Cross-Functional Team Decision-Making and Learning Outcomes: A Qualitative Illustration

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Members of cross functional teams in a large, multi-site organization discuss their experience in completing various decision tasks, illustrating a confluence of research literature relating workgroup dynamics, information processing, and organizational learning. Interview responses illustrate how components of the group decision-making process—the ***decision scenario****, the team's* ***functional diversity****, and* ***external information exchange****—drive the learning process, resulting in a knowledge directory system with* ***organizational learning*** *and* ***individual learning*** *components. Research propositions, directions for further investigation, and managerial implications are presented.*

In recent years, increased attention has been given to the role of workteams in contributing to organizational knowledge stores. Workteams are theorized to solve problems at multiple levels of a firm (Cohen & Bailey, 1997), process information (Hinsz, Tindale, & Vollrath, 1997), and combine disparate resources to address complex decision scenarios (Denison, Hart, & Kahn, 1996). Valuable insights have also been gained through controlled experimentation in decision-making (e.g., Hollenbeck et al., 1995) and information processing systems (e.g., Stasser, Stewart, & Wittenbaum, 1995). In spite of these advances, there does not yet exist a clear understanding of the team decision processes that facilitate knowledge creation and learning, or in what circumstances they are most valuable to an organization (Bowen, 1995). This paper uses interview responses from members of cross-functional teams (CFTs)—including quality improvement teams, product development teams, and process development teams—to comment on progress in this area and to develop propositions related to how such teams create organizational and individual knowledge through their decision-making processes.

Group Decision Process

Group decision-making may be understood as a subset of information processing theory (cf. Hinsz et al., 1997) in that it necessarily involves data scanning, interpretation and, we will argue, "learning"—storage into individual or organizational memory. A workteam faced with an important decision scenario needs first to gather data from the environment (Corner,

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Kinicki, & Keats, 1994) and then assign meaning to it (Weick, 1995). For instance, an automotive design team may first choose to study reactions to earlier models, including sales, customer complaints, and safety ratings, then interpret the relevance of these data to their current task. This interpretation is accomplished through a combination of external information exchange and dialogue within the group (Daft & Weick, 1984). Once meaning is assigned to the data, the team may choose to codify it into their product (whether a design, object, policy, or other output) or to discard the knowledge gained. Knowledge is retained through organizational-level mental models, tacit procedures, manuals, team directory structures, and individual memory storage. Each of these may be categorized as a CFT learning outcome.

Individual and Organizational Learning

In this information age, it is increasingly apparent that competitive advantage can be purchased with the currency of knowledge (Foss, 1996; James, 1996). The most successful firms adopt a strategy of fostering learning and knowledge distribution at both individual and organizational levels through investing in both human and technical resources while developing tools and methods to support them (Conner & Prahalad, 1996). The CFT, one such method, has changed the structure and internal working relationships of firms while leading to learning outcomes at multiple organizational levels. However, as Weick and Roberts (1993) point out, we lack a complete understanding of the processes of collective learning that occur through the use of workgroups. We believe that examining CFT decision-making will generate greater insight into the organizational learning process and ultimately lead to applications that will foster improvement in organizational performance.

As a phenomenon at the macro level, organizational learning has been described as a "shift ... of collective understanding" that is developed through broadly defining task parameters and building consensus from extreme viewpoints within the diversity of an organization's members (Fiol, 1994, p. 404). Nonaka (1994) operationalizes this shift as the output of organizational routines, created through the pairing of tacit and explicit knowledge. We will refer to organizational learning in both these ways; the former is used as a theoretical guide, and the latter provides tangible outcomes that may be measured.

An additional form of organizational learning may be conceptualized as the development of linkages or "directory structures" (Anand, Manz, & Glick, 1998) that connect information sources within an organization. Such linkages may be thought of as organization-level mental models (Weick & Bougon, 1986) that structure interpretive systems through the knowledge present at lower organizational levels. These directories hold interpretations and solutions for future decision scenarios, stretching our definition of learning to accommodate potential as well as actual knowledge applications. Thus the relationship between individual and organizational learning can be seen as a system wherein a "shared awareness of who knows what" (Moreland, Argote, & Krishnan, 1996) links information stored in individual minds or multi-team networks (Mathieu, Marks, & Zaccaro, 2001).

In this way, learning that occurs within individuals is seen as an important component of organizational learning. The schematic directory structure enables both integration of knowledge in workgroups and its dissemination to the reaches of the organization, providing

a mechanism for knowledge aggregation. It is important to note that this aggregation could not occur without both the directory system and the individuals who make up the collective (Weick & Roberts, 1993). For this reason, we include individual learning as an important CFT outcome, operationalizing it simply as an increase in individual-level knowledge, skill, or ability.

