A Cooperative Approach To New Product Development

W. Letton
Daniel Industries
Houston, Texas
USA

Summary

In times past, development of new products for our and other industries could be described as **serial** and **compartmental.** It was serial in the sense that all major developmental activities - design, laboratory testing, field testing, regulatory approvals - were conducted sequentially, one following the other. It was compartmental in the sense that the parties involved - suppliers, users, governmental authorities, independent test laboratories - had access to and communicated only a portion of the total body of knowledge of the new product. The net result has often been that the new product was stillborn, or introduced years after it might otherwise have been.

The intent of this paper is to propose a better methodology to develop new products than this serial-compartmental model. What is suggested is a cooperative model, where the key participants come together early in the development program, discuss the issues involved, and formulate an introduction plan which satisfies the requirements of users, suppliers, and regulators in order to commercialize the new product in as expeditious a fashion as possible.

1 Introduction

The intent of this paper is to propose a better way of new product development for our industry than that we have traditionally used in the past. Here we suggest that a partnership between the three primary participants - suppliers, users, and regulatory authorities - can be the optimal means of commercializing innovative new technology in a manner which satisfies the needs of all three.

In what follows we first consider the primary needs of suppliers, users, and authorities, where they are in harmony and where they are not. Next we discuss a model for new product development used in former times (perhaps still in use today in some places?), and give examples of where and how it failed. We then consider a better methodology for developing new products which can overcome the deficiencies of its predecessor. The two halves of Project Ultraflow are used to illustrate the process.

2 Basic Needs of Suppliers, Users, and Regulatory Authorities

It should be apparent that users, suppliers, and authorities each have a set of needs which they

attempt to satisfy. In some cases these needs are identical for each participant - the need for product safety, for example - while in other cases they may be quite different. Table I is a partial list of needs for suppliers, users, and authorities. As noted above, there are certain needs which exist on more than one list, sometimes on all three. We do not suggest that each list is complete or absolute in any sense; one could argue for a different set.

There are several points we try to make here. The first is that supplier, user, and authority have needs which, though sometimes similar, often diverge. The second is that each is a necessary player in bringing the new technology to market; without the affirmation and participation of each, the common goal of commercialization can't be achieved. A third point follows from the first two: some form of accommodation among the participants must take place to bring the product to a commercial state.

In what follows, we describe two models of new product development. In both cases all three participants play a role, each striving to achieve the maximum on their needs list. The difference between the two is that, in the second model, the participants recognize the need for cooperation. In so doing, they come together early to develop a plan for bringing the new product to a state whereby it can be sold commercially and used for its intended purpose. In this way, they create a "Win-Win-Win" situation.

3 The Old Model of New Product Development

By the expression "Old Model" we simply mean the way new products were often developed in the 1970's and 1980's. There is no intended suggestion that all new products were developed this way, but our personal experience was that a significant number experienced some of the characteristics described below.

In both models, the source of the major innovation can be either supplier or user. Although we often think of the supplier as the innovator, in some high-technology areas it has been estimated that as many as 80% of the innovations came from users [1]. Indeed, among the products we have heard described here, the Daniel Multipath Ultrasonic Meter and the Kongsberg Multicomponent Flowmeter (MCF) are good examples of such.

In the Old Model, the three main participants typically did their work in series. First, the supplier did the bulk of his development work, taking the product far along before turning it over to the user for evaluation. Once the user was satisfied, the authorities whose approval was needed became involved. Lack of early extensive interaction among the three often proved costly in both time and money.

In the Old Model, the notion of secrecy was paramount. Intellectual property rights were precious, and neither user nor supplier was willing to divulge much, lest it give away the technology advantage. Users were reluctant to sign non-disclosure agreements, and suppliers declared that anything communicated to a customer was "as good as in the hands of our competitor." Often user and supplier companies were represented by personnel from their

respective research laboratories, hence the real users were not dealing with the real suppliers. If the innovation was from the supplier, often it was the result of a technology push rather than a market pull. Instead of looking for technology which might satisfy a perceived need in the user domain, an enthusiastic researcher at the supplier company would take some new technological starburst (fiber optics? micromachined silicon? neural networks?) in search of a problem he might solve. Such an approach is often unsuccessful; the dead product files of many a high-technology company are littered with such corpses. If the supplier was fortunate, he exposed the "hot new product" to user scrutiny at an early stage, at which time its deficiencies were highlighted. At times, however, the technology push within the supplier company is so great that the development can't or won't be stopped. This can be due to any of several reasons.

Poor feedback during prototype testing. If the supplier doesn't avail himself of the user community when he finally has something to test, he may proceed blithely on toward production, assuming all is well, when in reality the product should have been killed or substantially modified. This can result from very little or no user testing - perhaps a manifestation of the paranoia over secrecy - or can be due to testing with the wrong users. More about user selection will be said later.

