Proceedings of GLOGIFT 07
November 15-17, 2007
UP Technical University
Noida, pp. 606-610

MEASURING THE INNOVATION PROCESS

Ashish Soti*

ABSTRACT

The key of success of any organization is the management commitment, quality practices, process management and commited workforce. The application of quality system like ISO, TQM, CMM, Lean and Six Sigma have improved the productivity, reduced the cost and made workforce target oriented. But such quality movements are not going to be substatial as per latest studies coducted in various Nations. The need of implementation of Innovation is the key for success in present century.The major problem to implement innovation is to understand innovation as a process and further to measure the innovation. The paper dicusses various possible measures of innovation. It also disscusses how innovation can be taken as stepwise process using the theory of inventive problem solving. It further provides an idea about possible Input-Process-Output relation for innovation-process.The paper, will be useful not only for industrial professionals but also opens a new field for researchers.

Keywords: Innovation, Process, TRIZ

Innovation

The meaning of innovation is the act of introducing something new: something newly introduced (The American Heritage Dictionary). Krisztina Holly, Vice Provost, University of Southern California, and Executive Director of USC Stevens Institute for Innovation, innovation is the process of translating new ideas into tangible societal impact. Department of Trade and Industry, UK, explains innovation as the successful exploitation of new ideas. It is the change that creates a new dimension of performanc (Peter Drucker, Hesselbein, 2002). Innovation is also defined as a creative idea that is realized (Frans Johansson,Harvard Business School Press, 2004). It is “The capability of continuously realizing a desired future state” (John Kao, The Innovation Manifesto, 2005). It may also be termed as “The staging of value and/or the conservation of value.” (Daniel Montano, 2006).

Innovation can be in relation to technology, commerce, social systems, economic development, and policy construction. There are, a wide range of approaches to conceptualising innovation in the scholarly literature(Fagerberg et al. 2004, The Oxford Handbook of Innovation) From an organizational perspective (Luecke and Katz, 2003), “Innovation . . . is generally understood as the introduction of a new thing or method . . . Innovation is the embodiment, combination, or synthesis of knowledge in original, relevant, valued new products, processes, or services. (p. 2)”

* Assistant Professor, Department of Mechanical Engineering, RKG Institute of Technology, Ghaziabad

Innovation typically involves creativity, but is not identical to it, innovation involves acting on the creative ideas to make some specific and tangible difference. Amabile et al (1996) propose,"All innovation begins with creative ideas . . . We define innovation as the successful implementation of creative ideas within an organization. In this view, creativity by individuals and teams is a starting point for innovation; the first is necessary but not sufficient condition for the second"(p. 1154-1155).

A further characterization of innovation is as an organizational or management process. (Davila et al,2006), "Innovation, like many business functions, is a management process that requires specific tools, rules, and discipline." (p. 17)

The Organization for Economic Co-operation and Development (OECD), defines Technological Innovation in the Oslo Manual (1995) as, Technological product and process (TPP) '' == innovations comprise implemented technologically new products and processes and significant technological improvements in products and processes == == ==". A TPP innovation has been implemented if it has been introduced on the market (product innovation) or used within a production process (process innovation). TPP innovations involve a series of scientific, technological, organizational, financial and commercial activities. The TPP innovating firm is one that has implemented technologically new or significantly technologically improved products or processes during the period under review.

A 2005/6 MIT survey of innovation in technology found a number of characteristics common to innovators working in that field. 1) they are not troubled by the idea of failure, 2) they realise that failure can be learned from and that the 'failed' technology can later be re-used for other purposes, 3) they know innovation requires that one works in advanced areas where failure is a real possibility, 4) innovators are curious about what is happening in a myriad of disciplines, not only their own specialism, 5) innovators are open to third-party experiments with their products, 6) they recognise that a useful innovation must be "robust", flexible and adaptable, 7) innovators delight in spotting a need that we don't even know we harbor, and then fulfilling that need with a new innovation, and as such 8) innovators like to make products that are immediately useful to their first users.

