examination of Collaboration in High-Technology New Product Development Processes

Avan R. Jassawalla and Hemant C. Sashittal

For more than a decade, researchers have explored the benefits of eliminating organizational boundaries between participants in the new product development (NPD) process. In turn, companies have revamped their NPD processes and organizational structures to deploy cross-functional teams. These efforts toward interfunctional integration have produced a more responsive NPD process, but they don't represent the endgame in the quest for more effective NPD. What's next after the interfunctional walls come down?

Pointing out that many high-tech firms have already taken such steps as integrating customers and suppliers into the NPD process, Avan Jassawalla and Hemant Sashittal suggest that such firms need to go beyond integration and start thinking in terms of collaboration. Using information from a study of 10 high-tech industrial firms, they identify factors that seem to increase cross-functional collaboration in NPD, and they develop a conceptual framework that relates those factors to the level of cross-functional collaboration achieved in the NPD process.

Compared to integration, collaboration is described as a more complex, higher intensity cross-functional linkage. In addition to high levels of integration, their definition of cross-functional collaboration includes the sense of an equal stake in NPD outcomes, the absence of hidden agendas, and a willingness on the part of participants to understand and accept differences while remaining focused on the organization's common objectives. Collaboration also involves synergy—that is, the NPD outcomes exceed the sum of the capabilities of the individual participants in the NPD process.

Their framework suggests that structural mechanisms such as cross-functional teams can provide significant increases in NPD-related interfunctional integration. However, high levels of integration do not necessarily equate to high levels of collaboration. Characteristics of the organization and the participants also affect the level of collaboration. For example, achieving a high level of collaboration depends on participants who contribute an openness to change, a willingness to cooperate, and a high level of trust. Their framework also points to key organizational factors that affect the level of collaboration—for example, the priority that senior management gives to NPD and the level of autonomy afforded to participants in the NPD process.

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Introduction

There is a clear consensus in the literature that high level cross-functional integration improves new product development processes [30,33,47,68,69,70,71,72,73,74]. The stream of research following Souder [68,69,70], and Gupta, Raj and Wilemon's [30] writings on the marketing-R&D interface has stimulated considerable thinking and spoken directly to managers in functional-hierarchical organizations concerned with overcoming rigid interdepartmental boundaries, building cooperation, and accelerating the development of new products from new technologies. It also has generated a distinctive vocabulary of cross-functional linkages, i.e., terms such as cross-functional interaction, cooperation, and integration have come to hold distinctive meanings in the new product development (NPD) literature [see 9,29,33].

This article attempts to extend this line of thinking about cross-functional linkages to address the new and emerging contingencies faced by managers responsible for NPD processes in some leading high-technology firms (see Exhibit 1 for additional information). We contend that although the concern for cross-functional integration endures, major shifts have occurred within and outside high-technology firms that call for a re-examination of the ways in which cross-functional linkages are conceptualized. Many firms have integrated leading customers and suppliers in technology/product development processes [57], adopted features of horizontal, boundary-less organizations and innovative ways of managing technology and people [8,32], and experimented with cross-functional teams to manage NPD task environments [45]. These developments call not only for a re-evaluation of traditional thinking about cross-functional linkages but also for the adoption of a more up-dated vocabulary that speaks to the practical realities of managers responsible for NPD processes in leading high-technology firms [see 24].

Exhibit 1. High Technology Firms

High technology firms are a unique segment of organizations because in comparison to others they: (a) employ proporitonately more scientists, engineers, and technically (and often terminally) qualified people; (b) face considerably higher rates of product obsolescence because of rapid advances in new technology coupled with intense competitive pressures; (c) invest proportionatelyh larger sums in R&D, and focus considerably on developing new products from new technology; and 9d) rely inordinately on rapid, efficient new product introductions to meet revenue and profit objectives, and to remain competitive [see 80].

Our central purpose in this article is to develop a conceptual definition and framework that stimulate thinking about *collaboration* as the next generation of cross-functional linkage relevant to NPD processes. Initially, we compare and contrast the conceptual underpinnings of *integration* and *collaboration*, and show how the latter refers to a higher intensity, more productive cross-functional linkage. Then we develop a conceptual definition and describe our exploratory study of NPD processes in ten mid-to-large high-technology industrial organizations. Based on managerial descriptions we identify factors that appear to increase NPD related cross-functional collaboration, configure them into a conceptual framework, and develop propositions for future empirical analysis. Finally, we discuss several implications likely to interest practitioners and scholars.

Conceptual Background and Method

Thinking About Cross-Functional Linkages

In much of the NPD literature, *integration* is used not only as an umbrella term to describe a variety of cross-functional linkages, it is often used interchange-

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ably with *collaboration*. Both terms commonly refer to the coming together of diverse interests and people to achieve a common purpose via interactions, information sharing, and coordination of activities [64,72]. Overcoming the problems created by physical and perceptual distances among R&D, marketing, production and other functional groups, ensuring early involvement of all participants, and joint sharing of responsibility in ways that ultimately improve and accelerate NPD processes are among the commonly described advantages associated with both terms [29,30,31]. Kahn [33] makes an important contribution to this line of thinking by defining inter-departmental *integration* as an umbrella term that subsumes *interaction* and *collaboration*. By *interaction* the author refers to formal, transactional communication links, and by *collaboration* to informal, cooperative relationships that build a shared vision and mutual understanding among participants in the NPD process. He also proposes that the latter has a stronger impact on product development than the former. Our purpose here is to clearly differentiate the two terms in light of our findings and recent developments in the literature, and portray *collaboration* as a useful way of conceptualizing cross-functional linkages in emerging new product contexts.

An argument favoring the re-examination of current cross-functional linkage related epistemologies is easily constructed. Overwhelming evidence suggests that improved cross-functional linkages result in improved new product performance, i.e., improved product quality, reduced costs, fewer engineering hours for product development, improved manufacturability, fewer production start-up problems, faster time to market [10,64], and eventual commercial success [see 2,30,35,52,56,67]. To meaningfully address practitioners' concerns about developing new products, therefore, is to continually engage in a search for new, innovative ways of conceptualizing cross-functional linkages. Recent discussion about cross-functional collaboration as a higher level, more intense cross-functional linkage further reinforces this view [see 24,41]. More importantly, however, we find that the conceptual underpinnings of terms such as *cross-functional integration*, *cooperation*, or *coordination* fail to address the new, emerging challenges that beset managers responsible for NPD processes in leading high-technology organizations. By adopting features of flatter, customer-focused organizational designs, many are overcoming structural barriers to cooperation, perceptual distances among R&D, marketing, production, and other groups, and rigid interdepartmental boundaries [29]. Although not all have achieved identical levels of success in NPD programs, the Total Quality Management initiatives have helped increase interaction among functional groups and coordination of activities. For the growing segment of firms that routinely develop cross-functionally trained employees and deploy cross-functional teams, the new and emerging challenges in NPD task environments are less about overcoming rigid interfunctional boundaries or linear-sequential work-flows via cross-functional integration, and more about harnessing the improvements in product performance promised by the recently implemented structural and systemic changes. Hence, a clear need exists for thinking about and affecting innovative cross-functional linkages that can: (a) sponsor high levels of creativity in the way technological prowess is transformed into new applications and solutions for customers, (b) harness efficiencies and synergies promised by the recent restructuring, and new ways of organizing NPD task environments (such as cross-functional teams), and (c) optimize the creative potential of a cross-functionally trained work force, cultivate intellectual capital, and manage cumulative organizational learning [see 25,49,75].

