

Managing Innovation – Integrating Technology, Market and Organizational Change

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"To be creative is to be courageous. Those who lack courage or fear solitude cannot be creative".

Introduction

Innovation and creativity have both been very important to the growth and development of technology. Both have always had a very close relationship with human beings. Creative thinking has been an important survival skill since the creation of mankind. It has helped man go beyond what worked in the past in every endeavour, and come up with new approaches. In recent times, there have been substantive changes in the global economy, which makes it absolutely essential for any nation to sharpen its technological competitiveness, which is a direct outcome of its innovative capability.

The scenario today is represented by phenomena like the enhanced frequency of innovations, shortening of techno-economic life cycles, rapid generation and commercialization of new technologies, globalization of transnationals, strategic alliancing of large firms, intensive R&D programs, difficulty in accessing critical technologies, large multi-country R&D projects, large countries being threatened by

newly industrialized countries and such others, in each of which the over-riding influence has been that of INNOVATION. In this scenario, the strategic management of technology, prompted by strategic innovation decisions, governs the wealth and prosperity of nations.

Perspectives pertaining to research and development (R&D), which is an important component of innovation management, have undergone a number of changes over the years. At first, R&D primarily referred to basic research, efforts were mostly scientific in nature and were directed around 'discovery of the unknown'. Some of these inventions and discoveries were further developed to satiate the needs and curiosity of mankind and this is how R&D became application oriented. Later, when industries began to be established, R&D had to be necessarily inducted into organizational structures. Slowly, innovation became part of industry and over a period of time, the separate domains of Science and Technology started merging. Today, activities related to R&D and innovation, need to have a prominent place in the management systems of companies, businesses and nations.

Broadly, innovation could be grouped into the following categories:

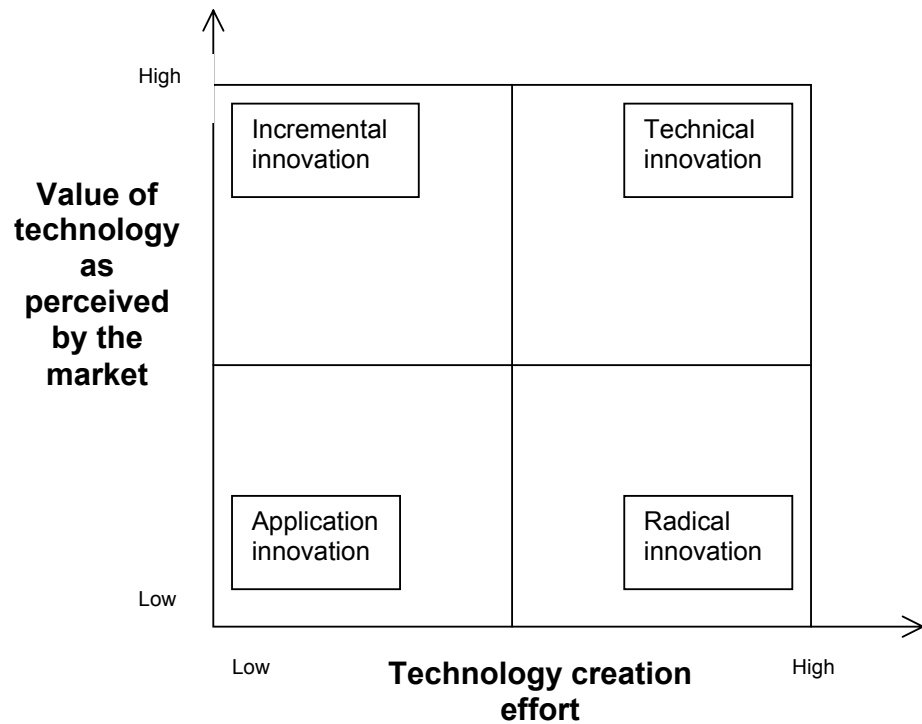
1. Product innovation
2. Technology innovation
3. Human innovation
4. Organizational innovation
5. Market innovation
6. Business innovation
7. Global innovation
8. Information systems innovation

The discussion that follows brings out some important aspects related to each the above

