Measuring Innovation: Challenges and Best Practices
Gus Manoochehri
California State University, Fullerton, CA

Given today’s competitive business environment, innovation has become a critical function. In order to manage innovation effectively, it needs to be measured. However, measuring innovation has proved to be very challenging. Based on review of literature, companies' practices, consultants’ experiences and survey results, this paper provides a clearer and more comprehensive understanding of challenges and best practices in measuring innovation. After review of key challenges, the use of an innovation dashboard is recommended. The dashboard should include a set of metrics in each of the three categories of inputs, process and outputs of innovation. Metrics for each of the categories are discussed.

I. INTRODUCTION

The business environment has become increasingly dynamic and competitive. Recent developments and trends in globalization and technology are the primary factors contributing to these pronounced changes. In such a dynamic environment only those organizations that can adjust and adapt swiftly will survive and prosper. A prerequisite for such adjustment and adaptation is the ability to innovate. Innovation has become a critical function in the modern world of global business. To manage innovation effectively, it has to be measured. However, as many companies have discovered to their chagrin, measuring innovation is a very challenging task.

The objective of this paper is to explore the challenges and best practices in measuring innovation and more specifically identify metrics to measure the innovation process effectively. The findings of this research can provide beneficial information to practicing managers, help them to understand the issues and challenges involved and provide guidance for effective development and application of metrics. The research methodology includes review of literature on measuring innovation, companies’ practices, consultants’ experiences and survey results.

II. APPROACHES TO INNOVATION

Innovation is an elusive, dynamic and broad concept that is difficult to define. Consider examples of innovation at Apple, in its superior understanding of customers’ needs in designing iPot; at Toyota, in designing the production system that revolutionized the auto industry; or at Dell, in rethinking the supply chain that established it as the market leader. It is hard to find much similarity among their practices (Shapiro, 2006).

There is a wide variety of approaches to innovation. Traditionally, the concept of innovation was primarily focused on technology developments, associated with a company’s internal R&D. More recently the emphasis is broadening to include other aspects of business. Han, et al. (1998) suggest a dichotomous view: technological and administrative. Damanpour and Goplkkrishanan (2001) focus on product and process innovation. “Product innovation is defined as new products or services introduced to meet an external user or market need; and process innovation is defined as new elements introduced into an organization's production or service operations to produce a product or render a service.” Boer and During (2001) focus on three types of innovation. In addition to product and process, they include organizational innovation. North and Smallbone (2000) take yet...
a broader view of innovation by including any changes across five different dimensions, namely: (1) products and services; (2) market development; (3) marketing methods; (4) production processes; and (5) the technology used in administration.

Booz Allen Hamilton Consulting Firm, based on a survey of 1000 companies with the highest R&D spending, identifies three distinct innovation strategies: need seekers, market readers, and technology drivers (Jaruzelski and Dehoff, 2007). The technology drivers’ strategy is more in line with the traditional definition of innovation, focusing on a company’s internal R&D and technological capabilities to serve the needs of the customers. The need seekers “actively engage customers and potential customers to shape new products, services and processes.” They invent first-to-market products. The market readers watch their market very carefully and respond to what customers buy. They are more cautious and create value through incremental changes.

Another approach divides innovation types into two categories: incremental vs. radical innovation. The incremental innovation focuses on improving the existing product to create some variations to serve the existing customers better. While, radical innovation is a departure from existing products and explores new technology, market, process, or business model to create new market and meet the needs of new customers. Radical innovation is more expensive and riskier, but it can be more rewarding.

Boston Consulting Group offers five types of innovations, primarily based on how new and radical the products are:

- “New to the world” products and services that create entirely new markets,
- New offerings that allow expansion to new groups of customers,
- New offerings for existing customers,
- Minor changes to existing customers, and,
- Cost reduction to existing offerings (Andrew, et al., 2007).