Based on our findings and the writings of Dougherty [24], and Liedtka [41], we present *collaboration* as a type of cross-functional linkage that speaks to this modern, day-to-day reality; and propose that high levels of collaboration among participants in the NPD process can result in significantly improved new product performance. In Figure 1, we delineate the cross-functional collaboration construct and compare and contrast it with the thinking about inter-departmental integration [29,33].

The figure shows our literature [21,24,41,58,79] and data derived view that integration is a subset of collaboration. By the former, we refer to interactions, information sharing, coordination of activities among participants in the NPD process, and the development of a shared vision. By the latter we refer to *additional* features of cross-functional linkages that address current managerial concerns. We define NPD related cross-functional collaboration as *a type of cross-functional linkage, which in addition to high levels of integration, is characterized by participants who achieve high levels of at-stakeness, transparency, mindfulness and synergies from their interactions.* NPD processes are collaborative, in addition to just integrative, when all participants' concerns are viewed

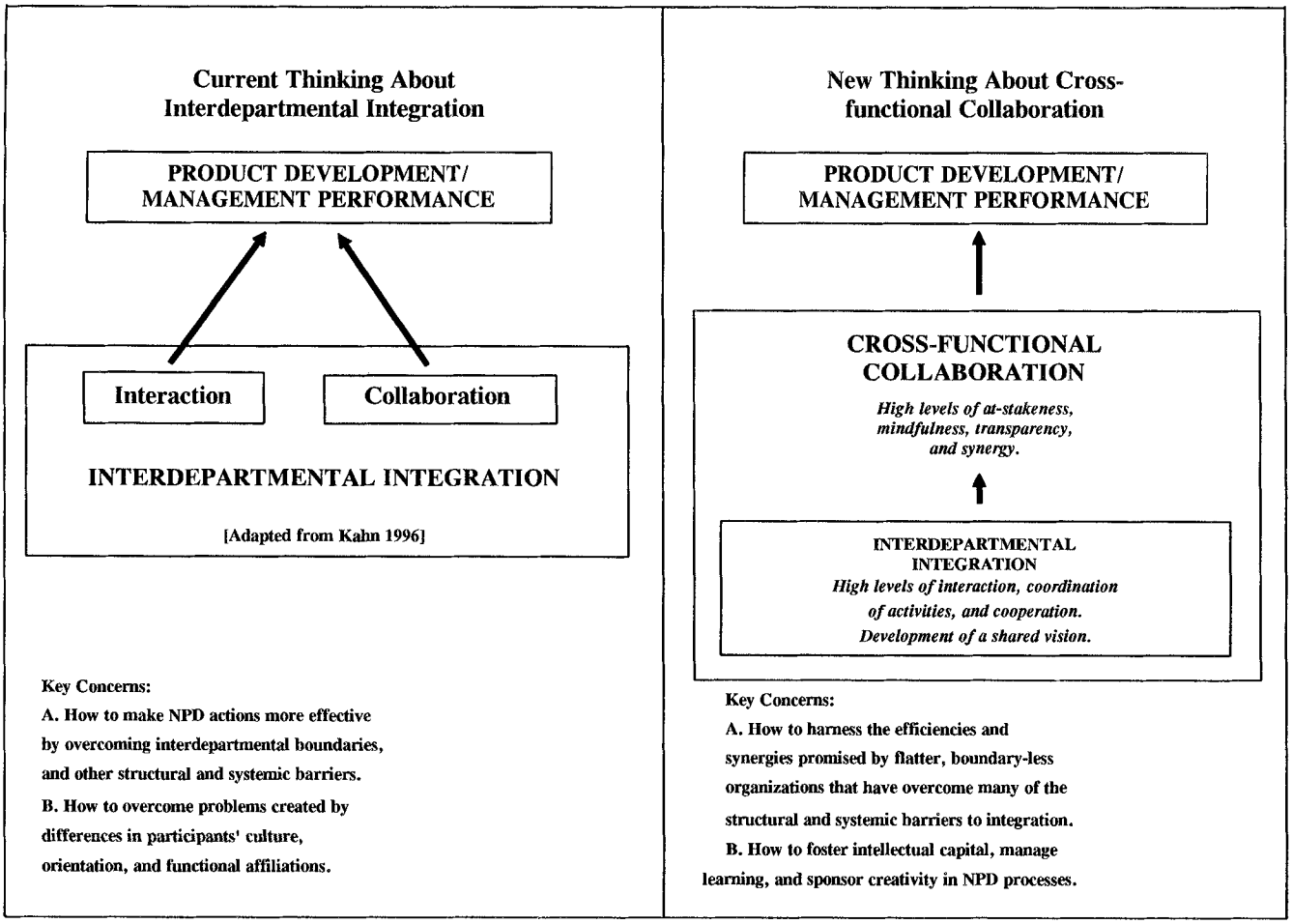

Figure 1. Differentiating Integration and Collaboration

as equally important, multiple perspectives and experiences are incorporated equally in decision making, and every participant's commitment and involvement is viewed as essential for effective implementation [79]. Key features of cross-functional collaboration include high levels of: (a) *at-stakeness*, i.e., a condition where participants have *equitable* interest in implementing jointly developed agendas, and feel *equal* stake in NPD related outcomes [41]; (b) *transparency*, i.e., a condition of high awareness achieved as a result of intense communication and exchange of hard-data[1] that makes the motivations, agendas, and constraints of all participants explicit [see 24]; (c) *mindfulness*, i.e., a condition where new product decisions and participants' actions reflect an integrated understanding of the breadth, and the often divergent motivations, agendas, and constraints that exist, *at all times* [24]; and (d) *synergy*, i.e., the accomplishment as a result of cross-functional linkages of NPD outcomes that reflect capabilities significantly beyond those participants individually bring to the process [see 59]. Collaborative processes are characterized not only by participants who think globally, act locally, and achieve high levels of openness about each others' motives and mindsets, but also by participants who understand, accept, and internalize differences that exist and agree to focus on common objectives [24]. More than other forms of cross-functional linkages conceptualized in the NPD literature, *collaboration* refers to scenarios in which participants explore new opportunities, enhance creativity, and open doors for new, innovative ways of thinking, organizing, and taking action.

Although much is known about factors that improve interfunctional integration, very little is known about the ones that promise high levels of collaboration. For

[1] By *hard-data* we refer to information that people with opposing orientations and points of view can accept as valid descriptions of situations and events.

instance, hierarchies, rules, goal setting and plans, liaison roles, interface and boundary spanning activities, task forces, integrative roles, matrix organization, concurrent engineering, and formal interface management processes such as Phase review process, Stage-Gate process, PACE, QFD are promoted as structural/processual solutions for cross-functional integration [26,29,33,40,72,73,76]. Similarly, co-location of multiple functional groups [54], informal social networks, and organizational cultures that tolerate risk, decentralize, and share rewards are viewed as important contributors [29,53]. Cross-functional teams are also viewed as an effective structural/processual solution for coordinating functional group activities and improving cross-functional integration [33,34,37]. Whether or not the strategies and structural/processual solutions that yield higher levels of cross-functional interaction and integration *also* result in collaborative NPD processes remains unknown.