Cross-Functional Teams

Although some of the discussion above may apply to various forms of workgroups in organizations, we have chosen to focus on cross-functional teams because of their distinctive structure and use. Designed to "span traditional boundaries both inside... and outside firms" (Ancona, 1990, p. 334), CFTs have gained an important place in competitive organizations as a means of accomplishing tasks from new product development to strategic planning, as well as being a major component of many quality improvement programs (Misterek, 1995). Denison, Hart, and Kahn (1996) describe CFTs as a means of connecting various functional "chimneys" of an organization which, if not linked, send output skyward without the influence of relevant information from other divisions. They outline three characteristics that distinguish CFTs from "conventional teams" in organizations: the distinct functional responsibility of each member; the temporary, project-driven nature of the team; and the unique performance criteria of knowledge creation and dissemination within a reduced cycle time. In other words, a CFT is a group comprised of individuals from separate functional areas convened with a specific purpose for a defined period of time.

In spite of the prevalence of CFTs in organizations, there has been limited field study of the determinants, process, and outcomes of such groups in industrial settings; in fact, the literature which does address collective learning at a group level tends to examine other traditional structures such as committees and task forces (cf. Ancona, 1990; Denison et al., 1996; Hackman, 1987; Weick & Roberts, 1993). However, the proliferation of CFTs in the workplace (Bowen, 1995) indicates that managers perceive significant advantages to CFTs. Coupled with the lack of research specifically geared to these groups, a need for further examination of how CFTs facilitate learning is readily apparent.

Interview Responses

The CFTs sampled for this study illustrate a confluence of literature relating workgroup dynamics, information processing, and organizational learning. This depiction was culled from a set of personal interviews with members of 39 CFTs in four divisions of a large multi-site Midwestern company, emerging independently of an interview guide focused on operational procedures. Interviewees were selected on the basis of positional leadership or diversity of opinion within the CFTs as perceived by their management. Interviews were recorded by audiotape and subsequently transcribed, so as to preserve the respondent's original locution. The teams themselves were formed for various and diverse reasons within the organizational need structure, but all were supervised under the umbrella of the company's formal quality improvement program. Some teams were assigned product development tasks, such as the refinement of products through successive generations, while others analyzed production-related processes such as environmental waste procedures, or organizational

practices, such as plant performance measures (Misterek, 1995). All teams relied on collective decision processes to reach their goals.

CROSS FUNCTIONAL TEAM DECISION-MAKING AND LEARNING

We believe that a discussion of key input and process variables will contribute to understanding the role of CFTs in building organizational knowledge structures that are associated with both individual and organizational learning. Inspired by interviews with CFT members, we develop propositions to describe variables important to the generation of such learning within the context of relevant research literature. We believe these insights to be valuable for researchers as they ground the discovery and description of important variables in real-world phenomena (Glazer & Strauss, 1967), beginning with "real groups" that differ in their interdependent relationships, changing roles over time, and directive to "develop a concrete work" (Gersick, 1988, p. 12). Further, this method may be useful for practitioners because it identifies and emphasizes levers that managers can manipulate to influence the performance of CFTs in real organizations.

Exposition and Propositions

Although the CFTs used a variety of means to resolve their specific tasks, we believe that their progression can be illustrated through the structure of an input-process-output design, such as those discussed by Hackman (1987), Denison and his colleagues (1996), and others. The input variables include the *decision scenario*, the level of each workteam's *functional diversity*, and the amount and type of *external information exchange*. Process variables include *dialogue (internal information exchange)* and the level of *shared functional knowledge*. Output variables are *organizational learning* and *individual learning*. Briefly, we propose that the decision scenario assigned to or undertaken by the CFT influences the degree of functional diversity utilized in the team, as well as affecting the exchange of information between the team and its environment. The degree to which the functional diversity affects the group process is influenced by this external information exchange, and vice versa. CFT members from diverse functional backgrounds meet in the group processing stage, engaging in dialogue, combining different types of knowledge, and developing functional redundancy. This interaction works to produce outcomes of knowledge creation as organizational knowledge structures, routines, and individual learning.

It is important to realize that, as in any theoretical presentation, many variables exist in real-world counterparts that will not be explained by our set of propositions. For instance, managerial expectations may have a reciprocal effect with the task, leadership may influence group processes, and interpersonal relationships and tangible products may be outcomes of the group process. Many of these variables have been explored by other researchers (e.g., Graen & Cashman, 1975; Stewart & Manz, 1995); others may benefit from further examination.

Input Stage

Decision scenario (functional complexity). The purpose of the CFTs in this setting was to make decisions to fulfill a project or task (cf. Denison et al., 1996). The decision scenario

was therefore determined by the specific aim of the team—whether for product development, quality improvement, policy development, or other processes—as well as its scale and expected duration (Misterek, 1995). This scenario in turn directed the design of the CFT and subsequent operation, often through defining which divisional functions will contribute (Numata & Taura, 1996). We therefore characterize the decision scenario according to its degree of functional complexity. This complexity may be usefully understood in accordance with Wood's (1986) description, such that components (the number of unique acts and information cues required to perform), coordination (the relationship of task inputs to products), and dynamism (the responses to a changing environment) all contribute to the complexity level. As a caution, we stress that only the functional components specified and those that actually contribute to group performance will be accepted by the CFT as legitimate (Weingart, 1992). For instance, CFT members may not be sufficiently aware of managerial intentions due to a breakdown in communication or other interpretive processes.

