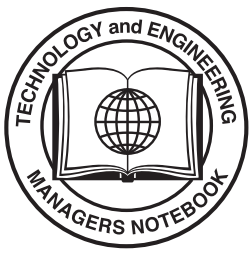
Innovation: Feasibility

—GERARD H. (GUS) GAYNOR
3M Director of Engineering, Retired



IEEE DOI 10.1109/EMR.2016.2595081

IN Volume 44.2, I discussed the *Idea to Concept Stage* of product innovation that included transitioning a *raw-idea into a working-idea* and framing the *working-idea* by answering the questions related to the *what, why, and how* of the proposed idea. Let's now examine some of the elements involved in developing the *feasibility* of the *framed idea*.

James Bryan Quinn ([1]) reminds us that the innovation process can be defined as "controlled chaos." There is no doubt, and it will be substantiated by any innovator, that the initial effort to define the idea and develop it into a communicable and realistic concept, does involve various levels of mental chaos; it involves hard mental work. Studying an idea over many iterations and developing it into a concept presents a challenge. But the time comes when the mental activity must move from chaos to rational thinking.

You may ask, why formalize the process: the answer is simple; improve the innovation success rate. An innovation related to a new-to-the-market product, as an example, involves more than the design of the product: it requires understanding the interactions and complexities involved in the *idea to commercialization cycle*. The process requires applying the principles of engineering design to managing innovation. I suggest that expanding the *feasibility study*, to include all the involved organizational functions, makes managing an innovation for a more orderly process; the design process.

Keep in mind that our discussion continues to describe innovation as:

INNOVATION = INVENTION
+ CMMERCIALIZATION or
IMPLEMENTATION

No implementation or commercialization, no innovation: perhaps, an excellent idea, but no commercialization or implementation.

FEASIBILITY

As technology professionals and managers, we understand the need to develop the feasibility of a new product proposal as far as the technologies are concerned. We accomplish this task, after analyzing the known and the unknown, either through experimentation, physical prototyping, mathematical modeling, or combination of techniques. Such efforts are usually limited to the technical. Successful innovation, however, requires taking a much broader perspective of innovation risk and giving due consideration of all the organizational functions involved in the innovation process such as:

- Technologies
- Marketing and Sales
- Manufacturing Capabilities
- Product Distribution
- Legal, Environmental, and Regulatory
- Customer Service
- Competencies and Capabilities

The depth of analysis depends on the extent to which the innovation deviates from the organization's current business scope, capabilities, and available resources; the analysis may span a continuum from the cursory to the comprehensive. Failure to address the critical issues, prior to going forward, too often leads to failure.

TECHNOLOGIES

Identify the technologies involved in this innovation; the core technologies that drive the organization's business; the supportive technologies essential to maintain the business; the emerging technologies that provide entry into new markets; and the

technologies that must be developed or acquired. At the same time, identify the "knockout-technologies," thsose technologies, that if not resolved, essentially scuttle the project. The emphasis is not on classification, but gaining an understanding of the limitations of the organization's technological base, *now*, before extensive assets are employed.

Marketing and Sales

The input from the marketing group generally determines the success of introducing a new product. The input from the sales professionals, who have direct contact with the customers, determine the life of the product. Customers do not buy technology, they buy performance and service.

At the same time engineering and technology managers must recognize the limitations of marketing information; marketing study without knowledge of the industry may be suspect; a marketing group that focuses on traditional marketing processes may fail to recognize the need for an innovative approach. As an example, the marketing group that decided the proposed product had no market, yet the product developed into an annual billion dollars plus business.

New products must be sold and require a sales organization with an infrastructure suitable for moving the new product to the customer and then servicing the customer. Developing a new sales force to serve a worldwide economy could be a *knockout* because of the significant costs involved. The time to consider the marketing and sales issue is *now*, not when the product development has been completed.

Manufacturing Capabilities

Can the new product be manufactured within the current manufacturing capability or will totally new manufacturing facilities be required? Using current manufacturing facilities provides a financial benefit, but do those facilities impose significant design constraints and added complexities on the designers and developers? The time for decision, now. The funds to develop new manufacturing capabilities or make major modifications to existing facilities may require major investments. Manufacturing facilities require consideration not only related to production equipment and levels of automation, but also the subsidiary issues like environmental, safety, and standards. And what are the implications on the organization's resources of using new materials; designing new processes; identifying supply chains, etc.; disregarding these issues at this stage causes future delays as the project progresses.