Method

We conducted an exploratory study and collected qualitative data for two reasons. First, the lack of a critical mass of research findings about cross-functional collaboration in the NPD context precluded theory derived hypothesis testing approaches, and suggested the need for an exploratory, grounded analysis (see Exhibit 2 for additional information). Second, our over-riding purpose was to understand how the information and ideas flowed between participants (representatives of the major functional groups including marketing, R&D, and production), and how NPD activities were organized in high-technology firms. Grounded analysis promised the opportunity to gain a holistic understanding of the key interpersonal, group and organizational issues from the perspectives of managers directly participating in NPD activities [see 27].

Exhibit 2. Grounded Theory

"The grounded theory approach is a method for discovering theories, concepts, hypotheses, and propositions directly from the data, rather than from *a priori* assumptions, other research, or existing theoretical frameworks," [77, p. 126]. To build grounded theory in this context is to believe that new product related cross-functional collaboration in high-technology firms is best understood by obtaining firsthand knowledge, and by focusing on the personal experiences of managers directly involved in the process. Therefore, information gained via depth-interviews with the most knowledgeable participants in new product development processes (versus information gained via other means and from the literature or other sources) served as the *principal* basis for constructing our framework and hypotheses.

Our study was conducted in two stages. First, as part of a pilot study, we approached four high-technology firms and depth interviewed six managers (four from R&D and two from marketing). We pre-qualified participants as middle-level managers that possessed the most knowledge about their firm's NPD processes. We asked them to describe their day-to-day NPD related concerns, experiences, and interactions with others; and tape recorded and transcribed their responses. Based on the pilot data, we developed research questions on topics that were central to managerial experiences, viewed as problematic, *and* understudied in the literature. We translated the research questions into an interview protocol to guide depth-interviews in the second stage.

In the second stage, using the professional contacts of an advisory board as a reference, we identified the CEOs and divisional heads in ten mid-to-large sized high-technology firms. These individuals helped us gain access to suitable interviewees. To gain multiple perspectives, we interviewed at least one participant each from R&D, production, and marketing from each firm. In our sample, twenty-three managers served as functional heads including one president of the firm who also oversaw production. Ten served as functional group representatives to NPD teams, two headed their business division, and four served as leaders of NPD teams. One manager was titled the *facilitator of team processes* in a large, multi-divisional firm (with experiences in marketing and project management functions). All but one had engineering degrees, three had Ph.D.s in science/engineering, and eighteen managers had MBAs in addition to engineering degrees. Managers had an average of twenty years of experience in the industry, fourteen years in the firm, and twelve years participating in NPD activities. Among the questions on our interview protocol that relate to the findings we report in this article are:

What is your role in the NPD process?
What actions have you found that help (and hinder) NPD? Why was that?
Does (your functional group) cooperate with (other functional group) during the NPD process? How does this occur?

Is there a shared understanding between (your functional group) and (other functional group)? What, if anything have you done to gain the involvement of people from other functional groups?

We stopped data collection after the fortieth completed interview in the tenth firm because of time and resource constraints, and because we found clear signs of data saturation. Managerial responses increasingly reinforced the themes and patterns we had identified, without adding significantly to the breadth of findings. The interviews lasted between 90–120 minutes and were transcribed and content analyzed (see Exhibit 3 for additional information).[2]

Consistent with exploratory studies, our study was affected by several factors that held a potential for bias including: (a) our convenient sample, (b) the inclusion of only 3–6 managers per firm instead of more, (c) reliance on managerial descriptions and recollection of events from their memories, and (d) relatively short duration of each interview, i.e., 90–120 minutes. In view of these limitations, we focused on ensuring consistency among the taped managerial responses, the codes we assigned, and the themes we developed. The process of data analysis was overseen by a panel of experts who examined the fidelity of findings with original data. Consistent with the exploratory nature of our data, we develop propositions and a conceptual framework of cross-functional collaboration. Since only future empirical validation of our propositions and framework in a larger, random sample of firms can attest to external validity of our study, we make no such claims in this article.

Exhibit 3. Content Analysis

Content analysis is a method of "identifying, coding, and categorizing the primary patterns in the (qualitative) data," [51, p. 381], and a primary tool for *making sense* of interview transcripts. A simplified description of the content analysis we conducted is as follows.

In order to gain high level of familiarity with the data, we initially *listened* to the interview tapes and transcribed them. Then we examined each transcript and: (a) coded managerial responses to aid categorization and comparison across interviews, (b) wrote notes about our own learning and what we believed were the themes and patterns that existed in the data.

For instance, one of the notes we wrote in a transcript was: *Just like transcript #3, this manager is struggling with issues of building an environment where there are* no *hidden agendas between R&D and marketing, and taking steps such as . . . to create a climate of trust. We know this because on page __ the manager says . . . and on page __ he adds . . .*

We knew a *pattern* existed in the data when managers from several firms raised simlar issues. Eventually, based on this tentative pattern, we examined what *each* manager had said (or not said) about *hidden agendas* and *building trust* in the new product development context. We followed this process to develop each of our findings.

The content analysis was essentially iterative. Every interview transcript was repeatedly revisited and scoured for supporting as well as contrary evidence to the themes we had identified. Eventually, after we had amassed sufficient evidence to support our themes (i.e., actual quotes from managers), we translated many of our findings into *box and arrows* type frameworks. The framework of cross-functional collaboration we present here best explains the *generalized* view that emerged from our data and succinctly portrays our own learning.

A Conceptual Framework of Cross-Functional Collaboration

Figure 2 shows the framework of cross-functional collaboration we developed from our data. It shows that the nature of the organization and participants impact structural mechanisms employed to manage the NPD task environment, which in turn impact the extent of cross-functional collaboration achieved.

Extent of Cross-Functional Collaboration

The right-most box in Figure 2 shows the result of our attempt to locate each of the ten firms in our sample along a continuum of cross-functional collaboration. The continuum emerged after an iterative analysis of managerial descriptions (at least one each from R&D, production and marketing per firm). We initially classified each firm's NPD task environment on a rough scale ranging from *low collaboration* to *high collaboration.* The classification was based on a gestaltic view we developed from conducting interviews, listening to tapes, transcribing and coding data. We evaluated each firm's position based on the extent of: (a) integration and differentiation in their NPD task envi-

[2] The content analysis of interview transcripts, and the design of the study, were based on the guidelines of Bogdan and Biklen [6], Miles and Huberman [45], Patton [51] and Taylor and Bogdan [77].