Product Innovation

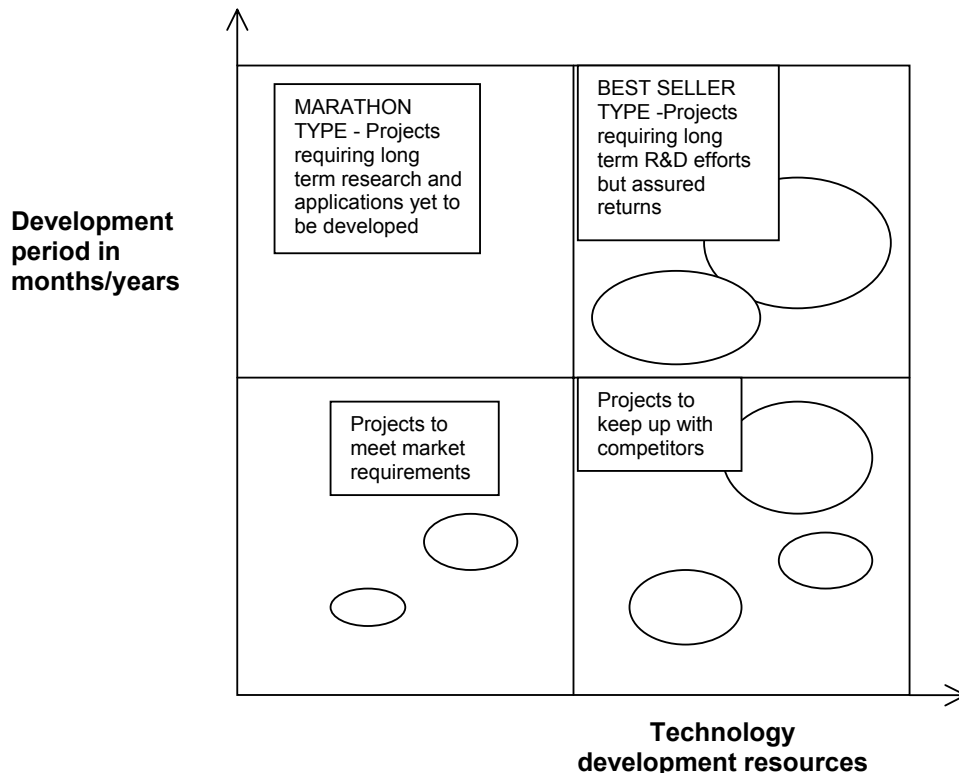
Technology developments that are oriented towards creation of products with higher performance, smaller size, lower price, better features, primarily fall under this category. Today, with the emphasis on environmental issues gaining ground, developments aimed at generation of products, which are environmentally friendly, efficient in terms of energy usage, which are safe to operate and which have larger links to social systems are becoming prominent. Product innovation can further be sub-divided into four categories:

- i) *Incremental innovation*: This refers to those efforts directed towards extending existing product concepts and is essential for strengthening the competitiveness of products. This form of innovation takes place continuously in any organization, has low risk and a high degree of certainty.
- ii) *Technical innovation*: Such innovation contributes less towards market creation, but leads to an entirely novel product based on developments in respect of existing technology. Such innovation should not be pursued relentlessly, merely for its own sake.



- iii) *Application innovation*: This is development of products guided by the customer's views. Both the Walkman and the Camcorder are examples of such innovation.

- iv) *Radical innovation*: This involves creation of both technology and market. It involves generation of new product concepts, convincing world markets and creation of new business concepts. Examples are the television, personal computer, VCR and such others. These are high-risk innovations involving long term R&D efforts.



In any organization, all these four forms of innovation, as shown in Fig.1 should ideally exist. The resources, in terms of personnel, time etc., should be allocated in each of these areas in accordance with the organizational strengths and weaknesses.

In order to aid one in the process a resource portfolio diagram, as depicted in Fig.2 is very useful. By plotting the man months required for product development versus the actual length of time for development and depicting circles in the ratio of the expected sales, one could identify those projects which would require considerable development efforts in response to competitive components.

Technology Innovation

Technology innovation can either be:

- i) 'evolutional' or
- ii) 'revolutional'.

It is said to be evolutional when the progress is continuous, there are significant changes in a short period of time and the efforts required towards technical innovation are considerable. The improvement in transmission loss by a factor of fifty, in 10 years, through low-transmission-loss-optical cables is an example of such innovation.

