Speeding Product Development: Making Teamwork Work

Deborah Ancona, 617-253-0568
MIT Sloan School, E52-582
Cambridge, MA 02139

and

David F. Caldwell, 408-554-4114
Leavey School of Business
Working Paper 3444-92-BPS July, 1992

Speeding Product Development: Making Teamwork Work

Rapid changes in technology and markets are the reality for increasing numbers of industries. Because of this, speed to market is becoming of critical importance in determining whether or not a new product will be successful. This point is illustrated by a recent McKinsey study that reports, on average, companies lose 33% of profit when a product is shipped six months late, as compared with an average loss of 3.5% when product development is overspent by 50% (House & Price, 1991).

Perhaps the most common approach for speeding up the product development process is the use of a team to design the product rather than assigning the product to a single engineer or scientist or even individuals from the same function. The use of such teams is not confined to high technology industries alone. For example, a recent Wall Street Journal article (White, Patterson & Ingrassia, 1992) describes how the product development process is changing in the automobile industry. To replace the traditional "chimney" based product development process -- so named because it describes large vertical structures that don't interact -- the industry is turning to a team based process. Members of different departments and disciplines are brought together under one manager and given the charge to make development decisions and enlist support for them throughout the organization. Such teams have the potential of speeding development by improving inter-unit coordination, allowing for the use of a parallel as opposed to a sequential design process, and reducing delays due to the failure to include the necessary information from throughout the organization (Kazanjian, 1988).

However, if teams are to fulfill their promise of shortening the product development cycle, they must develop the ability to collect information and resources from a variety of sources -- inside and outside the organization -- and interact with others in the organization to negotiate deadlines and specifications, coordinate workflow, obtain support for the product idea, and smoothly transfer the product to those groups that will ultimately manufacture, sell, and service it. If a team is unable to meet these challenges, it is unlikely that it will be successful in getting products to market quickly. What this suggests is that developing an understanding of how teams deal with other groups can have important implications for helping improve the performance of these teams.

This paper summarizes an investigation of teams responsible for developing technologically sophisticated new products. After a short discussion of the types of teams we studied, a description of the nature of team interactions with others follows. We end by describing how these interactions are related to the success of the team in completing its assignments and some recommendations about how team efforts can be enhanced.

Research Base

The conclusions described here rest on data we collected from product development teams in five corporations in high technology industries. Our motivation was to study how teams can coordinate more effectively with the other groups in the organization that are necessary to successfully manufacture and market a new product. Our conclusions are based on extended interviews with 38 new product team managers and in-depth study of an additional 45 teams.

The purpose of the initial interviews was to help us understand the range of actions teams must take to deal with others in order to complete the product development process. The insights from these interviews allowed us to generate hypotheses about how these interactions relate to the team's success. These hypotheses were tested with the set of 45 teams we studied in depth.

These 45 teams were all responsible for developing a prototype new product and transferring it their firm's manufacturing and marketing groups. All the projects used new or evolving technologies. For example, one product automated the sampling process in liquid chromatography, another combined photographic and computer imaging processes. Leaders of these teams were extensively interviewed, members of the teams completed detailed questionnaires regarding the nature and frequency of their interactions with others, and top managers in the companies were interviewed regarding product development strategy and the success of each of the teams.

Teams and their Environments

Recent research on groups in organizations has begun to focus on how group members interact with others outside the group. A number of studies have investigated the communication across group boundaries in R&D laboratories and have identified a set of communication roles including stars, gatekeepers,and liaisons (Allen, 1984; Katz & Tushman, 1981; Tushman, 1977, 1979). These studies have pointed out the importance of bringing technical information into groups and have established clear links between cross-boundary communication and performance. What these studies demonstrate is that the amount of communication between a team and outsiders is important in explaining

the team's success. However, what these previous studies do not address is the nature of communication with other groups that is most effective.

The data we collected suggest that there are striking differences in the way teams manage their relationships with other groups. Not only did teams differ in the frequency they communicated with other groups, they also varied in how they interacted with them. There was a common set of activities team members undertook in dealing with others. However in some teams members engaged in high levels of these activities, while in other teams, members scarcely undertook them. A description of three teams will help put these activities in context.