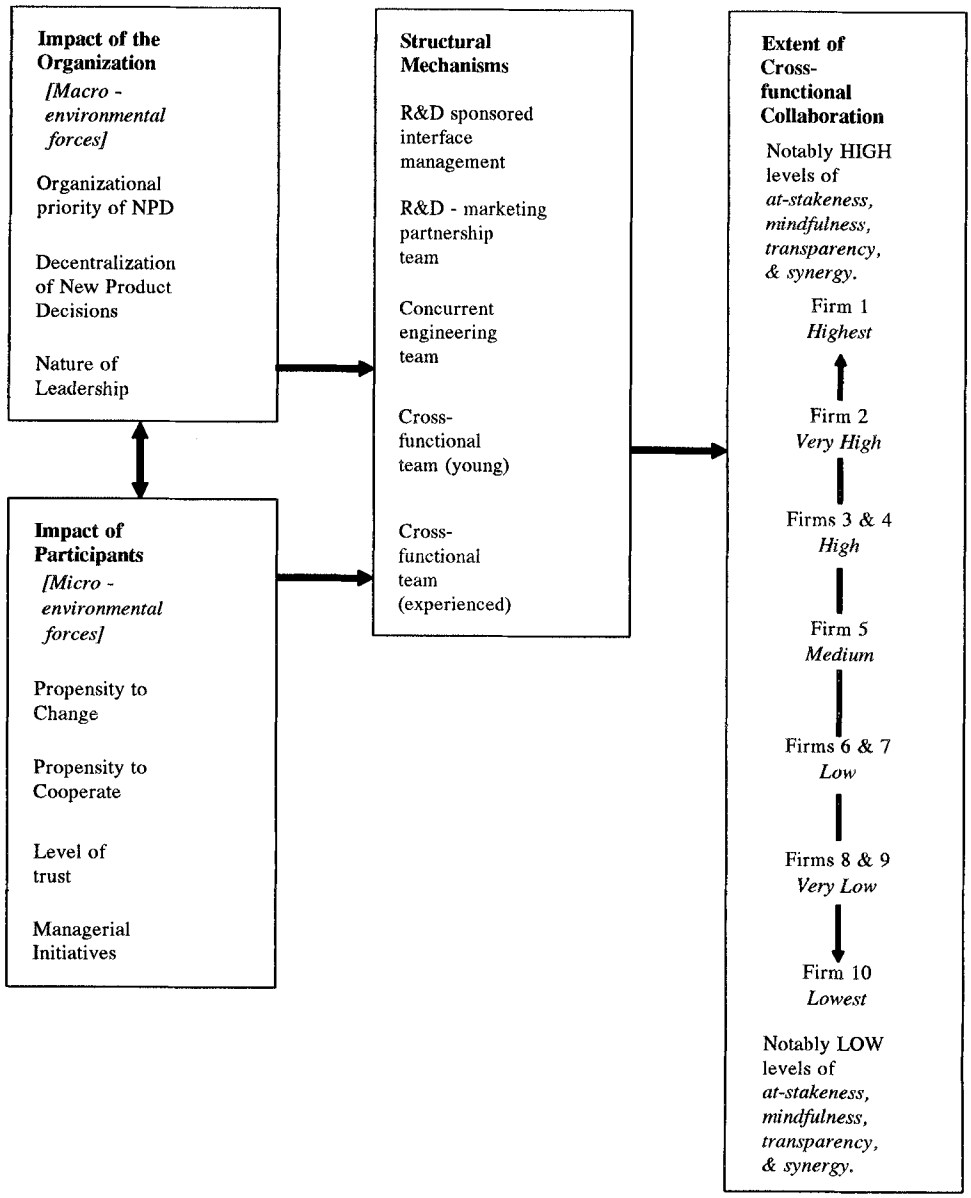

Figure 2. A Conceptual Framework of Cross-Functional Collaboration in New Product Development Processes

ronment,[3] (b) participation and contribution reported by each functional group in NPD activities, and its cooperation with others, (c) the perceptual and spatial distances that existed between functional groups, (d) participation reported by managers from the *initiating* stages of NPD processes. Finally, we adjusted each firm's location based on: (a) the reported level of synergy achieved by participants, (b) the extent to which participants shared power, showed equitable concern for implementing NPD decisions, and their reported stake in NPD outcomes, (c) the extent of hidden agendas and turf protection behaviors participants reported versus the degree of transparency achieved, and (d) the extent to which participants operated from a clear understanding of others' capabilities, constraints, and interests and the extent of mindfulness they displayed. A comparison of the firms on the opposite ends of our continuum helped portray in sharp relief the key features of *collaboration* as implied by our data (see Table 1).

[3] Highly *differentiated* new product development processes refer to instances in which R&D makes decisions by itself, or consults other functional groups at best. The coordination of functional groups' activities and cooperation with others is significantly low. High *integration* refers to new product development processes where R&D, production, and marketing groups are involved from the initiating stages of NPD, make joint decisions, and demonstrate high levels of coordination in their activities.

Table 1. Comparing the Least Collaborative with the Most Collaborative Firm

The NPD processes in the least collaborative firms were characterized by:	*The NPD processes in the most collaborative firms were characterized by:*
Unequitable distribution of power among participants, who held unequal stake in NPD outcomes. A clear *pecking order* existed among decision makers (led by R&D, tailed by production). Notable social (as well as perceptual) distances also existed among participants.	Equitable distribution of power among participants and equitable stake in NPD outcomes. If a *pecking order* existed among NPD participants, it was mostly imperceptible. Social distances among participants were notably close.
Concerns for technology and technical implications of NPD processes that overshadowed concerns for interpersonal interactions and interpersonal dynamics.	Concerns for interpersonal dynamics that were nearly as high as concerns for the technical aspects of NPD processes.
Participants who held strong affiliations with their functional groups, and weak affiliations with the NPD related task environment.	Participants who held at least as strong an affiliation with the NPD task environment (if not more) as they did with their functional groups.
Participants and functional groups that were isolated in self-contained units. They imported and exported ideas, energy and resources through gates and gatekeepers.	Imperceptible boundaries between functional groups. All participants functioned as boundary-spanners, explicitly acknowledged that they existed in reciprocally interdependent relationships, and appeared to take joint responsibility for NPD activities.
Unproductive conflict situations. Most positive outcomes of conflicts were *compromises* that diluted everyone's agenda and led to the adoption of mediocre, *safe* solutions.	Conflict situations that were often used as avenues for exploring *new* options and scenarios. Diverse voices were equitably integrated in an attempt to resolve conflicts, and resulted in creative solutions that extended everyone's thinking.
Interactions among participants that were entropic, and tended to deteriorate in the absence of directives from senior management (or directives from R&D managers).	Most interactions among participants that were self-initiated, intrinsically motivated, and synergistic.

Structural Mechanisms

There was considerable variability in the design by which the NPD task environments were administered in our sample, i.e., in the ways decisions were made, information was shared, work-flows were organized, cooperation among R&D, production, and marketing groups was fostered, and activities among participants were coordinated. For instance, two firms employed R&D sponsored interface management for NPD decisions. R&D controlled most all NPD decisions and managed the linear-sequential work-flows. Working in relative isolation, each functional group completed its assigned NPD related task and handed its output *over the wall* to the next functional group. One firm employed a partnership team between marketing and R&D groups to share NPD responsibilities. The two groups were co-located, and the R&D manager reported to the marketing manager on the status of NPD tasks. One firm used a concurrent engineering team including representatives from R&D, design engineering, and production engineering to make NPD decisions. The extent of interactions between the firm's *repertoire* of technical skills had improved significantly, but the input of marketing and other functional groups was conspicuous by its absence. Three firms had instituted cross-functional teams (*henceforth* CFTs) for NPD projects within the last three years, with at least one representative each from R&D, production, and marketing groups. They reported considerable struggle with managing people and the *process* issues of teamwork. Two firms were utilizing CFTs for managing NPD projects for over three years and had overcome several group and interpersonal problems that emerged in teams. Finally one firm was cross-functional in nature. Nearly all complex decision making and work-flows were entrusted to CFTs including all NPD projects.