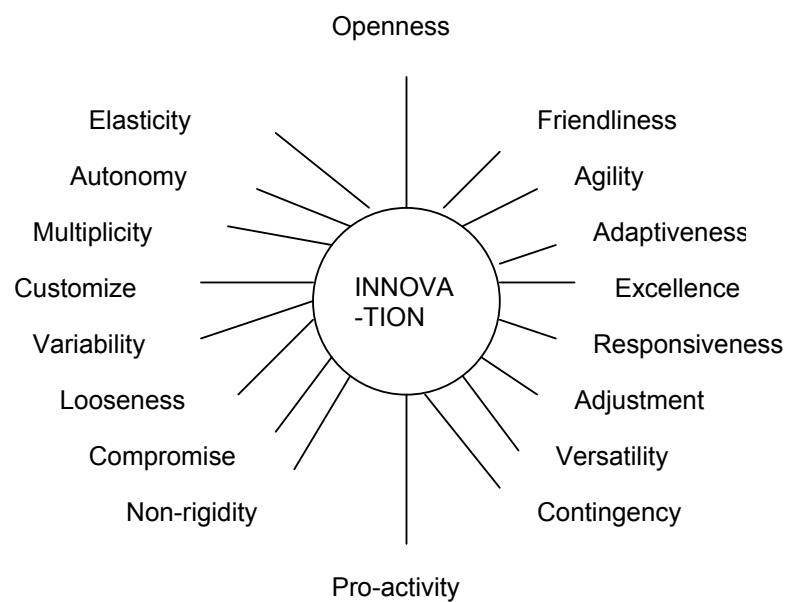
Evolutional limit pushing innovations can lead to either :

- i) explosive technology, in other words technology, which expands domains, (eg. Space research, deep-sea exploration, genetic manipulation), or
- ii) implosive technology, in other words technology which enriches domains (eg. microelectronics, composite materials, chemical analysis).

In contrast, revolutionary innovation is that where the technological progress is discontinuous. These generally remain as inventions or discoveries until their potential is unsheathed. These occur quite rarely, roughly once in fifty to hundred years, and these can completely change the foundation or structure of industry and society. The transistor, the practical application of nuclear energy and description of the structure of DNA are cited as the three such major inventive advances of this century.

Human Innovation

Innovative people should have diverse capabilities like the ability to view the technology both in terms of the market requirements as well as that of the shop floor or laboratory.



Innovation pre-supposes basic creative critical thinking skills. This is important as it enables one to express oneself cogently. Innovation in humans, therefore, calls for multifarious capabilities, some of which are shown in Fig.3.

Coming to innovation leaders: "What distinguishes leaders from laggards, and greatness from mediocrity, is the ability to uniquely imagine what could be". Innovation leaders, having foresight and intuitive capabilities, are indispensable for seeing through an innovation cycle from concept creation to success. In any innovation process, a leader needs to set appropriate milestones, monitor the progress, liaison with the top management for resources, cooperate actively in the actual development, give advice when necessary and offer constant encouragement.

Market Innovation:

In today's competitive situation, innovation in the marketplace is not solely dependent on inputs from any single source. There are many dangers if only a market-led product development approach would alone apply.

As shown in Fig.4, while identifying market strategies, an organization must identify whether it could place itself as a leader, niche player, challenger or follower in different categories of products depending upon the organizational strengths and vision.

One very important strategy to be adopted, is to ensure that adequate exchange of opinion and discussion takes place regarding product prices and distribution channels between R&D and Marketing units.

Q u a l i t a t i v e s t r a t e g i e s	Quantitative resources		
		Large	Small
H I G H		LEADER	NICHE PLAYER
		Omnidirectional strategies	Converging strategies
L O W		CHALLENGER	FOLLOWER
		Differentiating strategies	Limited strategies

It is preferable that products are developed by working together with customers to create goods that receive high acclaim or sympathy. An integrated marketing approach in which the manufacturer, buyer and seller function in a unified manner, is more beneficial compared to the conventional approach where the units operate independent of the others' view-points, as the user's role is not passive and the net creative capacity of such an integrated system is enhanced.