Wrong-headed technical management. Sometimes the urge to push the technology into a commercial form is overpowering. Those in powerful positions who believe in the technology may convince themselves and others that the market will develop around the product once it has been introduced. While this is sometimes true, it is a dangerous strategy. If the product is really good, the user community should be able to affirm this.

Wrong-headed general management. After investing much time and money on prior development, general management may not be receptive to suggestions of major changes in the program. Considerable pressure may be brought to bear to complete the product development process, reduce engineering expenses, start production, and begin to recoup some of the cost of development.

Whatever the cause, any new product development which is a technology push is a potential drain on the supplier's resources. In the worst of cases, large sums may be spent in development, then spent again in re-work. Two good examples of this phenomenon are found in wireline well logging.

(1) **LINAC.** In the first case, a downhole linear accelerator was developed ostensibly to replace an existing nuclear radiation instrument [2]. Called the LINAC, it accelerated electrons into a special target to generate bursts of gamma rays 100 times more intense than those from the existing tool, the Lithology-Density Tool (LDT). This meant that it could eliminate many of the statistical variations typically seen by nuclear instruments, move through the borehole much faster than the LDT, and turn its gamma radiation off when not in use (the Cesium source in the LDT radiated continuously and could be quite dangerous). However the LINAC was three times as expensive as the LDT and twice as large; an extra operator would have been required simply to maneuver the tool, had it proceeded to commerciality. The

program was killed after building two prototypes and performing limited testing. Very little was learned from prototype testing which wasn't predicted; the same decision could have been made before any money was spent.

(2) **SDT.** A second, more expensive example of a technology push gone awry was the development of a Digital Sonic Tool (SDT) in the early 1980's [3]. Here, as with the LINAC, the drive to introduce new technology overwhelmed the forces of reason, which asked only, "What will it do for the user?" It was well known that by observing how sound propagates in and around a borehole, one could conceptually learn much about mechanical properties, such as shear and compressive strengths of the rocks, cement bond quality behind casing, and so on. The technology to digitally capture acoustic waveforms downhole had been developed, so that all the power of digital signal processing could be applied to extract the relevant information. Prototypes were built, huge amounts of data were acquired and processed, and the SDT went straight into production. Unfortunately, the technology to acquire raw data was far ahead of the ability to process it. A more serious problem, however, was the lack of "answer products" from the SDT. The customer had no interest in acoustic waveforms, and only a little interest in the basic mechanical properties of the rock; what he wanted was someone to tell him when his production zone might collapse in a heap of sand, and when it would not. Unfortunately, years passed before these kinds of answers were available. In the meantime, the SDT struggled to do the job of its simpler predecessor, at twice the cost. In the end, it was actually the next generation acoustic waveform tool which was successful in achieving the goals set out originally for the SDT.

The two cases described above illustrate the point that pushing technology can be an extremely expensive exercise.

Neither of these examples required involvement of the authorities as part of the development process. Under the Old Model, however, taking such a new product to the authorities would probably have taken place after some amount of re-work had satisfied the user's needs. It is not inconceivable that the authorities might also require changes, in which case another round of re-work would be necessary.

4 A Better Model

As mentioned earlier, the source of innovation for the new product can be either supplier or user. Whichever the case, we shall assume the supplier is convinced that this technology has strong commercial prospects. What should he do next?

If we can assume that the supplier's technical and general management are enlightened rather than wrong-headed, the place he is most likely to falter is in testing the new product, and in gaining good feedback from both users and authorities on the test results. In general, suppliers can do only limited testing on their own; they need facilities and, more importantly, experience in similar product use that only the user community has.

In the new way of doing things, then, the essence of our problem is establishing a close working relationship early on between supplier, user, and the appropriate authorities. In the abstract it all sounds rather straightforward, however there is still one thing that can ruin the process: poor user selection.

To understand the importance of connecting the supplier of the new product with the proper users for testing, it is useful to consider Eric von Hippel's concept of lead users [4]. He defines lead users of a novel product, process, or service as those who display both of the following traits with respect to it:

(1) They face needs that will be general in the marketplace, but months or years before the bulk of that marketplace faces them.

(2) They expect to benefit significantly by obtaining a solution to those needs.

Lead users will not only follow the test program of the product with a keen awareness, they will be a constant source of new ideas about which features are missing from the product and must be added. They are also a thoughtful sounding board for new ideas from the supplier. Primarily, they will be involved.

Finding a group of such users to test the new product and provide feedback sounds like normal, common-sense advice. Why would a supplier not look to those users who satisfy these criteria?