The Swallow team was responsible for designing a computer for the CAD-CAE market. From the very beginning, the project leader of the Swallow team actively engaged top management. Before the project was discussed by the Operating Committee (a top management committee responsible for product decisions), he met with individuals in that group to answer questions and "sell" the project. When the decision was made to go ahead with the project, the project leader asked the President and Vice President of R&D to come to the first meeting to explain the importance of the product to the company and to communicate their support for the team. Throughout the life of the project, the leader maintained close contact with the President.

Lateral communication was also quite high throughout the project. When the team had a preliminary design, the leader set up a design review with multiple representatives from R&D. This review went on intermittently for a full two weeks, during which the team's assumptions were challenged and many points of the design

debated. During this time, the leader brought three people from the manufacturing function on to the team. These individuals were responsible for evaluating the ease of acquiring the components specified in the design. They also continuously evaluated the ease of manufacturing of the computer and acted as liaisons to others providing information on the product progress and detailing what would be expected from other functions. As the team leader explained, "Coordinating was a major task throughout this project. We could have never have gotten it out the door if team members hadn't been checking on other parts of the company and pushing to make sure things happened."

Each week a meeting of the team was held to which many outside groups were invited including purchasing, manufacturing, production planning, diagnostics, and marketing. People were informed of progress and changes. Notes for each meeting were taken and distributed by electronic mail so that they could be available to other groups. All members of the Operating Committee were automatically sent copies of the minutes.

Toward the end of the project, external activity increased even more as the product moved toward release to manufacturing and sales. There were many meetings to train manufacturing people, adjust schedules, and settle fights about when the product was "really ready" for shipment. When the product was finally "let go" the team was credited with a great success, although at the time, many team members were too exhausted to celebrate what they had been able to achieve.

The Beaver Project was done in the same company as *Swallow* but was not as successful. Although it ultimately filled a gap in the company's product line and sold

well, a substantial opportunity was lost because it was late to the market. The project leader primarily worked with his group to solve technical problems. His interactions with top management were focused on communicating product specifications and the technical challenges the group was facing. When asked how the team would coordinate with marketing and manufacturing, the leader replied, "Have common goal statements. In other words, we have goals around time to market, we have goals around product cost, we have goals around product functionality, we have goals around product quality."

Unfortunately, the reliance on goal statements to handle interdependencies among functions did not work well. About six months into the project another senior manager was put on the team to "help, as an additional resource." When asked why he was put on the team, the new member replied, "I'm to be a catalyst...to sell the product to other people, to be the champion of the product outside." When asked why he could do what the team leader could not, the new member replied, "He just didn't know how to make it happen. That was the part he had the biggest struggle with. Because he sort of kept saying we ought to do it this way and nothing would happen."

In contrast, the team leader would talk about his frustration with getting things done with other groups. While the new "resource" worked vertical and horizontal interactions informally, pushing team members into their own negotiations with outsiders, the team leader often escalated problems up the hierarchy. "Every time you elevate something it becomes a great deal more painful...As things get elevated it causes more work because you're dealing with people who don't understand the fundamental issues and you have to educate them, your dealing with more players...you've got to deal with

engineering and marketing VPs, so you end up with the pyramid growing and growing."

But issues with marketing and manufacturing kept growing. There was a stalemate with marketing over how many configurations of the product were needed and this issue pushed up to the Operating Committee for a decision. When differences with manufacturing were escalated, the team leader was demoted and replaced with an individual from the manufacturing function. As the old leader tried to make sense of what had happened he remarked, "Typically what happens, and I'm just finding this out...there is no justice and you're never right--just understand that and you'll be all set. I try to deal with things in a rational way; the manufacturing function in this company is not that nature of beast. Many things that were planned for Beaver six, eight, ten months ago were never really committed to by manufacturing."