Organizational Innovation

The tacit and intangible knowledge present in each individual employee becomes the collective knowledge bank of an organization only if structured and managed effectively. Ideally, each should be a 'Learning Organization', where "people continually expand their capacity to create the results they truly desire, where new and expensive patterns of thinking are nurtured, where collective aspiration is set free and where people are continually learning how to learn together".

Ideally, an organization should provide for both "slack innovation" which takes place only when the need for innovation is created, and also for "distress innovation" which occurs in a crisis situation. Strategies like 'Kaizen', which propagates continuous improvement in all units in all areas of operation and 'continuous risk-taking' are interesting variations of measures aimed at creating such an environment. It is also essential for the top management to be closely involved in such measures to ensure that concerned personnel feel sufficiently motivated and resources deployed are effectively utilized. Top management also needs to identify a vision that each employee in the organization can identify oneself with.

In respect of internal organizational linkages to promote innovation, management styles need be introduced depending upon several factors like the size, history, culture, field of operation etc. Importantly, integration between the various functional departments whether they relate to technology, development or marketing; should be achieved.

Business Innovation

Businesses and industries are thought to follow a life cycle pattern that is similar to technology i.e. a 'S' curve pattern. A very important corollary is therefore derivable from this.

An organization must invest the income of existing businesses in new business development when the former is still growing steadily in its late growth period rather than be caught unawares in the mature period or beyond, when business is likely to become stagnant, or reduce, or even worse, peter down to an insignificant one. Also, in order to venture into any new area it would first of all be essential to be sure of the core technology or generic technology, so that related business areas come into scope easily, and existing resources can easily adapt to the new developments. This would also enable usage of the same marketing resources for both the existing as well as new business. For example, telecommunications equipment manufacturers are finding it difficult to penetrate the fax business, inspite of being fully conversant with the technology, whereas office equipment manufacturers are finding it relatively easy.

This is not to say that an organization must never diversify, or that core competence is so sacred that no new venture outside the scope of the existing business must be thought of. But, it is to caution any enterprise from making foolhardy ventures.

Selection of right personnel, providing appropriate leadership, use of the brand name and identification of idle assets are some of the important measures involved in the management of business innovation. Judicial use of acquisitions and joint ventures could be made, whenever beneficial.

National and Global Innovation:

For any nation, at the national level, innovation is important to the economy for several reasons, notably: improving national productivity, providing competitive edge in international trade, improving the quality of life, better utilization and conservation of natural resources, preservation of cultural and aesthetic values; among others.

A national R&D system is that infrastructure that generates technology and largely influences the directions of its use and safety. Government, research laboratories, industrial research laboratories, consultants and consulting organizations, universities and other research organizations, are all part of this system. Each nation structures its national research system, which includes a mix of developmental research, basic and applied research, and cooperative research; differently; depending upon its culture, philosophy and form of governance. What is important is that a proper relationship between industry, the national research laboratories, academic institutions and the Government is fostered as it is essential for improving the long term technological capability of the nation.

The concept of globalization has meant many things, and very importantly, the creation of multinationals, resulting in management perspectives having to extend beyond national boundaries. This concept has to be clearly understood. It has many more dimensions and complexities of many orders than merely advancing overseas. It is a perspective in which fairness, freedom and ethics become the foundation for deals in technology. Corporate linkage strategies, a mutual understanding of different cultures, the individual implications of bringing together two alien systems of working, sharing of resources and profits for a common good and others are an indispensable part of globalization.

Information Systems Innovation

A new social and economic infrastructure has now been established through the establishment of internet and such new information and communication networks. The tangible effects are mainly economies of speed through real time inventory and production databases resulting in reduced lead times for order and delivery, economies of scope enabling increased linkages with customers, increase in capability of product handling and capability of providing product and service information.

Electronic Commerce, Strategic Information Systems, Computer Integrated Approach, increasing use of computers in research in diverse areas ranging from the design of organic and inorganic compounds; alloy and pharmaceutical design; molecular design of agricultural chemicals, dyes and polymers; to the analysis design of proteins and catalyst design and such trends are becoming the order of the

day. It is clear even now that the computer is going to be an indispensable tool for all businesses.

In this context, it is important that companies restructure themselves and utilize advanced information systems extensively for promoting innovation effectively.