Our findings about integrative mechanisms shed much light on the factors contributing to integration and those uniquely to collaboration. For instance, we found that the extent of integration varied with structural mechanisms employed. Integration was the lowest in instances where functional groups worked in relative isolation, performed their part of NPD activities, and handed over their outputs to the next group. Integration was higher, and the frequency of meetings, information sharing, and cooperation among participants increased substantially when NPD activities were managed by partnership teams, concurrent engineering teams, or relatively inexperienced CFTs. Integration was the highest when CFTs had considerable experience in managing the technical as well as human

interaction issues of NPD processes. Although the variability in structural mechanisms appeared to explain much of the variability in the integration, it failed to explain much of the variability in collaboration. For instance, even though many indicators of integration such as frequency of and time spent in meetings, amount of information exchanged, and coordination of activities were comparable in six firms that used CFTs in our sample, the extent of collaboration differed considerably. Our data showed teams as microcosmic arenas where organizational and participant related forces interacted, or more so, acted out. The nature of the organization and participants, more than the intrinsic nature of teamwork (or other integrative structural mechanisms) appeared to impact the extent of at-stakeness, transparency, mindfulness, and synergies achieved among R&D, marketing, production, and other groups participating in NPD activities. In sum, our framework was based on the following implications we drew from our findings: (a) structural mechanisms, particularly cross-functional teams, could do much to increase NPD related interfunctional integration, (b) high levels of integration did not high levels of cross-functional collaboration make, and (c) in addition to structural mechanisms, the impact of the organization and its participants was inescapably felt on the extent of cross-functional collaboration actually achieved. We next discuss the organizational and participant related factors that we configured into our framework.

Impact of the Organization

We found a host of organizational factors, the macro-environmental forces of NPD processes, impacting the extent of collaboration achieved. By *organizational forces* we refer to the senior management's resource allocation decisions that: (a) determined the extent to which participants overcame perceptual distances owing to differences in qualifications, orientations, and interests, and identified with the collaborative intents of NPD processes (versus exclusively with their functional groups), (b) defined the relative power of functional groups, and hence their relative stake in NPD decisions and outcomes, and (c) shaped how participants defined their own behaviors and roles in the NPD process and interacted with others. We next discuss the key organizational factors we identified from our data as contributors to collaboration.

Organizational Priority of New Product Development. The sense of urgency about new products that senior management conveyed, and the priority they attached to NPD processes sent powerful cues to participants, and shaped their collaborative behaviors. In other words, when senior management, by proclamation and deed, conveyed that product innovation was a central, focal component of the organizational mission, we found higher levels of collaboration.

When and *why* senior management initiated and allocated resources to product innovation activities largely reflected their sense of priorities. Collaboration was notably lower when resource allocation to NPD activities were defensive responses to competitor activities, and when concerns for cost saving and reduced time to market were its principal drivers. Collaboration was considerably higher when senior management's interest extended to creative utilization of *every* participant's potential.

Higher priority to NPD processes was apparent when senior management: (a) formally deliberated on the best structural mechanism needed to manage NPD decisions and tasks, (b) was just as likely to support new product ideas that originated from customers, or marketing, production, and other functional groups, as they were to support those from R&D, (c) conveyed a sense of urgency about innovation, and viewed new products from new technologies as the principal organizational activity as well as the principal vehicle for achieving market objectives, and (d) invested in people who, in addition to possessing technological skills, could manage the group and interpersonal dimensions of NPD processes as well.

For instance, in two firms, the fear of losing current customers was recounted as the principal driver of NPD processes. There was a clear reluctance to embrace organizational change implications of new technology, and NPD activities were initiated most always *after* customers insisted on new products or improvements and threatened to switch suppliers (*low priority*). Three firms exhibited a defensive posture and viewed NPD as a way of improving current products to defend, and occasionally to stay ahead of, competitors (*low-mid priority*). Participants' involvement with NPD activities was limited to solving technological problems if and when they occurred. Their responses showed a strong tendency to figure out expeditious solutions and return to their *real* jobs after the technological problem was solved. The lower priority to NPD processes in these five firms resulted from one or a combination of the following: (a) concern for

securing existing business, and frequent firefights, that restricted the focus on the future, (b) periods of undercapitalization which restricted direction of resources to NPD activities that only *promised* future gains, and (c) relatively lower rate of product obsolescence that lulled senior management into a false sense of security.

We classified two firms as *mid-high priority* because we found senior management strongly focused on continuous improvement of current products to counter technological obsolescence. Resource allocation decisions of senior management reflected a strong interest in: (a) staying technologically current, (b) designing and eventually instituting systems and processes that streamlined and accelerated the NPD process, (c) formal NPD related planning processes that could involve multiple functional groups in ways that overcame their pre-occupation with narrowly defined functional activities. Finally, in three firms, the importance attached to NPD appeared noticeably high (*high priority*). Managerial responses indicated that NPD was part of their organizational culture, i.e., they expect NPD related activities to be an integral part of their day-to-day schedule. Senior management continually sought opportunities to develop new technologies/products, scanned multiple venues (customers, trade shows, competitors) for ideas, had a system for assessing every new idea that came to their attention, and viewed NPD as central to the firm's mission and routinely allocated resources to NPD activities. Based on these findings we propose:

P1: The greater the organizational priority of NPD, the greater the extent of NPD related cross-functional collaboration.

Decentralization of New Product Decisions. The extent of autonomy and access to information and resources the organization made available to participants in NPD processes appeared to impact the level of collaboration achieved. We found the extent of collaboration notably lower in firms when: (a) the level of decentralization was low and senior management viewed themselves as the primary decision makers and participants as the implementors, or (b) all NPD related decisions made by participants (in cross-functional teams) were subject to scrutiny and approval by senior R&D management before implementation, or (c) one functional group (R&D) dominated NPD related decision making and performed most of the activities it entailed. On the other hand, collaboration was notably higher when decisions were left to the CFTs either within the guidelines provided by senior management, or with periodic status updates to senior management. We found the level of collaboration the highest in the firm where the CFT members had autonomy to make *all* NPD decisions and design their own work-flows. Hence we propose:

P2: The greater the decentralization of NPD related decision making, the higher the extent of NPD related cross-functional collaboration.

Nature of Leadership. The nature of leadership, particularly in terms of *who* led decision making and *how* the leader was chosen for the product development process, appeared to impact the extent of collaboration. For instance, when R&D's influence on NPD decisions was relatively higher than others' ($n = 6$), either no teamwork was used ($n = 2$), or R&D *appointed* one of their own to lead the team ($n = 4$). On the other hand, when R&D's influence on the NPD decisions was paralleled by the marketing group's influence, not only was teamwork used to structure NPD tasks, but a leader primarily responsible for managing the human interaction issues of NPD processes was *selected* by the senior management ($n = 4$).

The differences between *appointed* and *selected* leaders are worthy of note. R&D appointed leaders signified their relatively higher stature and symbolized inequality of status among participants, a somewhat flawed basis for collaborative relationships. Appointed leaders *consulted* participants if and when necessary, but did little to engender collaboration. They held strong affiliations to R&D, and viewed teams as vehicles for gaining compliance from other participants in NPD processes. CFTs with appointed leaders represented not a circle of participants willing to accomplish more than the sum of their talents, but a group of participants with unequal power, unequal stake in NPD outcomes, and a host of hidden agendas that were acted out in ways that prevented effective use of resources.