This functional complexity implies that the clarity and breadth of the scenario as defined will influence the team's ability to perform. If the scenario or mission of the task is unclear, the team will likely experience difficulties because their efforts will be unfocused. If the scenario is too broad, for instance, the team may not be able to focus its energies in the most useful areas, or even agree on the goals that they need to pursue. Alternatively, if the task is overly narrow, there may not be a need for a team in the first place; individuals can often perform a specific task more efficiently than a committee or a single function team. In either case, poor team performance will inhibit the team's ability to generate learning. Rajan,[1] a member of CFT # 32, speaks to the problems that may exist when the task is not clear:

> ***Interviewer:*** *What are the factors that you feel may have hindered this team's activities?*
>
> ***Rajan [# 32]:*** *The other thing was that it wasn't defined well for us what we needed to do....it took us a long time to come to a conclusion as far as exactly what we needed to do....*

In this case, Rajan found it difficult to operate when task direction and breadth were not sufficiently defined. The managerial challenge in this area is to set parameters for teams that are flexible enough to act as guidelines across situations yet definite enough to be operationally useful. This direction may involve procedures, resources, personnel, or network conduits to use in completely defining the decision scenario.

Hackman (1987) tells us that the design of the group precedes the interaction of the team; that is, there is a pattern, or scenario, in place before the group members even meet that will have some effect on its composition and operation. Because different scenarios have varying skill and knowledge requirements, and these CFTs were convened to resolve such scenarios, basing member selection on the decision scenario will better facilitate desired outcomes of learning and production. While this may seem evident, many authors (e.g., Recardo, Wade, Mention, & Jolly, 1996) have pointed out that workgroup membership is often based on

[1] "Rajan" is a pseudonym, as are all names representing CFT members who are quoted in this paper.

other considerations, such as positional politics or custom. The importance of the decision scenario (through its impact on the functional composition of the CFT) to the generation of organizational learning was highlighted by another team member:

> ***Joshua [# 12]:*** *The objective was to come up with a proprietary treatment ... so that there would be less dust... and as we went on we discovered that there were other benefits like reduced stain.... We ended up saving a bunch of money, too.... There was a marketing manager who showed up who was really firing questions at us.... so we were forced to run some more tests.... [in the end], we had more confidence that the product was going to perform.*

Because the marketing manager perceived that the scenario outcome would affect his responsibilities, he chose to become involved in the project. The marketing manager's different perspective caused him to ask new and different questions, resulting in the running of additional tests. Ultimately, the information generated by the added tests resulted in "more confidence that the product was going to perform," which indicates that learning took place within the organization. This interview excerpt illustrates not only how the decision scenario affected the functional composition of the group, but how the addition of a different functional perspective to the group resulted in the generation of new information and learning.

In addition to affecting the functional composition of the group, the decision scenario affects information linkages and exchanges between the team and organization members outside of the team. The following interview excerpt illustrates this:

> ***Interviewer:*** *Did the team have the expertise that was required to accomplish the project...?*
>
> ***Natasa [# 28]:*** *We didn't have so much the expertise; we enlisted other people in the organization when we had questions dealing with getting the money allocated and those sort of things. We don't have people that can sign for projects of this scale ...we have had to go to engineering, to management, to the plant engineering group and solicit their help in getting bids and samples and the money to do this ...*

It was the decision scenario and the tasks involved that determined which outside departments and employees the team contacted. Additional information, as well as authority and support, were received from organization members external to the team on an as-needed basis.

The decision scenario therefore has a direct influence on the diverse functional composition of the team and its external information exchanges, as well as being mediated by these two variables in its influences of the group processing stage. By combining diverse sources of expertise, a level of functional diversity is reached that is appropriate to the scenario. Similarly, the exchange of information with the external environment of the CFT (in nature and amount) will be guided by the decision scenario. McGrath (1984) proposes that the project assists in driving "whatever individual differences there are in determining communication patterns, satisfaction, and task effectiveness" of a team (p. 355). As we explain in a later section of

this paper, without this external informational exchange the positive impact of the functional diversity of the CFT will be greatly diminished. In accordance with these statements, we propose that:

> ***Proposition 1:*** *The decision scenario, or functional complexity, of a CFT's task influences the functional diversity and external information exchange such that increased functional complexity results in greater functional diversity of the team and increased opportunity for exchange with the external environment.*

As the team processes information from the external environment and from team members' personal knowledge, members exchange information, creating a certain level of redundancy of information concerning the team's project. This may be analogous to what many researchers refer to as the creation of a shared knowledge base (Nonaka, 1994) or a group-level mental model (cf. Weick & Bougon, 1986). We view this creation of a level of redundant knowledge as necessary for learning about organizational routines and problem solving. Important outcomes from this process of diverse information inputs and exchanges include individual learning about organizational processes and other functional areas, organizational knowledge creation, and improvement of organizational routines.