More recently, the concept of innovation is growing even beyond the firm’s boundaries. Due to the high global competitive pressure, some leading innovation companies such as Procter & Gamble, Eli Lilly, IBM, and Hewlett-Packard are moving toward open innovation, tapping talents from outside the company and soliciting solutions to science or product development challenges (Hamm, 2009). Procter and Gamble considers the use of outside sources very valuable to their innovation process. It is moving from R&D to C&D (Connect and Develop), because effective innovation is no longer a one-company task; it is a collaborative task. Procter and Gamble has set a goal of having 50% of its ideas come from outside the company (Sakkab, 2007).

III. MEASUREMENT CHALLENGES

Measurement is a critically necessary activity in managing any function. Measurement documents the organization’s performance. It guides the organization toward achievement of key business results and strategic objectives. It identifies successes and failures, resulting in the required corrective actions, if needed. It guides the allocation of resources. In particular, it clearly communicates the organizations’ priorities to the employees. And, it is a strong lever that senior management can use to influence employee behavior.

Can innovation be measured? Some doubt it. Given the breadth, complexity and elusive nature of innovation activities, its measurement is very challenging. “Measuring the immeasurable,” is how some companies view innovation measurement. “The essence of innovation is novelty, so it stands to reason that some innovation will elude any pre-set measuring scheme. It may even be that the most effective innovation is that which so changes the scheme of things that it makes the old measuring scheme obsolete!” (Shapiro, 2006) Rick Rashid, the head of Microsoft’s research department does not have any interest in measurement. He says
“Research management”, and its measurement one can assume, “is almost an oxymoron.”(Walters, 2009) The 850 Microsoft researchers are given wide leeway to pursue their own interests, without much guidance and direction. However, the Microsoft approach is an increasingly rare one. Most companies, motivated by recent cost-cutting pressures, try to manage and guide their researchers to focus on practical ideas that are more likely to lead to short-term financial payoffs.

While the importance of managing innovation and its measurement is well recognized by the majority of companies, still many (about one-half) do not have a sufficient measurement system in place, due to challenges in measuring innovation. For example, in a Boston Consulting Group (BCG) survey (Andrew, 2009), 73% of the respondents agreed that “innovation should be tracked every bit as rigorously as other business functions.” However, only 46% of them said they did so. While some organizations might ignore measurement because they don’t see the benefits of measurement, or do not want to spend time and resources, or even because they are afraid of discovering problems; most ignore it because they don’t know what to measure. In the BCG survey, when respondents were asked why they did not measure innovation rigorously, the most common answer (from about one-third of the respondents) was uncertainty about which metrics to use.

Given the nature of innovation activities, deciding what to measure is a very challenging task. There is no standard set of metrics appropriate for all companies. Specific metrics should be developed to fit each company’s needs. Metrics should reflect the nature of the industry and the market, the company’s goals and strategies, its capabilities and weaknesses, and its approach to innovation, among other factors. Metrics should focus on key success factors critical to company performance and/or its customer satisfaction.

As discussed, the traditional orientation of innovation was on technological development focused on internal R&D activities. This orientation was reflected in the popular metrics of the past, such as R&D spending, the number of patents, and the number of technical journal publications.

More recently, due to the highly competitive environment, the focus of measurement has shifted more toward the output of innovation (Studt, 2005), emphasizing on meeting customer needs and financial performance, through measures such as number of new products launched, percent of revenue from new products, return on innovation investment, ability to solve customer problems, etc. However, getting the desired innovation outputs, that are lagging indicators, requires tracking the right inputs and the right processes. Many companies are focusing on these three categories of inputs, process and outputs, and developing some appropriate metrics for each (Anthony, 2007; Hempel, 2006; Mankin, 2007; Andrew, 2009).

The National Academy of Sciences in a report on “Measuring R&D Expenditures in the U.S. Economy” indicates that innovation measures must cover five activities:

- Introduction to the market of new products
- Development of new processes to produce or deliver products to the market
- Funding of new sources of supply of raw materials
- Development of new markets
- Changes in the organization of firms (Studt, 2005).

IV. BEST PRACTICES

4.1. Innovation Dashboard

Given the breadth of innovation activities, the use of a single metric, or a few, is insufficient and can be misleading. It is important that measurement to be comprehensive, measuring multiple activities and characteristics. Many companies use an innovation dashboard.
effectively. A dashboard is a set of measures that displays a range of different performance criteria for a company. A dashboard allows management to monitor the company’s performance along different aspects of innovation. Given the elusive and broad nature of innovation, the use of a dashboard is highly recommended. In designing a dashboard a key question is: How many metrics should be included in the dashboard? While the exact number of metrics depends on the specific project and company, the recommended number is between eight to twelve (Andrew, 2009; Hempel, 2006).