Leaders *selected* by senior management on the other hand symbolized equality of status, and converted marketing and production representatives on CFTs from second class voices to first class voting citizens [see 17]. Selected leaders held strong affiliations to the NPD task environment (versus with their functional origins), enjoyed the tacit support of senior management, and focused on interpersonal issues at least as much as they did on NPD tasks. Distinctive behaviors of selected leaders included: (a) bringing in consultants to conduct team building exercises, (b) network-

ing with the functional groups and functional heads to gain their commitment and support for NPD projects, (c) educating, coaching and mentoring CFT members to increase their participation and cooperation with others, (d) making participants aware of the reciprocal interdependencies that existed and about the impact of their actions on the entire project/business (i.e., creating awareness of the *big picture*, and holding one-on-one sessions with CFT members to improve their participation). Based on these findings we propose:

P3: When the leader of the NPD process is ***appointed****, the extent of NPD related cross-functional collaboration is low.*

P4: When the leader of the NPD process is ***selected****, the extent of NPD related cross-functional collaboration is high.*

Impact of Participants

Figure 2 shows a host of participant related factors that determined how well integrative mechanisms delivered NPD related cross-functional collaboration. Participants principally determined the nature of human interactions and the negotiations that occurred, and represented the micro-environment of NPD processes. We found that participants, individually and collectively, explicitly or tacitly, determined the extent of: (a) personal commitment to NPD decisions and a personal stake in their outcomes, (b) social and psychological distances between each other, (c) cohesion and belongingness they attributed to their personal involvement in the process, and (d) creativity they were willing to employ in exploring new scenarios in conflict situations (versus a continual push for their functional group's agenda and for compromises). We discuss each of these participant related factors next.

Propensity to Change. Participants' propensity to change, or the extent to which they actually reported adoption of new behaviors, appeared to directly impact the extent of collaboration achieved. Participants that showed a higher propensity to change were unique in their view that changes in existing NPD related decision-making processes and work-flows could energize rather than disrupt the organization, and that re-distribution of power and re-definition of power-holders could revitalize rather than de-stabilize the process. They also were unique in their willingness to experiment with new ideas and adoption of new ways of thinking and doing.

For instance, ten participants (25% of the sample of 40 managers) reported no change in their activities, even though eight were involved in NPD related teamwork. They reported doing no more or different as part of the team than they did when they were exclusively assigned to their functional groups. Another 20 participants (50%) went only a step further. They informed other CFT members about their area of expertise, and provided a simple communication link with their functional group (e.g., the marketing representative informed the team about customer needs). Conversely, ten participants (25%) demonstrating a higher propensity to change described the new attitudes, mind-sets, and behaviors they had adopted as part of their new work environment (particularly CFTs). Of these, six actively sought opportunities to create changes and improve existing NPD processes. A manager describing the centrality of behavioral changes in NPD processes noted:

> I've done a lot of making changes and probably a lot of team building. . . . I think organizations have to learn how to change faster. And one of the ways to do that is to really be very open about what the situation is and what people are doing and how they're performing. And, as you start doing that and start moving things around because of it, you end up being a change agent. . . . I will get impatient once the changes are made. Once we've really changed and we're doing the things we really think we should be doing, I will start getting impatient (and look for new areas for change).

Hence we propose:

P5: Higher the propensity to change among the participants in the NPD process, the greater the extent of NPD related cross-functional collaboration.

Propensity to Cooperate. It is important to differentiate the rhetoric on cooperation which managers liberally espoused, from actual propensity to cooperate which we found linked to the extent of transparency, mindfulness, and synergy achieved in new product task environments. While nearly *all* managers in the study agreed in a general way that high levels of interfunctional cooperation was essential for new product development, the extent to which they reported actual participation in cooperative behaviors, or took steps to increase cooperation among functional groups varied widely. Most also betrayed a general belief in the notion that *they* (and their functional groups) were more cooperative than the others. Contrasting with expressed willingness and the wish for

others to increase cooperation, propensity to cooperation was a learned, attitudinal characteristic of participants, and reflected in the way they thought, acted, and interacted with others.

We found that higher propensity to cooperate was indicated by an enduring interest in exchanging information, preventing perceptual distortion, and developing a shared understanding that stretched everyone's thinking. Participants with a higher propensity to cooperate were uniquely identifiable because they: (a) identified at least as much with the NPD related task environment as they did with their functional group activities, (b) were explicitly aware of the reciprocally interdependent relationships among participants and between functional groups that existed, (c) coordinated their activities with others from the early stages of NPD, and (d) viewed others' contributions and ideas as essential for making high quality NPD decisions and taking effective actions.

On the other hand, representing the lowest propensity to cooperate, four participants (10%) either wanted to be left alone, or appeared interested in communicating with others *only if* some major problem arose. Three of the four represented firms that did not employ teamwork. Seven (17.5%) participants demonstrated medium propensity to cooperate. They met with others to exchange ideas and solve problems *only when* some important NPD issues arose. Most participants (n = 23, 57.5%) however, communicated with others during periodic, pre-scheduled meetings (*medium-high propensity*). A marketing manager from a division that manufactured environmental emission control products, describing regular pre-scheduled meetings as the principal forum for sharing status of activities, voicing concerns, and soliciting information, noted:

> This team that I talked about, there will be people from development, from marketing, from engineering. And that team meets every two weeks for a couple of hours. Just to bring everybody up on what's happening. Now two things happen in those meetings. One is, ideas from customers go to the development group. And ideas from the development group are coming to the engineering people. So they know what are the things happening. So if the development group is trying to do something that the engineering folks can't live with, that's the time to talk about it. Or if we are developing a product that customer's are not willing to pay for, then that is the time (for marketing) to talk to them (development group). . . . A lot of times, those are not the big issues. The big issues are that development people want to know, *Hey am I doing the right thing? Is this what the customer wants? Can you find out more about what they really want?* and those are the things that the team meetings are a vehicle to talk about.

Six managers (15%) were interested in talking about *every* idea with everyone else involved in the NPD process (*high propensity*). Four of the six represented firms in which CFTs were used for *all* major organizational initiatives. The director of this firm, explaining the cross-functional culture of the organization noted:

> It's important to understand that because when you start talking about new ideas, new business, it will come out of any of these areas (manufacturing, engineering or marketing). Because all of these people with maybe the exception of finance, and that's only a maybe, have interface outside the company. And any of these people from manufacturing, engineering, and even manufacturing engineering, spend time with our customers. So any of these people could identify something in terms of NPD. And when there is a new idea or a new concept, it is almost immediately discussed at one of my staff meetings, which includes all of these disciplines.

Based on these findings we propose:

P6: The greater the participants' propensity to cooperate with others, the greater the NPD related cross-functional collaboration.

Level of Trust. We found that the level of trust participants attributed to others in the NPD task environment functioned as a strong cohesive force and led to higher levels of collaboration. Participants that attributed higher levels of trust toward others were unique in their view that *other* participants were competent, responsible, open to new ideas, and willing to work toward common organizational interests. They appeared open to showing their vulnerability to the actions of other participants, and held longer term perspectives. In high trust NPD processes, we found participants more eager to share information, more likely to admit to their confusions and ask for assistance, and more likely to take the risk of voicing new, creative ideas. Hence, instead of originating from senior management's directives, the motivation to collaborate often emerged intrinsically. We also found higher levels of trust created a climate of inclusion and the view that people from other functional groups were *insiders*, capable of being engaged in a co-creative, mutually beneficial endeavor. A marketing manager

describing the link between trust and transparencies in each others' constraints, and motives, noted:

> . . . if we're really going to be team members and be us together, they really need to know *all* of the business details. So, how much do you tell people? I would rather tell them too much. Because I feel if you tell them too much, after they get through the hard spots, they're going to trust you more, because they know you are telling them everything. Good news and bad.