Functional diversity. Greater functional diversity within CFTs generates greater learning up to a certain level. Once this optimal level is reached, the increase in learning ceases to be observed; thus a curvilinear or congruent relationship is optimal (Clark, Amundson, & Cardy, 2000; de Janasz, 1997). Broader ranges and greater amounts of knowledge and information enhance problem-solving and decision making; however, at some point the benefits of an increased knowledge base are expected to be offset by difficulties in processing extensive amounts of knowledge, and hence organizational and individual learning will cease to increase with functional diversity. We propose that this optimal level of functional diversity, however, is not an absolute level that applies to any team, but exists as a function of the nature of the team's decision scenario or task. More complex tasks and projects benefit from greater functional diversity in a team, whereas simpler projects would not. The importance of functional diversity is highlighted by the following comments:

> ***Interviewer:*** *What factors do you think positively and negatively contribute to the team?*
>
> ***Steve [# 1]:*** *The diversity of people on the team....when I don't understand something, [others may provide an answer]...or just [see it] from a different point of view, because it's so easy to get locked into doing things a certain way.*
>
> ***Glen [# 9]:*** *...definitely the diversity of the team.*
>
> ***Mel [# 12]:*** *...diversity; everyone's from a different area.*
>
> ***Paul [# 19]:*** *...different people weigh different components of the mission differently.*

As illustrated above, the diversity of functions represented by individual CFT members was repeatedly perceived to be a critical determinant of group success. Significantly, as can be seen by the interviewer question, this was an emergent response pattern not driven by a specific prompt. This may help us to understand the team learning process, in that members combine their functionally diverse backgrounds, "thereby amplifying and sublimating individual perspectives to higher levels" (Nonaka & Takeuchi; 1995, p. 76). Driven by the needs of the task, members of varying expertise and resource levels are assigned to teams based upon their potential to contribute to project success.

This effect of functional diversity on team performance may at first seem to be contrary to the negative relationship between functional diversity of a team and its performance reported by Ancona and Caldwell (1992). However, a positive relationship between functional diversity and innovation was also found in their study, which may have been due to an unmeasured mediating variable; one such possibility raised is that "diversity impedes social integration" (p. 338). In other words, functionally diverse groups without highly developed team skills may not operate well together in initial stages (Clark, Anand, & Roberson, 2000). For instance, such groups may engage in dysfunctional emotional conflict rather than the more functional conflict related to the task (Pelled & Adler, 1994). It could be that the CFTs interviewed in the current study, however, are further along in terms of group processing skills. Although the mean tenure of the teams studied was not available, the parent organization of these CFTs was committed to the training and practical experience of its employees in team situations, and fostered a corporate environment of team commitment (Misterek, 1995). Alternatively, as might be implied by our proposition of an "optimal" level of functional diversity, the level of functional diversity in the groups studied by Ancona and Caldwell may have been excessively high.

The level of functional diversity in a CFT also relates to a classic cybernetic concept—"requisite variety"—that refers to the capability of a system to respond to and process a variety of inputs (Ashby, 1956). Greater functional diversity within a team, and the external links that it provides, increases the team's requisite variety. The wider range of inputs that the functionally diverse CFT can successfully process would suggest that a cross-functional team possesses a higher level of knowledge than a conventional team. This wider knowledge base should provide greater potential for generating new learning for the organization than a conventional, single-function team. This optimal level of functional diversity, however, is not an absolute level that applies to any team, but exists as a function of the nature of the team's tasks. More complex tasks may benefit from greater functional diversity in a team, whereas simpler tasks likely would not (cf. Bowers, Pharmer, & Salas, 2000). This leads us to propose.

> ***Proposition 2:*** *The functional diversity of a CFT has a curvilinear relationship with organizational learning generated such that both increase to an optimal point determined by the task, after which further diversity impedes learning.*

External information exchange. The real medium of exchange for these CFTs is their information stream; effectiveness, rather than simple efficiency, is the hallmark of successful teams—"faster, higher quality decision-making occurs in teams that use more, not less,

information" (Eisenhardt, 1989, p. 548). In order to utilize the diverse knowledge base of CFTs, information exchange must occur among members (dialogue) as well as between members and the environment. We distinguish the two types—internal dialogue and external information exchange—because we believe them to effect organizational and individual learning at different stages and through different processes.

External information exchange comes to the team through the links to structures and persons outside of the team, within or outside of the organization. It is viewed as an input to the team process, as well as a feedback mechanism for the various linked functional divisions. The importance of external information exchange is highlighted by the following comments:

> ***Joshua [# 35]:*** *We have surveyed a lot of people in here, and gathered data from them, opinions and numbers and, you know, put all that together. We have contacted and been involved with other companies and other plants, gathering data from them. And that has played a major role in how we see what we should be developing...*
>
> ***Interviewer:*** *So what would you say then is the value added of the team?*
>
> ***Luis [# 18]:*** *I would say that it's a [way of] standardizing throughout our division, getting knowledge disbursed through all the plants rather than having each person struggling with the same problem in different plants and trying to come up with a different solution and have each plant come up with a different solution for the problem. Um, it works much better to have someone, or a team, or whatever, disseminate the knowledge across everyone, have everyone do things the same way, standardization is really a key thing in our division that we haven't had in the past.*