While measurement should be comprehensive, but not everything that possibly could be measured should be measured. It is observed that for some companies, the challenge is one of abundance rather than scarcity. Too many measures can be overwhelming and confusing (Mankin, 2007). An effective approach is to first identify all the measures considered important, and then to begin reporting on a few critical metrics before deciding to expand further.

4.2. Metrics
What metrics should be included in the dashboard? This section identifies and discusses some popular innovation metrics: input metrics, process metrics and output metrics.

**Input Metrics**
The two most critical inputs for the success of innovation projects are allocation of financial resources and assignment of key people. The financial metrics basically measure the amount of financial resources allocated to a project, as an absolute amount or as a percentage of sales.

Financial resources are required for the success of any innovation project. While a huge budget does not guarantee success, the lack of sufficient funds can lead to failure of the project. A valuable metric is R&D spending as a percentage of sales. This metric relates spending to the output of the project revenue. It can be calculated at the product level, business unit level, or company level. It also allows for comparison with spending on other projects and benchmarking against competition. This metric can help management to balance allocation of financial resources among different business units of the company, or between different types of projects such as incremental innovation projects vs. radical innovation projects.

The number of key people dedicated to a project is another important success factor. The required quantity and skills of critical staff should be identified and monitored. Dedication of senior management time deserves special attention. Some projects such as radical innovation projects might require higher investment of senior management time.

Often, companies do not appreciate the importance of allocating sufficient resources during early stages of the project. Such oversight will lead to delays or more expensive corrective actions in later stages of the project. Development of input metrics and monitoring them will help management of the innovation process to be more effective.

**Process Metrics**
Four aspects of innovation process deserve special attention: managing time, managing innovation pipeline, new projects’ performance projection, and staffing against plan. A critical factor in managing the innovation process is time. How quickly can the company get projects completed? Meeting the project target date or being first-to-market can be crucial in getting the desired market share and establishing dominance and profitability. There are a variety of time metrics used, some examples include:

- Time to market
- Milestone progress
- Time to break even.

Time to market measures the time from product concept to its launch in the market. The project can be broken down into milestones with discrete, measurable deliverables in order to better monitor the project progress in critical phases of the project. Time to break even relates
the project time to its costs and revenue. It measures the time it takes to recoup the investment in a product. Variations of this metric can be used to measure the time it takes for the product to reach a target level of revenue.

Another critical part of the innovation process is managing and monitoring the innovation pipeline. It is crucial to generate sufficient new ideas, move them forward through progressive phases of the process and keep the pipeline full. Some examples of pipeline metrics include:

- Number of new ideas generated
- Number of projects in the pipeline
- Number of ideas that get funded
- Sum of the projected net present value of projects in the pipeline
- Breadth of the idea-generation process.

Idea generation deserves management attention. It is where the innovation projects start. The number of ideas/projects at specific milestones, such as approval for funding, could be monitored. The breadth of idea generation among employees is important and is a clear indication of supportive organization culture and effective innovation management process. An electronic system that manages new ideas is helpful in encouraging employees’ contributions and measuring volume. With “open innovation” approaches some companies, such as Procter and Gamble, set metrics for measuring the flow of ideas from outside the company.

A key aspect in evaluating the overall performance of the innovation process is to see whether the actual projects’ performances meet their expected targets, measured in terms of time, market share, revenue, cost, etc. Some examples of such metrics are:

- Projected vs. actual performance
- New product forecast accuracy
- Number of projects that meet planned targets.

Such measures are very effective in tempering exaggerations of initial target forecasts, and in holding the team accountable for delivering the forecasted project results. They show how well the company can predict the impact of new products on future revenue and resource requirements. These metrics spot troubled projects and help to identify the process’s weak links that need attention and improvement.