As Davila et al (2006) note,"Companies cannot grow through cost reduction and reengineering alone . . . Innovation is the key element in providing aggressive top-line growth, and for increasing bottom-line results" (p.6)

It is not surprising, therefore, that companies such as General Electric and Procter & Gamble have embraced the management of innovation enthusiastically, with the primary goal of driving growth and, consequently, improving shareholder value.

Process Approach

An activity using resources, and managed in order to enable the transformation of input into output, can be considered as a process. Often the output from one process directly forms the input to the next process. The application of a system of processes within an organization, together with the identification and interactions of these processes,and their management, can be referred to as the process approach. The advantage of using process approach is that input and output can be measured and controlled to enhance process capability.

The key output measure of innovation is the success of the organization. The success indicators can be revenue growth, market share, productivity etc. Gow and Kells (1998) disscussed the profitability measure whereas Roger (1998) disscussed the productivity measures. ABS innovation survey used the estimate of percentage of sale accout for new

products, improved products and unchanged products to measure the innovation. The patent data as a part of intellectual property has been reviewed by Basberg (1987) and Griliches (1990). The performance as market value has been taken a measure by Hall(1993), whereas Klette (1996) has taken productivity as a measure.

Measurement of Innovation using TRIZ

To development of a measurement of innovation the primary requirement is to identify innovation as a systematic process. The theory of inventive problem solving 'TRIZ' can be used to make innovation a systmatic step by step process.

G. S. Altshuller screened over 200,000 patents looking for inventive problems and how they were solved. Altshuller more clearly defined an inventive problem as one in which the solution causes another problem to appear, such as increasing the strength of a metal plate causing its weight to get heavier. Usually, inventors must resort to a trade-off and compromise between the features and thus do not achieve an ideal solution. In his study of patents, Altshuller found that many described a solution that eliminated or resolved the contradiction and required no trade-off. Altshuller categorized these patents in a novel way. Instead of classifying them by industry, such as automotive, aerospace, etc., he removed the subject matter to uncover the problem solving process. He found that often the same problems had been solved over and over again using one of only forty fundamental inventive principles. If only later inventors had knowledge of the work of earlier ones, solutions could have been discovered more quickly and efficiently.

In the 1960s and 1970s, he categorized the solutions into five levels

- Level 1: Routine design problems solved by methods well known within the specialty. No invention needed. About 32% of the solutions fell into this level.
- Level 2: Minor improvements to an existing system, by methods known within the industry. Usually with some compromise. About 45% of the solutions fell into this level.
- Level 3: Fundamental improvement to an existing system, by methods known outside the industry. Contradictions resolved. About 18% of the solutions fell into this category.
- Level 4: A new generation that uses a new principle to perform the primary functions of the system. Solution found more in science than in technology. About 4% of the solutions fell into this category.
- Level 5: A rare scientific discovery or pioneering invention of essentially a new system. About 1% of the solutions fell into this category.

He also noted that with each succeeding level, the source of the solution required broader knowledge and more solutions to consider before an ideal one could be found. What Altshuller tabulated was that over 90% of the problems engineers faced had been solved somewhere before. If engineers could follow a path to an ideal solution, starting with the lowest level, their personal knowledge and experience, and working their way to higher levels, most of the solutions could be derived from knowledge already present in the company, industry, or in another industry. The stepwise TRIZ can be implemented as:

Step 1: Identifying My Problem

Boris Zlotin and Alla Z usman, principles TRIZ scientists at the American company Ideation and students of Altshuller have developed an "Innovative Situation Questionnaire" to identify the engineering system being studied, its operating environment, resource requirements, primary

useful function, harmful effects, and ideal result.

Step 2: Formulate the Problem

Restate the problem in terms of physical contradictions. Identify problems that could occur. Could improving one technical characteristic to solve a problem cause other technical characteristics to worsen, resulting in secondary problems arising? Are there technical conflicts that might force a trade-off?