The answer is simply that it is often a good deal more work to line up a group of lead users than to assemble a user test group with no such selection criteria. To determine who those lead users are for a specific product - and they obviously will vary from product to product - the supplier will need to perform an analysis of the market. If, as is often the case, the Sales Department is responsible for finding test opportunities for the new product, one can almost guarantee the test group will consist of three types of users: (1) the supplier's largest clients, (2) clients with whom most recent sales contact has been made, and (3) clients to be seen in the near future. None of these users inherently has a need for the new product, hence getting the strong user interaction required may be difficult for the supplier. These non-lead users may agree to test the new product, perhaps as a favor, however their lack of need for the product will do nothing but impede real progress, as the testing will likely yield very little. If no true lead users are engaged in the test program, an important step in the development cycle will have been skipped. At a later point in time this omission may result in a re-design of the product to correct faults which should have been uncovered during the development program.

Also important in getting the hot new technology into a form that it can be used commercially is identifying the appropriate authorities who will need to be persuaded, and including them during the period of testing the product. If a strong core group of lead users has been identified, they probably have very clear ideas about where it will be of use to them, and hence which authorities will need to approve it. These people should be included from the very beginning in whatever test programs are arranged between suppliers and users, and can thereby have a

major positive impact on the development program.

V Project Ultraflow

The Project Ultraflow has been a good example of many of the ideas proposed here. Begun in 1989, this Joint Industry Project had the goal of bringing high-accuracy multipath ultrasonic flowmeters to a point of acceptance as a viable means of fiscal metering of natural gas. Early in the program it was recognized that there were really two distinct sets of objectives among the interested users, hence two separate JIPs were formed inside Project Ultraflow, the so-called Wet and Dry Gas Projects you have already heard described here.

In each of the Ultraflow projects, the members were lead users almost by definition. Each member paid a substantial sum simply to participate and to have access to the results. Had these users not recognized the benefits to be derived from this new form of gas flow measurement and believed they would benefit significantly from its introduction, it seems doubtful they would have spent such a considerable sum. In each of the Ultraflow groups, it was the users who defined the environment in which the meter was required to perform and specified how it was to be tested, whether in third-party test laboratories, their own laboratories/test facilities, or through actual field installations. Decisions on how to proceed at key points during the development were made by supplier and users together, in consultation with third-party lab personnel as required. Early in each project it was decided that certain improvements to the meter would be permitted, but only if it could be shown that these did not invalidate earlier results. This was a crucial and correct decision; when a product is sailing through uncharted waters, it is essential that alterations be permitted to take advantage of what is learned during testing. Both groups met often during the course of development. Wet Gas met ten times in 33 months, Dry Gas eight times in 23 months.

The role of the authorities in both Wet and Dry Gas groups has been fundamental from their beginnings. The DTI was involved from the very start of the Wet Gas activities, and has kept a close watch on results obtained both at NEL and at the Bacton field test site throughout the development. On the Dry Gas side, the following statement was highlighted in the group's first separate meeting on 1 March 1990:

> "The objective of the work programme to be proposed is for ultrasonic meters to be approved, by the appropriate European authorities, for fiscal metering applications."

To achieve this goal, representatives from DTI, PTB, NMi, and the French Ministry of Industry were direct participants in the project as members of the Quality Assessment Team required by the EEC.

As soon as the Dry Gas effort began, the group informed the convenor of the ISO TC30/WG20 of the work planned and of its relevance as the basis for a draft standard. In fact, the Synthesis Report of results has recently been provided ISO for just that purpose.

A brief word needs to be said about secrecy. If the liaison between supplier and user(s) is for the purpose of further developing the technology, accommodation must be made for protecting information which is revealed during that development. Without this, the supplier will be reluctant to enter into the kinds of discussions necessary to move the technology forward.

VI Conclusion

So in the end we conclude that we all have more to gain by working together to develop new high-technology products. On the surface, this certainly doesn't sound controversial or revolutionary. After all, aren't we encouraged from the time we are small children to cooperate with one another, that more can be accomplished working together than individually?

The simple fact is, however, that what is suggested here is contrary to certain aspects of human behavior. If we work in a cooperative way with those outside our own company, we will likely be required to share some our secrets with them, albeit within the protection of a confidentiality agreement. Furthermore, if we work side by side in the development as proposed, there may be times when our partner sees our "dirty laundry." And since the individual partners have differing goals for the development, there will be times when they must compromise on the execution of the development activity. For all these reasons and more, companies may find it difficult to participate in a cooperative development program, even though the concept sounds simple.

Finally each company must decide if this cooperative development model is workable. The cost to be paid is the sacrifice of a certain amount of one's autonomy in new product development. However, sooner or later the market may make one wish the sacrifice had been made.

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