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Technological Innovation And Its Management

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ABSTRACT

The paper highlights case history of technological innovation created by a private company. The study reveals how the innovation was conceived, developed and marketed. The various stages of innovation involve management of technology, design, prototype, market, demand; investment, competition and profitability. A product was developed for an actual user — a large telecommunication company operating at all India level. The case history reveals how innovation resulted into inception of an entrepreneurial company, providing rapid growth in terms of resources. The paper also highlights details from development to successful launching of the innovative product. The paper discusses the economics, turnover, and management of innovation, personnel, product life cycle, business management and finally the conclusion about the case history of the innovation. Innovations also in many cases enhance the national resources by import substitute; thereby it saves foreign exchange, generates employment and provides secured future. New product development is necessary for establishing a new industry in a short time, say a year. The case history discussed here confirms this that if the innovation is managed well it can cause phenomenal growth of an enterprise into an organization.

Keywords: Technological Innovation, Management, R & D, Business Development.

Managerial Relevance Statement

The case history of the innovation discussed in the research paper provides several inferences and guidelines to practicing technocrats and managers in proceeding with new innovation of this category. Apart from technological aspects of the development of a new product, the management process in launching the new technological product is also discussed in detail.

How to select a product or process for a sure success? It has been identified from the case history of the MRPC Company that the following factors influence the success of a technological innovation and its management:
(1) Originality (2) Salability (3) Demand (4) Market scope (5) Acceptability by the user (6) User motivation (7) Publicity, demonstration and user training (8) Availability of components (9) Investments and adequate returns (10) Growth offered by the innovation (11) Reaching the buyer

The above factors are recommended to practicing engineers to incorporate for achieving profits, economy and efficiency.

1. INTRODUCTION

Technological innovations are of two categories:
1. Mass utility technical products like, Windows Software, Computers, Mobiles, several other types of products that are used by electronics industry in their manufacturing process like IC's (Integrated Circuits) and testing instruments.
2. Specialized technological products which have specific purpose and users such as: (a) Testing instruments used by Defense, Railways, Tele-communication and other industries.
(b) Products and machines used by engineering institutions for teaching and training.

The total process of innovation, entrepreneurship, management& marketing are different depending upon the category of product developed. This limits generalization of the process of innovation. Innovations can make radical changes in certain categories as it can make an existing product totally redundant and force the closure of such industries which have thrived on limited product line like the Typewriter manufacturers.

The author Andrew H. Van de Ven [1986] concludes in his paper that creative idea does not become innovation until it is implemented and earns profits. He highlights here basic problems confronting the management:
(1) Human problem of receiving attention from all the members of the company. (2) The process in managing new ideas in to good returns
(3) Institutional leadership Innovations have always been essential for a firm's long-term survival and growth. Santos-Vijande and Álvarez-González (2007) concludes that "innovations play a role in the firms' future and, further, by adapting to radical technological changes. The management of technological innovation is one of the most demanding challenges today Dodgson et. al. (2008).
These authors propose a model of technological innovation capabilities and investigate in detail the potential differential impact of a technological innovation. They contribute to the recent pool of knowledge, the theory about firms' dynamic capabilities, and introduce technological innovation capability as one of the important dynamic capabilities that represents the dominant criteria of competitive advantage. They have presented combinations of capabilities and resources that can be developed, deployed and protected to sustain competitive advantage through technological innovations. The paper outlines evidence from a case study that was conducted in 2012.
Literature review on dynamic capabilities Baretto, (2010) reflects on a promising approach creates confusion that might hinder any more effective progress within the field. Danneels (2008) and Ambrosini and Bowman (2009) indicate the fine-grained case studies of firms is needed which have been able to sustain a competitive advantage over time in dynamic environments.

The dynamic capabilities view has emerged as an attempt to untangle the complex problem of sustainable competitive advantage in today's dynamic environment, Eisenhardt & Martin (2000); Teece et. al.,(1997). The underlying assumption is that firms which are able to sense and seize new opportunities, and further, reconfigure their resources in line with recognized opportunities and change can create and sustain competitive advantage Teece (2009). Smith and Prieto (2008) argue that the premise of most dynamic capabilities research is that firms must use and renew their tangible and intangible resources and capabilities to achieve and sustain.

Cepeda and Vera (2007) consider that knowledge management processes lie behind the development and use of dynamic capabilities. Lopez (2005) comments that the knowledge-based view and the resource-based view as strategic management approaches are still essentially static in nature. In sum, knowledge equals a resource hence it should be transformed into a capability, Shih-Chia et. al. (2007).
Dynamic capabilities arise from learning mechanisms of knowledge and experience accumulation processes, Zollo & Winter (2002). In line with that, dynamic capabilities could be the real sources of sustained competitive advantage in competitive world.

Rothaermel and Hess (2007) maintain that dynamic capabilities facilitate the ability of an organization to recognize potential technological shift, and also its ability to adapt to change through innovation. Innovation requires a search for new information outside the existing knowledge in the areas unrelated to existing operations.
Since innovation play a key role in survival and growth, developing an innovation is one of the important strategies, Camison & Villar-Lopez (2012; Francis & Bessant (2005).
Innovation studies have developed rapidly in recent years. The ability to continuously generate innovations capabilities in today's business for good currency, Elonnen et. al. (2009). Firms wanting to sustain their competitive position have to develop technology innovation. Firms need to upgrade innovation capability for developing and commercializing new technologies to sustain a competitive position, Wang et. al. (2008).