Product Distribution

Product distribution includes all the operations required to move the product from the end of the assembly line to the customer: does the current system meet the requirements for the new product? Why think of this at this stage of the innovation? At first sight it may appear that this is a minor issue, however, distribution seldom receives the attention required. Does the new product require special handling of any kind; as an example, packaging, storage, and shipping?

Legal, Environmental, and Regulatory

Why should you as an innovator be concerned, at this time, about the legal, environmental, and regulatory issues? Simple answer, they determine success of the innovation, you, through your professionals in these specialty areas will need to resolve them. Not asking for a solution now, just recognizing that they exist and understanding their significance and impact, will they require resolutions. Those patent applications, vendor and consultant contracts, and designing to meet regulatory requirements become part of the process. The innovator may not be directly involved in negotiations, but will be responsible for meeting the requirements.

Customer Service

Customer service involves more than answering client calls on the generally easy to resolve issues; it involves responding in a timely manner to those questions that do not appear in the coded manuals. Customer service includes both pre- and post-sales activities. It begins with the attempt to sell the product to a specific customer and ends when the product is delivered to the customer, installed, meets the product requirements, and fulfills the customer's requirements; in this case, the user's requirements. Customer service also involves educating the customer on any idiosyncrasies involved in the customer's processes.

Competencies and Capabilities

Successful innovation of new-to-the-market products requires people resources with the required competencies and capabilities; those resources include all people to be involved in the aforementioned functions. Major problems arise in the innovation cycle because of failure to consider the full scope of the required organizational competencies. While focusing on the technical competencies and capabilities at the beginning of any development may be important, disregarding the analysis of the system competency requirements only leads to missed expectations. Focusing on individual competencies only, fails to take into account that innovation success

demands integrating individual competencies into organizational capabilities.

Most innovation projects begin with a lack of the specific knowledge about the competencies and capabilities of the people responsible for leading the activity. If you question this statement, reflect on any past innovations in which you might have participated. Yes, there's general knowledge, but the specifics are lacking. Generally, no organizational database exists that allows selection based on comprehensive records of knowledge, experience, and performance. Who are the key people, the people who will take on the responsibility to solve the many problems that appear almost unsolvable when first encountered.

Keep in mind that like any other activity that includes the introduction of something new, i.e., something that has not been previously experienced, must be staffed by people who span the continuum that includes those willing to do the routine work to the most creative. I'm not speaking of product modifications or upgrades, but a new product/service that does not exist and has no competitors.

Innovation requires people from all functions, the strategic thinkers; the tacticians; the opportunity finders and problem solvers; those with good powers of observation; those who can reduce the complex to the simple; the self-motivated; and the analysts and synthesizers. These competencies and capabilities must be identified, especially those that are not available. It's too late to look for people with specialized competencies when they're needed, so anticipate the needs and plan ahead.

Knowledge or lack of knowledge about the organization's history impacts innovation performance; knowledge, for positive impact and lack of knowledge for negative impact. Eventually, thinking must be translated into the tangible, and here's where the organization's historical knowledge comes into play. That knowledge that tells the stories of how problems were solved; how they worked as teams well before the word teams entered our vocabulary; the rules of thumb learned after many years of burning the midnight oil; that knowledge may be as simple as to know that moving parts usually need a lubricant and holes need to be drilled clean, whether in metal or composites, no fuzz.

Innovation implies something new, something that has not been done previously, so in most cases new talent will be required; not new talent to begin learning, but new talent to begin working.

The Silverlake Project ([2] and [3]) tells the story of how a group of engineers, programmers, and planners, totaling about 2,500, transformed themselves from a technically driven laboratory (rated in the lower third of of the 15 IBM development sites based on technical vitality), into a customer-focused and market-driven organization. A new project manager arrives, no band to meet him, and transforms the group commercializes IBM's AS/400 series of computers.

Conclusions

Innovation requires a cadre of professionals in all disciplines as well as managers and executives. So, I suggest that innovation be treated as a design project. After concluding the "controlled chaos" stage and answering the what, why, and how of the proposed innovation, develop the facts that allow the decision-making process to go forward, but recognize that those facts will need to be upgraded throughout the project cycle. Please send your comments or experiences to Gus Gaynor at (g.gaynor@ieee.org).

References

[1] James Bryan Quinn, "Managing Innovation: Controlled Chaos," *Harvard Business Review*, May–June, 1995, pp. 73–84.
[2] Roy A. Bauer, Emilio Collar and Victor Tang with Jerry Wind and Patrick R. Houston, *The Silverlake Project*, Oxford University Press, 1992.
[3] Gerard H. Gaynor, *Decisions: an Engineering and Management Perspective*, John Wiley & Sons, Inc., Hoboken, NJ, pp. 165–185.