The quotes above represent a motif that recurred across interviews similar to that of those mentioning the positive incidence of functional diversity as a component of team success. Within teams, between teams, and between teams and outside resources, information access and manipulation through functional expertise enables the team to succeed. Over and over throughout the interview process, team members brought up the importance of information, in large quantities and from many sources, in the success of their decision-making and development processes. As Hauptman and Hirji (1996) point out, "problem-solving requires frequent, two way flow" of information (p. 154). Ancona (1990) supports the importance of this exchange, maintaining that "teams that manage external demands become better performers" (p. 338). More formally, we propose:

> ***Proposition 3:*** *The external information exchange between a CFT and its environment has a curvilinear relationship with the organizational and individual learning generated such that both increase to an optimal point, after which further external information exchange impedes learning.*

Interaction of functional diversity and external information exchange. Understanding the relationship between the functional diversity of team members and a CFT's information exchange with the external environment is crucial to a complete application of our

conceptualization to real-world CFTs. It is through the information exchange process that the influence of the external environment can be seen more clearly. Each member of the team brings a "directory structure"—knowledge of who knows what information—to all relevant resources known to the organization (Stasser et al., 1995). In this way, the outcomes of CFT learning are available for use at other points in the organization. This may occur through the development of organizational routines, interpersonal relationships, and individual knowledge acquisition that facilitates future operational success. Thus, the team serves a function of providing critical links with other areas of the organization (Cardy & Stewart, 1998). Such connections facilitate two-way feedback between the team and its environment. As one team member observed,

> ***Steve [# 1]:*** *...if you don't have the expertise, you know where you can go get it.*

These critical links in specific functional areas underscore an important area of difference demonstrated in these interviews as compared to group models of the past. Ancona (1990) describes the dominant paradigm until recently as one in which groups are closed systems. Today, organizations use multi-team systems (Mathieu et al., 2001) to process information both within and between teams, "entailing complex interactions with people beyond the borders" (p. 335). The team members themselves, through their interpersonal interactions and their connections to various functional areas of the organization, are the agent of exchange. Their interaction facilitates the achievement of project goals, the development and dissemination of organization routines, and the sharing of knowledge. Our interviews suggest that utilizing individuals in this way is more effective than relying on written or recorded materials, even allowing for some process loss. Without external information exchange, functional diversity would not have as positive an effect on the team's learning or performance. Without functional diversity, the external exchange would be limited in access to other areas. We assert, then, that CFTs support an open system model through the combination of their information structure and functional diversity. In other words, the information brought to the CFT by the diverse functional areas represented on the team is the value added by the CFT process. Although a formal proposition may not aid further understanding in this case, it may be useful to consider what insights may be gained through the conceptualization of CFTs in an open or multi-team system, rather than as self-contained units. For the method of the information exchange, we turn to the group processing stage and the discussion of dialogue.

Group Processing Stage

> *The key question in the study of cognitive structure and process at the group/organizational level of analysis is to what degree the total (or collective) differs from the sum of the parts (or individuals) (Schneider & Angelmar, 1993, p. 356).*

The interactions that occur within the group process—pairing persons and information sources that lead to learning outcomes—are the heart of CFT operation, what allows CFTs to meet their unique information processing demands (Denison et al., 1996). Without the interaction of individuals within the group context, the process occurring would merely consist of the sum of individual cognition; that is, the sum of the individual cognitions would equal the

aggregate cognitive performance change. Ideally, however, the aggregate performance is more than and, in fact, qualitatively superior to the sum of the individual changes. In other words, there are interactions between CFT members that build upon the cognition of individuals and influence the total outcome of the team.

A challenge to researchers and practitioners alike is to ascertain the specific processes at work mediating the sequence of inputs, or stimuli, and decisions, or reactions (Bowen, 1995). Indeed, many have argued that cognition can only occur within individuals; one, and only one, brain is a necessary prerequisite for thinking. This has often resulted in organizational theorists merely using individual cognitive theory to "apply...to organizational concerns, one brain at a time" (Weick & Roberts, 1993, p. 332). While we acknowledge the validity of this perspective when a narrow definition of cognition is used, a broader concept of cognition has both more theoretical and practical value.

How, then, can we conceptualize the group interaction process? Wegner (1987) likens the group process to a transactive memory system connecting diverse information sources through knowledge of the expertise of other members in the group, in effect making other members "locations of external [memory] storage" (p. 189). This view is consistent with Hutchins' (1991) description of organizations to "distributed information processing systems" of which the groups are a part. The knowledge generated through such a system is connected through networks and therefore "resides in patterns of connections" (Weick & Roberts, 1993, p. 333). The group process is one of information flow, combination, and transfer between individuals.

