

Team Decisions

Seven heads are better than one, but it takes a lot of care and nourishing to keep group dynamics on track.

By David G. Ullman

DURING PRODUCT DEVELOPMENT many problems deal with complex, strategic, and influential issues that require team resolution. A poor decision on these problems may not be easily corrected later or noticed in time to correct it. Poor results may have significant impact on product quality, cost, and development time.

There is much evidence in most companies that the decision-making process could be better. For example, decisions don't stick, so issues that earlier seemed resolved are often revisited.

Team members don't buy into decisions. They may say they do, but then pursue their own agendas.

Group decisions are made by edict, according to the loudest voice, or in haste at the last minute.

There is little confidence in the resulting decisions, especially those made early in the process—when information is uncertain.

The team fails to draw on collective expertise to reach the best decisions.

The decision-making process isn't reusable. There is no history of, or justification for, previous decisions. Do any of these problems sound familiar? They are the symptoms of poor decision making.

Team decision making is often complex and difficult to structure. It involves solving problems that require the best use of an organization's intellectual assets, which are stored in human minds, with each person bringing different expertise, insight, and perspective.

Consider the following case study. BikeE Inc., a manufacturer of recumbent bicycles in Corvallis, Ore., introduced a very successful product in 1998 and was trying to decide what to develop next. Recumbents are the

low-slung bicycles whose profile is intended to make more efficient use of human pedaling. BikeE has built a reputation for turning out innovative models priced to appeal to a large buying public.

The product management team's situation was fairly typical. The team consisted of 10 people representing different functional areas, including engineering, manufacturing, sales, and administration.

Some product concepts were proposed, but there had been no effort to reach a shared vision of them. None of the concepts was well refined. Among them were a mountain bike, a tandem, and a child's bike.

There were no clear criteria for selecting among the concepts. Everybody was concerned about profit, price, and how a product might affect the company's image, but none of those issues had been discussed or refined.

The team had limited time and funding.

In short, this team, like most, was faced with uncertainty, limited resources, and the desire to make the best choice with buy-in by everyone in the group.

The route they chose led to the development of a recumbent bike designed specifically for off-road use.

If the team had made a poor choice, they might have ended up making a product that did not sell well, was overpriced, or was late to market. Teams often don't know how well they have done until long after the decision is made, so it is imperative that they make the best decisions possible, the first time.

It is surprising that so little emphasis is placed on decision making in a typical engineer's training. Making decisions is a critical activity in product development. Whenever a concept is chosen, a new feature is added to a part, or a vendor selected, a decision has been made.

Before the mid-1980s, product development was focused on the end result. In the 1990s, concern for the process resulted in standards like ISO 9000. The focus is now moving toward how people interact, either face to

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face or across distances, to make decisions.

Whenever one of many proposed alternatives is chosen, it becomes the focus of time, money, and other resources. If developers later change their minds, a majority of the intervening time is lost and expenditures are, for the most part, unrecoverable. Decisions commit the decision-makers and others to further effort. In fact, part of decision making is determining how much commitment each alternative will require.

Given the importance of decisions, it is worthwhile to explore methods that can help teams choose the best courses of action.

Developers are encouraged to generate more than one possible solution to a design problem. Having to choose among many forces them to analyze and compare.

A case in point comes from a dissertation, *Thinking Methods and Procedures in Mechanical Design*, published at the Technical University of Munich in 1991. Norbert Dylla, the author of the dissertation, described an experiment involving six mechanical engineers. Each engineer worked independently for about 10 hours on the same simple de-

sign problem: to mount a camera on a wall. The problem was well specified with numerous criteria that had to be met, such as angles for adjustment, locking capabilities, and ease of mounting. The aggregate number of concepts considered by all the subjects totaled 18, including various methods of adjusting, locking, and mounting.

An independent group of engineers judged results by measuring how well the final designs met the original criteria. The results showed a significant relationship between the number of alternatives explored and the technical quality of the chosen solution.

How do you encourage people to generate multiple alternatives? One manager said that his engineers always had at least three alternatives. When asked why, he responded that he would not approve a new idea unless at least two other solutions for the problem were presented at the same time.

Experience suggests that effective team situations generate multiple alternatives as the result of normal communications. This is especially true in a collaborative environment, when team members have established an atmosphere of trust. If multiple ideas are not generated in a team situa-

tion, it is likely symptomatic of a rubber-stamp process where management does not encourage and reward ideas.

Criteria are needed to measure the important features of alternatives. If the criteria for a satisfactory solution are not defined at the beginning, the only way to know you are done is to run out of time.

At the same time, criteria need room to evolve as understanding of the problem develops. Early criteria may be uncertain and can be refined only as the project progresses. In balancing these two opposing views, awareness and control of the evolution of criteria are what is important.

'FEATURE CREEP'

If criteria are not documented, they will change during problem solving. This is commonly called "feature creep." It can come from business units such as marketing and sales, and can also come from within a project. If criteria are not documented, they become unmanageable.

If criteria are not shared among the team members, each may be working toward a different goal, while they all believe they are working in common.