Finally, another valuable process metric is staffing against plan. It shows how well a project is staffed. It is an effective leading indicator to warn management of problems ahead. If a project is 50% staffed, it will result in some unsatisfactory results, either in delayed completion of the project or not meeting the deliverables. It helps to keep management focused on projects on hand and to allocate the required resource.

### Output Metrics

The primary focus of output metrics is on financials and in particular on revenue generated from innovation projects.

- Percentage of revenue from new products
- Percentage of profit from new products
- Percentage of revenue growth from new products.

Such metrics are very popular, as increase in revenue, and resulting profits are the ultimate indicators that the innovation process and new products are succeeding. A challenging issue, however, is defining what a new product is. One question is: How new is new? How big a change constitutes newness? How about changing the color of a razor, or its packaging, or substituting one of its raw materials? Do any of these changes make the razor new? A second question is: How long before the new gets old? Often, companies use 3 to 5 years as a benchmark. But that is not universal. It varies from industry to industry. One meaningful indicator is the average product life cycle in that industry. These two questions have to be answered in order to use these measures effectively.

Two comprehensive measures of innovation projects’ impact are:

- Innovation ROI,
- Total shareholder return.
Both show the overall impact of innovation projects, but neither is defined very clearly. Typically, each company should define its approach to calculating these metrics based on some specific assumptions. Innovation ROI is an ultimate financial measure that has to take into account the innovation projects’ expected revenue, investment costs, the time it took to launch the project, and the costs of the projects that were initiated but killed before launch.

While process improvement projects can lead to higher revenue by, say, improving quality and performance of the product, they often lead to cost savings in production and delivery processes. So, a measure of total cost savings is also needed. This is a relatively straightforward metric to calculate and interpret. Finally, two nonfinancial measures are popular:
- Patents granted, and
- Number of new products launched.

The number of patents granted is not critical for some industries. However, for some companies that have to focus on development of intellectual property and need to allocate some resources to basic research, the number of patents is an important metric. However, it should be noted that it is an interim goal, and invention is not necessarily innovation.

Number of new products launched is a very clear measure, once you determine what constitutes a “new” product as discussed earlier. Monitoring the number of products launched shows how well the innovation process is working. However, just counting the number of new products launched, without considering the quality of these products and their impact on customer satisfaction and revenue enhancement can be misleading.

V. FINAL NOTES

What gets measured gets done. Performance measures have a considerable impact in directing where organizations should go. It is critical to understand the significance of having the proper measures in place. Here are some general guides to measurement:
- Measures should be linked to key success factors. It is important to understand the key success factors of your innovation process, based on the special circumstances of your company, market, strategies and goals, strengths and weaknesses.
- Measures should start at the top and flow down the levels of the organization. Alignment of the measures at different levels of the organization is essential. It prevents sub-optimization and leads the whole organization in the same direction.
- Measures should provide a comprehensive picture. They should include input, process, and output metrics.
- Innovate your innovation measures. Measures should be updated as the environment and the innovation strategy change. They should be modified to reflect the organization’s experience with their use.
- Less is more. Because of the breadth of innovation activities, a small number of measures can’t always provide a comprehensive picture, but don’t fall into the trap of measuring the trivial, or measuring irrelevant and inappropriate factors.

VI. CONCLUSIONS

As the business environment has become more competitive, managing innovation function has become more critical for survival. To manage innovation effectively, it has to be measured. However, as many companies have discovered, measuring innovation is a very challenging task. Innovation is an elusive, dynamic and broad concept that is difficult to define, and therefore difficult to measure. Given the breadth of innovation activities, the use of a single metric, or a few, is insufficient and can be misleading. It is important that measurement to be comprehensive, measuring multiple activities and characteristics. It is recommended that companies use an innovation dashboard,
including a set of about eight to twelve metrics. The dashboard should include three categories of metrics: inputs, process, and outputs. Popular metrics that have proved effective, and their associated managerial insights, were presented in this paper. Of course, there is no standard set of metrics appropriate for all companies; rather the metrics should reflect the nature of the industry and the market, the company’s goals and strategies, and its approach to innovation, among other factors. It is a critical, yet challenging task that deserves attention.

VII. REFERENCES