The *ID Printer* team was set up to take the company into a new line of business by combining two existing technologies into a revolutionary new product. The team was assigned extremely talented engineers, given ample financial resources, and provided with an experienced team leader. Further, the team was given six months to "play in the sandbox" that is experiment with different technologies and product designs. Despite these advantages, the project was a complete failure.

The team was organized so that different team members worked on separate aspects of the new design and got input from different parts of the organization and outside world. The team therefore developed a great deal of information about "the market potential, all the amazing applications that we could use this technology for" and "the way we could put this thing together." The team was very excited and worked long

hours getting as many new ideas as possible out on the table.

However, after six months the team could still not agree on what exactly the first product was going to do nor on what components would be used in the design. When questioned about this lack of progress, the team's response was to continue to seek information and change the product design. At first, top management was quite lenient, but then "the pressure started." While management tried to get commitments on schedules, the team was always late. A design would come in, and then it would be followed by another design that ostensibly had some "new and exciting feature that would make the product even better." Design and redesign continued for many months before the project was finally killed. During this time period, the team leader was frequently hard to find. He often avoided meetings with top managers by promising that the solution was "coming soon."

Activities with Other Groups

As these cases indicate, a great deal of interaction and coordination is required between team members and others. The team must acquire information and resources from outsiders and must gain the support of other groups who will ultimately implement the team's ideas. Our results, based on a statistical analysis of survey data from the members of 45 teams, indicate that individual team members engaged in three distinct sets of activities in dealing with other groups. Individuals varied in terms of how frequently they interacted in these ways within a team. In addition, teams varied greatly in terms of how much these activities were done by members. The cases help to illustrate each set of activities.

♦*Ambassador* activities -- One set of activities were those aimed at representing the team to others and protecting the team from interference. These activities were often directed toward influencing individuals at upper levels of the organization and generally had one of four aims. One aim of these activities is building support for the team. This frequently means "talking up the team" to outsiders in order to build their enthusiasm for the team and its product and obtain resources the team needs. Related to this is a second aim of reporting and "interpreting" the team's progress to those higher in the organization. A third aim is developing an understanding of the company strategy and of potential threats to the team. Finally, these activities were aimed at buffering or protecting the team from outside pressure. The first set of activities basically represent vertical interactions that hook into the firms power structure in order to protect the team and gain support for the team and its product. The manager of the *Swallow* team was extremely active in this regard. He worked with management to both obtain resources and shape the perceptions others had of the team. This was in contrast to the leaders of the other two projects. Although the *Beaver* team leader communicated frequently with top management, he focused almost solely on technical issues. The *ID Printer* team leader avoided contact with top management.

♦*Task Coordination* -- The second set of activities we identified were aimed at coordinating the team's efforts with others. Examples include discussing design problems with others, obtaining feedback about the team's progress, and getting information about the progress other functional groups are making in accomplishing goals. Thus, these activities are primarily lateral interactions that hook into the work

flow to coordinate the team's work with that of other groups, particularly those that will market or manufacture the new product. High levels of these activities were displayed by both the manager of *Swallow* and the new member assigned to the *Beaver* project. In contrast, the manager of *Beaver* avoided these activities and instead tried to rely on formal procedures and the hierarchy to deal with other groups.

♦***Scouting*** -- The third set of activities we observed represented general scanning for information about markets, technology, and competition. As such these activities were relatively unfocused lateral interactions to connect with the firm's information structure to learn about new technologies, markets, etc. Most of the interactions of the *ID Printer* team fell into this category. Members of this team spent a great deal of time interacting with others trying to absorb any new information that became available.

External Activities and Team Performance

The major question we were interested in was how these activities were related to the performance of the team. We investigated this with the sample of 45 teams. Top management in each of the companies rated the teams both while they were working and after the product was complete. During development, teams were rated on their adherence to budgets and schedules and their overall efficiency of operation. After the product development process was complete, top management rated the innovation of the team.

There were three clear results of this analysis. First, teams with high levels of Ambassador activities did a better job of adhering to budgets and schedules than did teams with lower levels of this activity. It may be the working with management allows

the team to develop a better understanding of the expectations the organization holds for the new product, and hence be more clear about money and time targets. It may also be that teams with high levels of this Ambassador activity are able to shape the way performance is viewed by creating a favorable impression of the team.