The design activities of Norbert Dylla's six engineers were also evaluated to find how much



Using techniques to aid group decision making, a design team took a recumbent bicycle off the beaten path.

of the total problem-solving time each one spent to understand and develop criteria. There was a strong correlation between the percentage of time spent analyzing the criteria and the technical quality of the result.

A similar study, although in a different field, suggests that the same holds true for teams.

This study looked at 17 seven-person teams as they tried to solve open-ended problems concerning claims of more than \$50,000 in the insurance industry. The researchers counted the number of times criteria were discussed during each team's deliberations. Then two experts in the field judged the effectiveness of each team's solution. The results, published in *Southern Communication Journal* in September 1997, showed that effective teams expended twice the effort establishing evaluation criteria as did ineffective teams.

Most problems are caused by information that is uncertain. It is important to be aware of uncertainties and control them during decision-making.

Last year, at the beginning of a 2½-year project, a team of 20 people in a large high-tech firm needed to select a technology for a new ink jet delivery system. The team's goal was to select one technology to develop in a typically uncertain research and development environment.

They faced uncertainty because they had neither time nor money to refine all the alternatives, and some of their information was qualitative.

Inconsistencies arose because team members represented different functions within the company. Their evaluations of the alternatives varied and, in some cases, conflicted.

The data were constantly evolving. Throughout the deliberations new information was introduced, at times without warning and at other times purposefully collected.

The team needed to choose the best alternative with the least sensitivity to these uncertainties, and to get all its members to buy into the final decision.

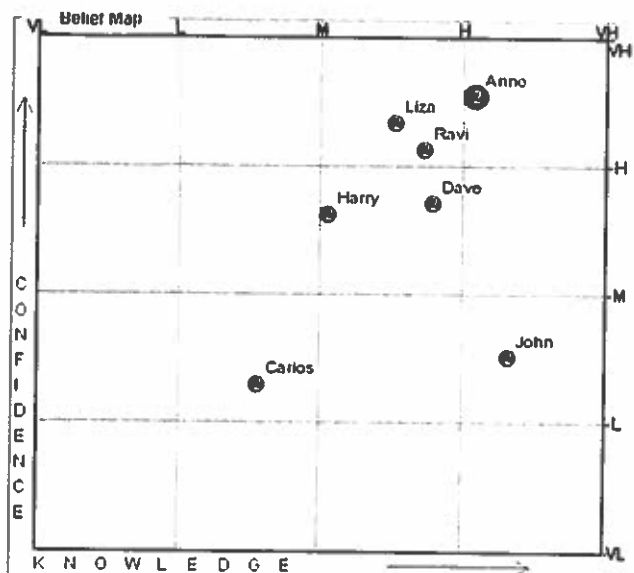
The team members came up with five alternatives to study and developed 15 criteria, including time to first prototype, system cost, refill time, and system reliability, against which to judge each idea.

USING BELIEF MAPS

This team used belief maps to help manage the uncertainty, inconsistency, and evolution of their work. The belief map is a method of graphically representing relative levels of knowledge and confidence.

It is a plot whose horizontal axis represents the evaluator's knowledge of the alternative's feature measured by the criterion. The vertical represents confidence in the concept's ability to meet that criterion.

This team's work is proprietary and cannot be discussed in detail. But to illustrate, consider a hypothetical example. For instance, one of the alternatives a team develops is called "dropper" and a criterion on a team's list is "ease of manufacture." Carlos may admit little firsthand knowledge of manufacturing the dropper by plotting a point left of center on the map. He believes the concept might be about average in manufacturing ease, and so places a point halfway up the grid.



A belief map graphically depicts differing levels of knowledge and confidence; it is intended to guide discussion toward consensus.

Liza, with more knowledge and higher confidence in manufacturing efficiency of the dropper, will plot a point closer to the upper right-hand corner. Five other members of the team will find their own points.

Belief maps make it easy to visualize uncertainty (that is, lack of knowledge) and lack of consensus. More on the use of belief maps is available in the book *12 Steps to Robust Decisions*, written by the author of this article and published by Trafford Publishing of Victoria, British Columbia.

Belief maps even the evaluation playing field and provide a forum for sharing and combining information. No one has a louder voice than anyone else and the knowledge of the whole team can be brought to bear on the evaluation.

For most nonroutine design problems no one is an expert in all the areas that need evaluation. Although some people have more knowledge than others about certain factors, many on the team have knowledge important to the decision. Thus, it is critical to combine the expertise of many on the team to the best advantage. There are mathematics that do this combining. These are doable by hand from the belief maps, but not easily, and there is computer software, Accord, which does them automatically. Accord is available through the author's company.

The use of belief maps helped move the team, in the words of the team leader, "from relying on a few experts who have all the knowledge to a team, many of whom have valuable knowledge."

Use of the belief maps greatly improved communication within the BikeE team. For the first time, they clearly articulated the criteria and the alternatives. The discussions were facilitated by the belief maps as they compared and contrasted their evaluations.

They reached the decision that they should design and market a recumbent mountain bike. The product proved to be innovative and opened new markets for BikeE.

The ink jet team chose a system that is now in development. The team manager is convinced that the company can bring the product to market six months earlier than originally planned. ■