Conversely, level of trust was low when participants attributed high degrees of hostility to others, and viewed others' motives and potential for cooperation with suspicion. This occurred when perceptual distances between functional groups were high, the level of inter-functional communication was low, and when other participants and customers were viewed as *outsiders*. Managerial responses in low trust NPD processes reflected the powerlessness, the politicized turf protection behaviors, hidden agendas, and lack of initiative that characterized the organization. Hence we propose:

P7: The higher the level of trust among participants in the NPD process, greater the extent of NPD related cross-functional collaboration.

Managerial Initiatives. The level of collaboration achieved owed much to managerial initiatives, or the types of self-motivated actions they took to improve interactions with others, and among other participants in the NPD process. Managers representing more collaborative NPD processes were distinctive because they appeared to act in ways that: (a) increased other participants' access to information and resources, (b) shielded participants from the bureaucratic forces of the larger organization, (c) created a climate that encouraged creativity and risk taking, tolerated and viewed failure as an opportunity for learning, (d) coached participants to adopt holistic, mindful ways of thinking and making decisions, and (e) encouraged participants to experiment with new ways of thinking, doing, and interacting with others.

We identified seven types of managerial initiatives that appeared to uniquely impact the level of cross-functional collaboration achieved. For instance, we found that four managers (10%) ensured participants had access to information and resources and tried to foster creativity in the way NPD problems were solved (*Type 1*). Two of the four were *selected* CFT leaders with an entrepreneurial style, i.e., they took risks, showed openness to new ideas, encouraged change, worked closely with team members, tracked daily progress, and battled for resources for their CFTs. The other two were department heads who encouraged and supported change and experimentation in the NPD process. Ten managers (25%) emphasized holistic, integrative thinking and raised awareness of the reciprocal interdependence that existed between participants (*Type 2*). Two others (5%) held all CFT members responsible for the team's actions, discouraged finger-pointing, and emphasized collective responsibility for NPD outcomes (*Type 3*). This group of twelve managers (*Types 1*, *2*, and *3*) functioned primarily as coaches and educators, emphasized the *big picture*, helped participants view their role and contributions in perspective, and fostered a flexible, integrative, inclusive team culture. A manager describing his role and actions noted:

> My role is really to be the coach . . . . I encourage or point people in the right direction. Gee, we're having a problem here, what do you think we should do? Well, have you talked to so and so, I suggest you talk to that person. Work with that person. If you can't work it out, come back and see me. And 99 times out of a 100 I never see him again. I try to encourage right from the beginning that they're empowered to do it. They don't need me. They're empowered to make the decision. I trust you. You're on the team, you need to make a decision, you think it's best for the team, make it. Don't come to me for approval. Make it. I trust you to do it.

Five managers (12.5%) primarily bridged the gap between the CFT and their own functional groups (*Type 4*). They shared information about their functional group with the CFT and vice versa. For instance, a manager representing the marketing function on the CFT provided market/customer information to aid decisions. Another manager representing production ensured that the manufacturing floor was prepared for new production runs. Seven managers (17.5%) primarily informed the CFT about how their functions operated (*Type 5*). Their purpose was to liaison between their functional groups and the CFT mainly to safeguard their functional agendas. Although these twelve managers (*Types 4* and *5*) provided information and participated in the NPD process, their contribution to cross-functional collaboration was notably lower than the previous group.

Six managers (15%) performed NPD tasks specific to their functional expertise only when asked and did little else (*Type 6*). They primarily fulfilled their for-

mal obligations within the NPD process by contributing their technical skills. Finally six managers (15%) recalled taking no specific initiatives, and reported the lowest interest in interacting with others (*Type 7*). These managers (*Types 6* and *7*) represented the most reluctant participants in NPD processes and identified the least with its collaborative intents. Based on these findings, we propose that *Type 1* interventions are associated with the highest, and *Type 7* interventions associated with the lowest levels of NPD related cross-functional collaboration. More formally:

P8: The variability in managerial initiatives is related to the variability in NPD related cross-functional collaboration.

Findings and the Literature

Although our framework and propositions emerge from managerial descriptions, they resonate strongly with findings in new product development research. It is important to recognize that we elected an *exploratory* approach because few studies have defined collaboration as we do, or assessed its relationship with the contributory factors we identify. Nevertheless, all components of our framework, i.e., the organizational and participant related factors as well as structural mechanisms, have invited discussion in the product innovation literature because they directly or indirectly impact cross-functional linkages and new product outcomes (see Figure 2). For instance, the *structural* implications of new product development processes are widely discussed because the nature of decision making and the designs by which new product development processes are administered directly influence new product outcomes [see 5,37,60,76]. Similarly, teamwork as a *structural mechanism* for improving new product related cross-functional integration, and ultimately new product performance, has attracted considerable attention [20,21,22, also see 9].

The three *organizational factors* we identify from the data have also attracted discussion in the literature (see Figure 2). First, even though the phrase *priority of new product development* is rarely used, the views that innovation must be a driving force and that participants must *know* that new product activities are a top organizational priority for effective innovation to occur, are widely shared [46]. For instance, scholars advocate that innovation must be a top-down approach [19], incorporated in the firm's strategy and strategic planning in a proactive manner [14,23,39,62], and attract the focus and attention of top management to ensure sufficient allocation of resources [55]. Relatedly, Buckler and Zien [11] find distinctive corporate legends and myths in innovative firms that help diffuse the view that innovation is basic to the process of creating value. Buckler [12] notes that "innovation, . . . is an environment, a culture—almost a spiritual force—that exists in a company and drives . . . value creation," [p. 43]. Second, Griffin and Hauser [29] note that *decentralization* reduces new product related decision-making time since it utilizes local knowledge. Considerable empirical evidence exists to suggest that autonomous, empowered employees and *decentralized* new product decision making improve cooperation and integration between marketing and R&D groups [30] and lead to effective new product processes [see 9,47]. There is also general agreement that participants in new product processes are likely to be more creative and committed when they are given responsibility for making decisions and taking actions [30]. Third, team/project *leaders* are viewed as central to effective product innovation, and their role and influence on new product development processes has received *wide* attention [see 4,7,11,16,36,44,78].

The four participant related factors we include in our framework are frequently discussed in the literature as well (see Figure 2). First, managers' attitudes towards *change* and cross-functional cooperation are viewed as important determinants of quality organizations [see 28]. Second, cross-functional *cooperation* during new product development processes has attracted considerable interest [15,42,64]. Third, higher levels of *trust* is viewed as an essential contributor to effective new product teams [3], and to effective new product development [22]. Fourth, higher levels of managerial involvement and participation are shown as key contributors to cross-functional integration [22,43,81]. Moreover, *managers' intervention* and resourcefulness are viewed as crucial for the implementation of technological innovation [1,43,82]. For instance, managers who provide guidance, encourage creativity, seek ways to tap team members' potential, create a supportive environment that fosters exchange of ideas and cooperation, and develop a culture of consensus and continuous improvement are linked with effective new product development processes [see 50].