Second, the level of Task Coordination was related to the team's level of innovation. Those teams that developed highly innovative projects spent a great deal of time working with other groups in the organization on solving specific problems. Spending time working with marketing and manufacturing on design issues, deadlines, and customer needs was associated with innovative results.

Third, and somewhat surprisingly, the more time the team spent in Scouting activities, the lower the performance. This was consistent across all three measures of performance. At first glance, this result my seem odd. Why would it be that the more time a team spent trying to understand its environment, the poorer it performed? Perhaps this result can be understood by comparing the *Swallow* and *ID Printer* teams. Both these teams spent a great deal of time communicating with other groups, yet the focus of that communication was very different. *Swallow* team members communicated with other groups to ensure functional integration and solve specific problems. They used the information they obtained from other groups to set basic parameters and identify issues for discussion. In short, their were efforts directed toward the acquisition of specific information. This is not to say that the *Swallow* team did not conduct that broad environmental scanning that allows the group to attain information about market demands and understand new or evolving technologies. Rather, the scanning that did

occur took place early in the development process. The group used the initial information to set the parameters of the design. Team members then worked extensively with others to negotiate specific items and refine the basic design. This is in contrast to the *ID Printer* team who were never able to decide on a standard and allowed new information to change previously determined standards. The *ID Printer* team continuously tried to acquire new information until it seemed that their primary task was absorbing new information rather than finalizing a design.

Strategies for Dealing with Other Groups

Although every team differed in the way it dealt with other groups, we observed certain patterns of activity in the teams we studied. Four different patterns or strategies were evident based on the extent to which group members collectively engaged in Ambassador activities, Task Coordination, and Scouting.

♦ *Ambassadorial Teams* -- In thirteen of the teams we studied, the primary purpose of communicating with other groups seemed to be directed toward persuading others to support the work of the team. Team members did not do much in the way of Scouting or Task Coordination; rather most of their activities with others fell into the Ambassador categories.

♦ *Technical Scouting Teams* -- Collecting general intelligence about market and technical trends was the primary focus of twelve teams. In dealing with other groups, these teams did not focus on resolving specific coordination issues as much as they did on trying to understand potential changes in technology, what competitors were doing, and how the market might evolve. In short, these teams had low levels of Task

Coordination and Ambassador activity but high levels of Scouting.

♦ *Isolationist Teams* -- Ten teams engaged in little external activity. These teams did not interact much with top management nor did they seek information from other functional groups or communicate with those groups to resolve design questions. An Isolationist strategy did not always mean that the team was not aware of the importance of other groups. In some cases, these teams made elaborate plans for dealing with others after the team's work was done. The approach these teams took was to work independently to design the new product with the plan of "selling" it to the other groups that would ultimately manufacture and market it.

♦ *Comprehensive Teams* -- Ten teams were extremely active in dealing with other groups. These teams worked to develop a strong relationship with top management. They were also very active in working with other groups to negotiate schedules and resolve design questions. In contrast to Technical Scouting teams, these teams were much more focused in their search for general technical and market information. As such, they displayed high levels of Ambassador and Task Coordination activities but low levels but low levels of Scouting.

What To Do

Teams can be extremely valuable mechanisms for improving coordination and thereby speeding up the product development process. However, the increasing use of teams is not a panacea. If teams are to live up to their potential, the process for managing them must be improved.

Simply setting up a cross-functional team is not enough to ensure success. Our

research has shown that such teams are inherently difficult to manage (Ancona & Caldwell, 1992). Developing an effective, highly motivated team, that shares a common purpose is difficult when individuals have different functional backgrounds and perspectives. A cross-functional team does not even guarantee that the team will develop good relations with other groups. Unless the team is able to collect information from a variety of sources -- inside and outside the organization -- and negotiate with a number of different functional groups, success is unlikely.