Dialogue (internal information exchange). While the external information exchange is both critical and enriching to the ultimate realization of team goals, the information exchange within the group process brings knowledge sources together and manipulates it into new knowledge structures or other specific learning outcomes such as organizational routines. The coordination of individuals' separate thought processes into a team conversation must involve individual interpretation and intragroup dialogue—problem-oriented discussion between individuals or group factions who represent diverse functional backgrounds (Clark, Anand, et al., 2000; Daft & Weick, 1984). As CFT member ***Mindy [# 26]*** contributes,

> *One of the benefits is that people get a chance to learn a little bit about other people—other people and their roles and things that they normally wouldn't have exposure to because the teams do encompass people from all throughout the plant.*

Also, ***Tom [# 18]*** expressed the following point of view:

> *The group I'm working with ... [includes] a chemical engineer ... an industrial engineer, ... an operator ... pretty diverse backgrounds ... then when we get to talking about different issues, we had a lot of different ideas about how things should be ... We're just coming from completely different backgrounds, ... but I think that disagreement in negotiations ... is what really brings out a lot of different ideas. We all try to keep open minds, ... a lot of valid points ... get brought up [that] one of us would*

> *never have thought of ... if we were just working on this on our own. I really think that with cross functional teams it helps to be around each other and to bounce things off each other on a regular basis so that you get a little bit more of the feeling of someone else's viewpoint as opposed to just your own.*

Further, Nonaka and Takeuchi (1995) maintain that "original ideas emanate from autonomous individuals, diffuse within the team, and then become organizational ideas" (p. 76). This results not only in the transfer of information, but also the creation of new knowledge as group members combine diverse sources and types, both tacit and explicit, of knowledge. Explicit knowledge, which is by definition directly transferable to others in written or other verbal form, is shared. The less visible function of the group process, however, is the facilitation of the transmission of tacit knowledge, described as procedural or "deeply rooted in action," that requires personal interaction to be shared (Nonaka, 1994, p. 16). Numata and Taura (1996) assert that the group members must work together, rather than merely sharing information; the exchange between individuals within this stage make this possible. Nonaka and Takeuchi regard knowledge creation in organizations as resulting exclusively from the pairing of tacit and explicit knowledge. Therefore, the group process is virtually indispensable to organizational learning. Of course, as we discussed previously, individuals are a key storage device of organizational knowledge.

Again, without information exchange, functional diversity provides very little benefit for a team. Therefore, we propose:

> ***Proposition 4:*** *Increases in dialogue among CFT members are associated with increased opportunity for the generation of organizational and individual learning.*

Shared functional knowledge. We believe that there is an optimal level of redundancy of functional knowledge in CFTs necessary to promote the greatest learning, dependent on the task assigned, the willingness of members to share idiosyncratic information, and the ability to interpret this information as a group. The concept of redundant representation describes the replication of skills and expertise within a workgroup (Hutchins; 1991; Nonaka, 1994). An optimal level of redundant representation promotes shared understanding and discussion "which enables them to enter another person's area and give advice" that leads toward better problem solving (Nonaka, 1994, p. 25). It seems likely that too much redundancy can lead to members being, or feeling, unproductive with an overall loss of efficiency for the team and the organization. The concept of an optimal level of redundancy is supported by Nonaka and Takeuchi's (1995) finding that the most innovative projects were developed by teams which "consisted of 10 to 30 members with diverse functional backgrounds [as well as] 4 to 5 core members, each of whom has had a multiple function career" (p. 76). In other words, the multiple functions of the core members were redundant and shared. This balance of redundant functionality, therefore, was related to the overall success of the team.

> ***Scott [# 25]:*** *I really think that with cross functional teams it helps to be around each other and to bounce things off each other on a regular basis*

so that you get a little bit more of the feeling of someone else's viewpoint as opposed to just your own.

Interviewer: *What is the value added, if any, of having a team like this?*

Laurel [# 32]: *Increased understanding of [the] process that wasn't there, a focal point for learning about something that probably wouldn't have been done, or some general base of knowledge so that—and that's maybe something that this group setting does is that it allows things that people have learned on a smaller scale, that small group, to bring to the rest of the group and say, Hey, don't make this mistake like I did, or, Here's what we've learned, you don't want to do this, you do want to this—those kinds of things. So a way to share information.*

Redundant representation, then, enables group members to generate a common, shared understanding of the team's project (Nonaka, 1994). Without this common knowledge base, learning will be hindered. Another reason that members may gain functionally redundant knowledge within a CFT is to facilitate the member's own skill development for use in future assignments. Also notable is that Nonaka and Takeuchi's (1995) above finding related CFTs to innovation, or knowledge *creation* rather than mere duplication, a topic discussed further below. Following this:

Proposition 5: *Creation of shared functional knowledge aids CFTs in generating organizational and individual learning.*

CFT Learning Outcomes

It is the learning outcomes of CFTs that are ordinarily the point of interest for practitioners, and they often have also been the primary concern of management researchers (although a rich literature in social psychology and small group communication continues to explore input and process issues). Our examination specifically focuses on those learning outcomes generated or enhanced through the use of CFTs: improved organizational knowledge structures, new knowledge creation, routines, and individual learning. This focus is in keeping with our theoretical and operational definitions of organizational learning and individual learning as described above.