Implications for Managers

Since our propositions and framework, the theoretical implications of our findings, emerge from actual man-

agerial experiences, practitioners concerned with improving product performance may find them of interest as well. Our study shows that collaboration represents a more intense and a more relevant way of conceptualizing cross-functional linkages in NPD contexts, particularly for the leading high-technology firms that use cross-functionally trained personnel and cross-functional teams. We find that higher levels of at-stakeness, transparency, mindfulness, and synergy among participants are features of cross-functional linkages managers achieve *after* they have attained high levels of interfunctional integration, overcome structural-functional impediments to cooperation and resolved many of the problems associated with linear-sequential NPD related work-flows. In Table 2 we highlight the implications of our findings and show how *collaboration* extends the nature of cross-functional linkages beyond *integration.*

Since six of the ten firms in our sample used teams to manage NPD task environments, several CFTs practical implications emerge from our data. Concurring with the views in the literature [20,21], we find that CFTs effectively: (a) increase the frequency of meetings and extent of cross-functional communication, (b) raise awareness of reciprocal interdependencies that link functional groups, and to some extent, (c) improve participant's contributions and willingness to perform tasks implicated by the team decisions. Much of the dissatisfaction that can arise upon *implementation* of cross-functional teams appears rooted in the unrealistic expectations that: (a) higher levels of interactions among participants will result in higher levels of collaboration, (b) a retrofitted team in a departmentalized firm will overcome people's functional affiliations or their concern for pushing for their own personal agendas, and (c) that such teams will insulate the participants from the larger culture, and the implicit hierarchy of departmental power in the organization. We find that cross-functional teams can do much to alleviate problems stemming from complex work-flows entailed by NPD, but rarely overcome the systematic, deep-seated problems created by isolation, distrust, and functional groups locked in a struggle for power and control. Far from being a panacea for divided organizations, we find that CFTs represent microcosms that accurately reflect the macro-environment, and display the interpersonal and group dynamics that characterize the larger culture. Our findings indicate that involving functional groups from early stages of the NPD process, and placing an emphasis on the interdependencies that exist can significantly improve CFT performance. Additionally, the need for training and educating cross-functional team leaders and participants on interpersonal issues of building

Table 2. Implications of our Findings: How Collaboration Represents an Extension of Integration as a Cross-Functional Linkage

High levels of INTEGRATION can lead up to:	*Additionally, high levels of COLLABORATION can lead up to:*
Early involvement of all participants in NPD processes, and joint responsibility [31,47,61]. Multiple concerns influence NPD decisions [29].	High levels of at-stakeness, characterized by equitable input in decision making, equitable stake in NPD outcomes, and close social distances among participants. Explicit acknowledgement of the interdependencies that exist.
A better understanding of the differences that exist in participants' culture, language, perceptions, orientations, and visions [29]. High levels of integration *can* occur when participants are socially distant, and hold unequal power.	High levels of mindfulness that functions as a basis for *all* NPD related interaction. Participants understand and internalize the differences that exist among people, and operate from that understanding at *all* times.
Fewer time wasting, resource draining, destructive, conflict situations [30].	Constructive conflict situations that harness the creativity of participants as a result of interactions between diverse voices. All voices are not only heard, but *all* participants become voting citizens in NPD processes.
Frequent exchange of information, higher levels of communication, and the development of a shared vision [61,68,69]. Joint decision making among participants. Hidden agendas can exist.	High levels of transparency. Participants are continually involved in making explicit *all* assumptions, all constraints, all objectives, and operating from a condition of high levels of knowledge about others.
High levels of cooperation, and coordination of activities is achieved, particularly in compartmentalized, functional-hierarchical organizations characterized by notable spatial and perceptual distances among participants [30]. NPD decisions and work-flows result from efficient exchange of information [71].	Exploration of innovative scenarios, joint expeditions with leading customers and suppliers, development of intellectual capital in flatter, customer-focused, boundary-less organizations. NPD decision making is viewed as a means of stretching functional groups' thinking and roles in the organization (i.e., decisions are creative and require all participants to stretch).

trust, overcoming defenses and managing conflict to achieve creativity are clear implications of our findings.

Rarely discussed, even within the proliferating literature on CFTs is the impact of the disinterested participant [see 20 for a notable exception]. We classified ten managers (25%) as *disinterested* participants in NPD processes because they: (a) waited to be asked before taking actions, (b) showed little interest in interacting with others and rarely initiated activities, (c) were the slowest to respond if not always the fastest to raise objections, and (d) were unimpressed by the collaborative, co-creative team concept. Disinterested participants sapped others' energies, dampened enthusiasm, prevented synergistic interaction, and failed to contribute to teamwork; i.e., "cooperation and sacrifice of individual interest to group goals," [20, p.382]. Training, coaching and guiding disinterested participants, failing which, leaving them out of NPD initiatives are clear implications of our findings.

Concluding Comments

The concern for improving new product performance is closely associated with the search for innovative ways of conceptualizing cross-functional linkages that address the emerging contingencies of new product related task environments. Our current conceptualization owes much to the contributions of scholars such as Souder [68,69,70], Gupta, Raj and Wilemon [30] and others [29,33,40,47,48,66,67,73,74], and to those of Dougherty [24] and Liedtka [41] who initially proposed *collaboration* as a new way of thinking about cross-functional linkages.

Our study shows that while the interest in interfunctional integration is alive in firms that continue to struggle with isolated functional groups and linear-sequential NPD work-flows, those that have successfully fostered high levels of integration via teamwork are seeking new ways of linking people and functional groups that create synergies, utilize existing talent to their fullest potential, and harness people's creativity and learning to accelerate the NPD process. Building cross-functional collaboration, characterized by high levels of at-stakeness, transparency, mindfulness, and synergy, appears to help managers address these emerging issues. Our study shows that while innovative structural mechanisms such as cross-functional teams can increase the level of integration, effective management of organizational and participant related factors can elevate integrative processes into collaborative processes.

Our findings highlight several avenues for future research. First, the need for developing and adopting a newer vocabulary of cross-functional linkages that reflects the complexity of emerging new product task environments still exists. The epistemological domains *integration* and *cooperation* fail to adequately capture the complexity or the intensity of cross-functional linkages that some managers foster in their NPD task environments. They also fail to address managerial concerns with nurturing individual talent and intellectual capital, or with developing seamless, cross-functional organizations [see 18]. Second, it is important to recognize that when faced with new challenges, managers responsible for NPD processes often improvise and take steps to ensure creative utilization of available talents. Systematic development of research findings from a variety of settings is necessary to capture the processes by which managers foster new types of cross-functional linkages. Third, a host of factors originating in the external environment, including the nature of competition, customers, and suppliers, and the firm's market position may influence the organizational and participant related factors in our framework, or more directly, the level of collaboration achieved in the NPD task environment. Additional research that can shed light on these relationships is clearly essential [see 65].

In conclusion, consistent with our exploratory intent, we aim for consistency and internal validity and not for widely generalizable findings. Moreover, although the framework originates in our data and supporting evidence for each of its components can be derived from the literature, our own orientation and biases have influenced how we analyzed data and identified contributors to cross-functional collaboration. Hence, rigorous tests of our framework and propositions represents a clear avenue for future research. Empirical assessment in a variety of settings and with larger samples can shed light on the relative importance of structural mechanisms, and participant and organizational factors. It can also help compare and contrast the impact of integration versus collaboration on new product performance.

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