Frequent communication with other groups is also not enough. Although effective teams communicated slightly more frequently with other groups than did teams that were not as successful, our results indicate that it is the nature and pattern of communications, rather than frequency alone that facilitates product development. Rather, what was important was the strategy the team took in dealing with other groups. Teams that adopted a Comprehensive strategy were rated as doing a better job of meeting budgets and schedules and of developing a truly innovative product than were other teams.

The question becomes what can an organization do to make it more likely that teams develop a Comprehensive strategy for dealing with other functional groups.

♦ **Training**

Cross-functional teams and those that focus on building effective relations with other groups are inherently difficult to manage. In fact, encouraging teams to spend time working with non-team members is counter to what is seen as necessary to build a smoothly operating group. In fact, in our study, those teams that had the least communication with outsiders became the most cohesive and rated their own

performance higher than other groups. For a team manager, this is something of a paradox. Encouraging the group to build effective relations with outsiders contributes to high performance but at the same time may reduce the cohesiveness and sense of accomplishment of the group. If a team managers have an expanded model of what constitutes an effective group, he or she is unlikely to concentrate solely on what is going on within the group. Educating managers about comprehensive models of group behavior and providing training in skills such as negotiation and coordination can be powerful tools.

♦ **Reward Systems**

If teams are to develop an external focus, systems for supporting that will have to be developed. Strong functional organizations may limit the ability of teams to coordinate with multiple functional groups. Particularly important may be the reward and career development systems. If individuals are evaluated solely by their performance in a function or if product team members are accountable to a functional manager rather than a team manager, it will be difficult for individuals to take on unfamiliar responsibilities -- especially when it takes them outside their functions. If an organization wants to encourage cross-functional work, it must reward it. This does not mean that functional skills can or should be ignored in evaluation. Rather what it means is that if the product development process requires cooperation and problem solving across functional lines, individuals possessing those skills must be rewarded. At a broader level, if team based outcomes are necessary or important, the question becomes how to reward team accomplishments. In most organizations, individual

accomplishments are the main basis for determining compensation and bonuses. A very few organizations are beginning to experiment with ways of rewarding an entire team.

♦ **Culture**

In many organizations, a culture that supports teamwork must be fostered. In many cases, it may be necessary to "soften" the organization structure. Punishing people who depart from the chain of command, for example, will only inhibit cross-functional project work. In addition, relying exclusively on coordination through the hierarchy or formal design reviews will be insufficient. Clearly, our data support the need for high levels of informal communication and persuasion. Cultures that encourage broad networks of contacts and easy access to individuals are needed.

If the culture is based on exceptional individual performers as opposed to strong group efforts, building teams that adopt a Comprehensive strategy for dealing with others will be difficult. Along these same lines, how the top management team works together is a very strong symbol as to how product teams should work. If senior management has a reputation for defending functional areas, it will be very difficult to send a different message to teams. On the other hand, if top management models cooperation, team members will be likely to seek out opportunities for working together.

References

Allen, T.J. (1984). *Managing the flow of technology: Technology transfer and the dissemination of technical information within the R&D organization.* Cambridge, MA: MIT Press.

Ancona, D.G. and Caldwell, D.F. (1992). Demography and design: Predictors of new product team performance. *Organization Science*, forthcoming.

House, C.H. and Price, R.L. (1991). The return map: Tracking product teams. *Harvard Business Review*, January-February, 92-100.

Katz, R. and Tushman, M. (1981). An investigation into the managerial roles and career paths of gatekeepers and project supervisors in a major R&D facility. *R&D Management, 11,* 103-110.

Kazanjian, R.K. (1988). Relation of dominant problems to stages of growth in technology-based new ventures. *Academy of Management Journal, 31,* 257-279.

Tushman, M. (1977). Special boundary roles in the innovation process. *Administrative Science Quarterly, 22,* 587-605.

Tushman, M. (1979). Work characteristics and subunit communication structure: A contingency analysis. *Administrative Science Quarterly, 24,* 82-98.

White, J.B., Patterson, G.A. & Ingrassia, P. (1992). American auto makers need major overhaul to match the Japanese. *The Wall Street Journal*, January 10, 1992, 1.