Organizational learning: Structures, routines and knowledge creation. As discussed above, we use terms such as "directory structure" and "organization-level mental model" to refer to relationships used to store and interpret organizational knowledge within and between individuals and teams. A related concept described by Henderson (1996) is that of "architectural knowledge." As opposed to "local knowledge" within a specific organizational unit, architectural knowledge is concerned with the interactions between functional areas. It is more difficult to generate, disseminate, or exchange, and is thus less common and often holds great value for the organization (particularly in technical and engineering applications such as product development and process improvement). Due to its phenomenological association with operations research, architectural knowledge may be more directly related to the concept of organizational routines (discussed below) than are organizational mental

models. In any case, CFTs provide a suitable structure and environment for the generation of architectural knowledge through their diverse functional composition and their typical assignment to conjunctive tasks.

"Organizational routines" are tacit procedures that become embedded in the operational practice, whether as a manufacturing method, executive strategy, or improvement standard. (The routines discussed here are often referred to as *processes*, although the term *process* may imply a more explicit set of tasks or procedures than a *routine*.) Organizational routines serve to give employees a standardized, practical means of contributing to the work of the organization. They become the method of getting things done, a sharing between organizational members of learning as a "common understanding so as to exploit" what is necessary to achieve the ends desired (Fiol, 1994, p. 404). Routines go beyond written manuals; they include tacit procedures that can only be fully understood when enacted (Nonaka & Takeuchi, 1995), as well as explicit processes that are exhaustively documented. In addition to being a richer form of knowledge, there is evidence that routines may be more lasting than simple written or spoken instructions -it has been noted that "declarative memory appears to decay more rapidly than procedural" (Cohen, 1996, p. 193). Improvements in routines as important learning outcomes are reflected in the following interactions:

> ***Interviewer:*** *What would you say then is the value added by the existence of this team?*
>
> ***Bob [# 1]:*** *...quicker solutions and quicker answers. It's showing up at that time that the tasks and accomplishments are being completed ... everybody has a job to do and it gets done that way in a fast process.*
>
> ***Interviewer:*** *What are the positive outcomes of this project and this team?*
>
> ***Jim [# 26]:*** *Well, we're making a better product now - a lot better. It looks better, and ... it's cheaper... so they could compete better with the European [market] .... our [production] quantity has maintained at the same level and maybe even increased ....*
>
> ***Dave [# 39]:*** *I guess the obvious one was there was a reduction in the variability on our process, which was kind of the original goal.*

We propose:

> ***Proposition 6:*** *CFTs produce greater improvements in organizational mental models and routines than do single-function workgroups or individuals.*

Individual learning. Upon encountering decision scenarios, CFT members absorb and assimilate information individually (Walsh & Ungson, 1991). Individuals are the repository of much of the information generated by the organizational learning process; other information may be stored in routines and directory structures as described above, as well as in recorded datasets (Anand et al., 1998). Individuals learn, at minimum, the directory structure of how to access organizational memory (stored information), as well as other specific skills such as

group processes (Anand et al., 1998). Nonaka and Takeuchi (1995) emphasize that cross-functionality of team members allows each individual "to learn and internalize a breadth of development experiences beyond their own functional specialization" (p. 70). Bill, a CFT member from our sample, supports this notion:

> ***Interviewer:*** *Are there any other benefits that you would identify?*
>
> ***Bill [# 18]:*** *Just working with the knowledgeable people and hopefully having some of their knowledge rub off on you is always a good thing, basically as any team that you have experts, or whatever, that you're working with you can learn a lot from.*

According to Cohen (1996), the way in which the individual stores this learning differs depending on the type of information or task involved. Organizational routines learned by an individual will likely be "stored in a particular kind of memory" as compared to explicit directives (p. 191). While we often think of routines as operating for more "mindless" activities, Cohen's (1996) writings lead to the implication that more complex cognitive skills may also be routinized. Individual learning may therefore include routines of a higher cognitive function.

It is important not to dismiss the relevance of individual learning when discussing the contributions of CFT outcomes to organizational learning. Although routinized functions may be of a fairly high cognitive processing level, there is yet plenty of room left for individual judgment. As Anand and his colleagues (1998) warn, conceptualizing organizational learning only as routines does not necessarily explain how organizational memory is used in non-routine decisions.

> ***Proposition 7:*** *CFT membership will result in increased levels of individual learning as measured by increases in skill proficiency and the level of knowledge of functional specialties outside one's own.*

DISCUSSION AND IMPLICATIONS FOR RESEARCH AND PRACTICE

Morgan (1997) argues that "developing capacities for individual and organizational learning" are essential to "designing and managing organizations" in today's competitive markets (p. 88). The prevalence of CFTs in today's organizations provides opportunities for generating these significant, strategic learning capabilities, and understanding their optimal construction and operation is crucial to this aim. In this paper we have illustrated literature relating organizational learning and team decision-making with insights from working quality improvement groups in four divisions of a single multi-site organization. We propose that the decision scenario for a given CFT drives both the selection of team members—and hence functional diversity—and the exchange of information between the CFT and its external environment. Important outcomes of the CFT's activities include individual learning by team members, improvement of organizational routines, and the development of organizational knowledge structures. We propose that functional diversity within the team is an important source of learning by team members and by the organization, because we believe the application of a wide range of different sources and types of knowledge to an

organizational project increases learning. Information exchange with the external environment is enhanced by functional diversity within the team, since team members possess a wider variety of linkages with organization members outside of the team. Further, dialogue within the CFT helps members to build new knowledge and develop functional redundancy to ease interpretive processes.

