

## High Technology Product Realization

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In previous the authors established a methodology for identifying factors that can be targeted to affect internal rates involved in the diffusion of technological innovation in the high technology environment. A corollary area of research involved the methodology of the creation and management of product champions, i.e., the pathogens of innovation diffusion. In this paper we outline the Product realization process. Our intent in providing this information is to stimulate the thought processes of the readers. The foundation of successful product development is the link between business and marketing strategy and a shared vision of the future product agenda. Yet many companies fail to provide the proper direction to product teams and to the product development function as a whole. Widely varying opinions on direction often exist between R&D, Marketing, Customer Support and Sales on questions such as:

- What markets will we pursue?
- On what value dimensions do we expect to compete?
- Where will we excel?
- What is the scope and boundaries of our future products?
- How should we balance the needs of current and prospective customers?

The consequence is usually slow decisions, much starting and stopping, excessive finger pointing and even pseudo-sabotage of development projects in the name of "XYZ department knows best".

The following questions would help determine if the firm was operating with a clear understanding of the product development process.

- If you took an informal poll of your product development professionals and asked them to describe your product development process how consistent would the answers be?
- Do you have an owner of the process?
- Has the process been examined and improved in the last 18 months?
- Does each project start with it's own idea of how a good project should be done?
- Do projects have a clear beginning and end? Who sanctions projects?
- Are mistakes from the last project often repeated on the next?

Understanding the Product realization process helps the organization define and build development processes, which will improve product delivery.

In the 1989 report "Made in America" by the MIT Commission on Industrial Productivity (Dertouzos, et. al.), two principal weaknesses hampering American product development were identified...

1. Technological weaknesses in development & production.
2. Failures in cooperation. (Lack of teamwork)

These potential problems must be addressed at the top levels of management if change is expected, because management is part of the problem!

The separation of the product and process design functions, as well as marketing and customer support, tends to promote interdepartmental rivalries and lack of communication. This is an isolated, unsupportive design environment that has been tried over the past several decades and has always been found wanting. These problems would be solved by a concurrent, team approach to product realization. Effective product design requires an open, active dialogue between all stakeholders in the product, from top management on down, if the highest quality product design is to be achieved. This will normally require a massive change in corporate culture.

The ability to develop new products of high quality and low cost that meet customer expectations is essential to continued profitability and global competitiveness. Customers are increasingly demanding both innovation and value. Companies are increasingly engaged in global competition to satisfy customer demand and gain market share (i.e. to be profitable). If a company cannot be profitable in the long term, it cannot survive and all the jobs that it provides will be lost to global competitors.

Developing a product realization process that is tailored to the specific product line of a company is absolutely essential for long-term survival and engineering design is a vital part of that process. Based on the work of Shingo, the essential elements of product production outlined in [Shingo, 1986, p. 3] and repeated in this paper. Each of these areas must be addressed for a successful product realization effort.

The top 20 product realization process concepts that U.S. industry wants mechanical engineers to have are shown in table 1 of this paper. A technical employee would be well advised to insure that he or she has some knowledge and experience with as many of the concepts as possible.

Real change cannot be accomplished in a large organization without the impetus of a "change agent", a person whose sole responsibility is to initiate and facilitate change. Change agents are necessary because people whose main responsibilities lie elsewhere usually have neither the dedication nor the time to initiate significant change themselves.

The product realization process must be specifically tailored for each organization. What works for one organization, may not work for another because of organizational, cultural, or personal differences. The product realization process is also a very dynamic process that benefits from continuous quality improvement (CQI). The product realization process should be adapted constantly to changing environment, culture, problems, and needs.

### **The PRODUCT REALIZATION PROCESS Design Phase:**

The Product realization process is the process by which a new product idea is conceived, investigated, taken through the design process, manufactured, marketed and supported through obsolescence. The structure of the product realization process is fluid and varies from company to company and from product to product. The identification and design phases of a generic product realization process are depicted in the figure 1, however, each organization should tune the product realization process to suit their specific needs and capabilities.

- It **MUST** be developed under the direction of top management.
- It must involve all aspects of the enterprise including marketing, sales, finance, etc. in addition to engineering and manufacturing.
- It is not static, but continually improving -- feedback comes from ALL levels.

Innovation in response to a market need or opportunity has a greater probability of success than innovation in response to new basic research findings. A study of 200 innovation failures showed the following [Dieter, 1983]...

- **50% failed due to market obstacles**
- **28% failed due to management problems.**

- **10% failed due to technology related problems.**
- **12% misc. causes.**

Anyone in an organization can have a viable idea for a new and profitable product, not just one of the executives. The motivation for new product ideas comes from watching the market change, thus those employees most directly involved with customers (sales and service staff) should provide periodic feedback on how existing products are doing and what customers have to say about them. The marketing staff can conduct periodic customer surveys or bring in focus groups of customers to get a sense of where the market is heading and what new features customers want. The engineering staff should be engaged in continual benchmarking of competing products and processes and should be aware of any product innovations. Production workers know what works well and what doesn't work well in the manufacturing process. Sometimes simplifications in the production process lead to a more robust design. In addition, some of the employees should be using the company products routinely and have a very good feel for how they actually perform. All ideas for new products should be submitted to top management and reviewed periodically.

Once an idea for a new product has been identified and selected for possible implementation, a management team defines the strategic goals for the product and forms a product team to oversee the product realization process. For a well-balanced product team, all process areas must be represented.

The product team should retain stewardship over the production phase of the project as well. This will allow them to implement the plans made in the design phase. Pre-production tasks include planning, budgeting, facilities & equipment acquisition, tooling design & acquisition, and employee training. Most of these tasks can be accomplished in parallel (concurrent engineering).

### **Design Reviews:**

A design review is a meeting involving the product team and selected experts, consultants and managers. The purpose of a design review is to take a hard critical look at the current design to determine if the project should continue and, if it does continue, how to make the design better. The product team should present their design to the group and field any questions. They should remember when doing this that they are justifying their survival as a team as well as justifying the continuation of the project. Then, the supervising manager of the project should conduct the critical review process using the product design specification as a guide.

A design review is a rigorous self-evaluation of a design that is used to determine if resources are allocated wisely, if goals will be met, and if the best design possible will be used.

A quality audit is done to identify potential problems that must be addressed to improve quality. A product quality audit should be based on the voice of the customer and benchmark data from competing products. A process quality audit should be based on the quality of the product produced by the process and should involve substantial operator input.

Many rules and procedures outdate quickly. All rules and procedures, except those mandated by law should be regularly evaluated. When a rule or procedure has outlived its usefulness, discard it. Simplify everything all the time! Rules and procedures are usually put into place to solve some current problem, although quite often they produce unwanted side effects later on. If the problem is no longer a problem, perhaps the rules and procedures it spawned are no longer necessary. If the side effects are more of a problem than the original problem, the rules and procedures that caused them should be reviewed and revised, or eliminated.