Step 3: Search for Previously Well-Solved Problem

Altshuller extracted from over 1,500,000 world-wide patents these 39 standard technical characteristics that cause conflict. Find the contradicting engineering principles. First find the principle that needs to be changed. Then find the principle that is an undesirable secondary effect. State the standard technical conflict.

Step 4: Look for Analogous Solutions and Adapt to My Solution

Altshuller also extracted from the worldwide patents 40 inventive principles. These are hints that will help an engineer find a highly inventive and patentable solution to the problem. Examples from patents are also suggested with these 40 inventive principles. To find which inventive principles to use, Altshuller created the Table of Contradictions, The Table of Contradictions lists the 39 Engineering Parameters on the X-axis (undesired secondary effect)

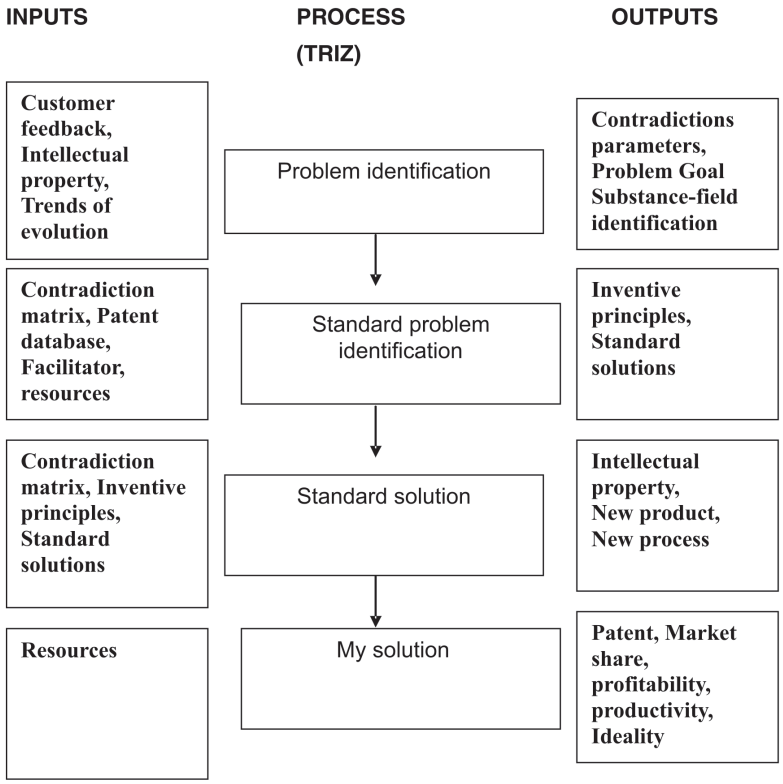

Figure 1: Input-Process-Output Diagram

and Y-axis (feature to improve). In the intersecting cells, are listed the appropriate Inventive Principles to use for a solution.

Identification of Input-Process-Output Diagram for TRIZ

The input-process-output for TRIZ process can be developed as shown in figure 1. The proposed input-process –output diagram can be converted into detailed Supplier-Input-Process-Output-Customer diagram for specific problem.

Disscussion and Conclusion

Individual and team-level assessment can be conducted by surveys and workshops. Business measures related to finances, processes, employees and customers in balanced scorecards can be viewed from innovation perspective (e.g. new product revenue, time to market, customer and employee perception & satisfaction). Organizational capabilities can be evaluated through various evaluation frameworks such as European foundation for quality management model.The OECD Oslo Manual from 1995 suggests standard guidelines on measuring technological product and process innovation. The new Oslo manual from 2005 takes a wider perspective to innovation, and includes also marketing and organizational innovation. Other ways of measuring innovation has traditionally been expenditure on R&D (Research and Development) as percentage of GNP (Gross National Product). But the use of triz process for innovation implmentaion and fixing innovation variables stepwise can improve the process capability of innovation process and significant results can be achieved.

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