It may be important to note that these propositions were generated through an examination of a study of cross-functional project team performance (Misterek, 1995) where the relationship of functional diversity to organizational learning was not the intended topic, but one that emerged over the course of the interviews. Team members repeatedly indicated that diverse functional backgrounds and expertise were important influences on team functioning and drivers of performance. Furthermore, learning—both by individuals and in the form of improved organizational routines—emerged as an important benefit associated with CFT use.

To improve our understanding of organizational knowledge creation, it is important that researchers identify processes by which organizations manage knowledge and ultimately "learn" (Leonard-Barton, 1995). The identification of CFTs as one such mechanism is important to stimulate further research questions as well as to aid practicing managers in addressing important decision tasks such as product development procedures, environmental waste reduction policies, and strategic planning. The generation and capture of organizational knowledge structures as a method of interpreting complex issues is a significant capability of CFTs. For instance, we might investigate the role of CFTs as part of a multi-team interpretive system that uses directory structures, tacit procedures, and new configurations of architectural knowledge to generate solutions to complex organizational issues.

Many others have contributed valuable insights into the use of teams as organizational knowledge creation systems (e.g., Denison et al., 1996; Hinsz et al., 1997; Mathieu et al., 2001). For instance, Denison et al.'s (1996) diagnostic model of cross-functional teams developed some of the concepts we have discussed here, including the team's mission and direction (closely related to the team's decision scenario), and information creation and learning as outcomes. We believe that the illustration presented here adds value through providing a real-world setting that links specific contextual and process variables with particular outcomes of interest. As such, we move beyond providing the set of variables that are important in the study of CFTs, to explaining proposed relationships—how specific variables relate to and affect other processes and outcomes.

Cohen (1996) indicated that "organizational structure is viewed as a design for organizational learning .... for improving what the organization can do" (pp. 188-189). The relationship that we propose between CFTs and organizational learning posits such learning to be the result of a particular organizational structure—the cross-functional team. The propositions presented above provide a new understanding of the nature of learning within CFTs. The "decision scenario," "functional diversity," and "external information exchange" are presented as group input factors that affect CFT learning outcomes through the mediating effect of group processing, consistent with the position of Hackman (1987), who advises us "to search for input factors ... that can foster ... effective task performance" (p. 321). Thus, to the extent that these factors affect learning, examination of these external group input factors

and how they interact in the group process may lead to development of greater understanding of learning within organizations. It is important that we continue this direction of research and learn more specifically how the design and functionality of CFTs affect organizational and individual learning.

Project leaders may also find insights and suggestions for management of CFTs in the discussion presented here. We suggest that the choice and scope of the decision scenario are very important choices for managers to make. If CFTs have difficulties with inappropriately aligned projects, learning outcomes will not be as great as expected. Also, it is important to have the "right" people on the team, in terms of knowledge and expertise relative to the team's task or project. The appropriate people will communicate both with each other and with organization members outside of the team, which should improve the learning outcomes generated by the CFT. Furthermore, the inclusion of internal and external information exchange and the creation of functional redundancy in the model point out the importance of group processing and relationships within the group as well as with external organization members.

We believe that the propositions presented here will aid researchers and practicing managers in their study and management of the processes and outcomes associated with CFTs. We have sought to remain parsimonious in our suggestions, highlighting a small number of variables that are crucial for generating organizational and individual learning outcomes. Project team leaders in particular benefit from the learning generated by CFT decision processes in product development and process management applications. We hope that additional research will further develop the nature of the learning processes during cross-functional exchanges, adding further insights into the development of new knowledge in organizations. Also, we hope that managers will find these insights to be helpful in drawing their attention to the most critical elements in the generation of learning in cross-functional teams.

Limitations

This paper illustrates a confluence of research literature relating workgroup dynamics, information processing, and organizational knowledge structures through a series of interviews with members of cross-functional teams in a given organization. As such, it is not meant to provide definitive research findings or contribute a new theoretical model. Rather, we hope to raise interesting questions through the interplay of research literature and CFT member comments. As pointed out variously above, there are factors other than functional redundancy and heterogeneity to consider when assembling a group. For example, the differentiation of status among group members and any resultant discomfort or imbalance might be offset through the "stacking" of the team with more members of a given status. This was the case in a few of the CFTs in our dataset. To empower the unskilled (as opposed to professional, technical, or managerial) workers within a given CFT, a disproportionate number of them would be assigned to the same team. Other factors that may be important in explaining learning in CFTs include team collocation or dispersion, team skills, resources available to the team, and deadline pressure, among others. We hope that our examination helps to illuminate a path that leads to greater understanding of how CFTs contribute to organizational and individual learning.

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