Burgelman et. al. (2004) defines technological innovation capability (TIC) as comprehensive

characteristics that facilitate and support an innovation strategy (Wang et al., 2008). An innovation strategy is the basis for the firm's overall strategy (Dodgson et al. 2008). It further represents the link between customers' needs satisfied by a firm's products. Establishing such a link motivates technological innovation Pratali (2003); technological innovation capability, the resources of technology, inspiration and experiences, Karagouni & Papadopoulos (2007). However generating technological innovation is one aspect in business success Teece (2010). Indeed, only firms which are able to deploy their resources and capabilities upon the dynamic capabilities framework can create and sustain a competitive advantage, Teece (2009).

2. CASE HISTORY

The case history here is a technological innovations created by The MRPC Company located at Hyderabad, India which was studied with their concurrence. The company took on innovation as its starting point. The innovation of the company during the period 1990 to 2010 was selected for this study. Cable Fault Locator (see photo 1)

This product is the original creation of The MRPC Company. There is a need for cable maintenance in organizations that have extensive cabling like Department of Telecommunications who have several hundred kilometers of underground network of telecom cables in every city. And their cables are also running intercity. The other major establishments using underground cables are electricity utility industries, railways, production industries and defense. In fact, there are no industries without some kind of cable network.

During the 1990's The Department of Telecommunications (DOT), Kolkata Telephones approached Dr. Anand Khare, then Professor at Indian Institute of Science IISc. Bangalore regarding the solution for their major problem of cable faults.

They were using paper insulated cables and each cable contained about 500 to 1000 Cable pairs. During the rainy season, water seeped into their cable through imperfect joints or pin- holes or cuts during unauthorized digging of the road causing damage to underground cable resulting in the breakdown of many of their cables in different locations thus interrupting communication system within and outside Kolkata. The Kolkata telephones had no suitable instruments to locate these complicated faults quickly and accurately hence the faults lingered causing anguish to public. There were no mobiles at that time.
Here the motivation for the innovation and a large market was assured. A product had to be innovated to suit the client requirement.

2.1. THE INNOVATIION

Dr. Anand Khare in his R&D workshop worked on the formulae and design for a suitable Cable Fault Locator. A product was innovated finally taking into consideration the problems of the DOT cabling that had break, short low insulation and unstable faults with foreign potential induced from the working pairs that deteriorated rapidly. In the rainy season the instrument that was developed could locate all types of faults in Telecom cables with different types of insulation, that is paper, plastic and jelly—accurately and efficiently.

2.2. THE DESIGN

The instrument developed was robust, battery operated, portable and light weight that could be connected to the faulty cable at any point either at the Telephone Exchange or the Junction Cabinet in the field. The instrument based on digital technology using microprocessor software with memory chip stored the data in the memory and made calculations according to the formulae fed in its memory and displayed the distance to fault in meters. Thus the instrument became automatic and the results given by it were accurate. Single switch operation of the instrument made it user friendly and little training only was required. This low cost instrument that could locate all types of cable faults e.g. short, earth and low insulation faults that were encountered in their underground cables was proved a boon to the Telecom Company.

2.3 PROTOTYPES

Several prototypes were prepared and sent for testing at various locations of Department of Telecommunications(DOT) that is Delhi, Bombay, Kolkata, Chennai etc for testing under different condition of field, gauge, length and all types of cables.

2.4 MARKET AND FEEDBACK

The user feedback was excellent and immediate orders were generated for quantities from all the test sites of the Telecom Company that had used the prototype. More prototypes were prepared and sent to other cities.

2.5 LAUNCHING THE INNOVATION

The demand was rapid with a promise for a long term future and the inventor incepted a company – The MRPC Company to take up the manufacture and distribution of this miracle product and called it the **Master Cable Fault Locator**. Technical literature for the user, and all India circulars to promote the sales were sent out. Good number of fresh graduate Engineers with electrical and electronics degree were appointed in the company and trained for production, marketing, planning and r & d.

The MRPC Company with head office at Hyderabad AP India opened branches in major cities like Bombay, Delhi, Kolkata, Ahmadabad, Chennai and Bangalore. Engineers were appointed at these branches under a branch head. Number of vacancies started to grow every month. Within two years the company strength swelled up to 150 graduate engineers.

2.6 DEMAND & COMPETITION

The demand of the product grew rapidly as there was a requirement and necessity for the users to solve the field problem of cable fault localization. At this point of time there was no competition in the market therefore the company enjoyed a monopolistic market condition. As we all know under this condition the seller is a price maker and good margins of profits resulted into a growth of the effective infrastructure.

The product also showed up scope of market in other departments like railways, defence and industries who had abundance of underground cable network for power transmission and this further increased the scope and enhanced the market.

2.7 ADDITION OF A NEW PRODUCT

Cable Route Tracer (Photo 2) apart from localizing faults in the underground cables the users faced another problem of finding the route of their underground cables. The MRPC Company quickly developed a reliable and accurate Cable Route Tracer comprising a Transmitter and Remote Receiver. For tracing the cable route the Transmitter was connected at one end of the cable and the Receiver picked up the signal above the ground. The transmitter injected music signal into the cable to avoid any difficulty in identifying the signal and therefore the cable route could be traced easily and accurately. The demand for this product grew in parallel to that of the Master Cable Fault Locator and users now ordered both the products. Thus the turnover doubled.

3. ECONOMICS, TURNOVER & PROFIT

The company chose to divide the turnover in the following ratios:

Turnover = 1.00
Salary = 0.15 (salary, commissions, bonus)
Production = 0.35 (purchase of raw material)
Tours = 0.15 (for demos, sale promotion, training and delivery)
R & D = 0.05 (tools machines, purchase, towards quality improvement)
Stocks = 0.05 (raw material, finished and semi finished material)
Sales Tax = 0.04 (or .02 with form C or D for outsides state sales)
IT = 0.06 (depending on the profits)
Profits = 0.10 (approx)
Loan Int. = 0.05 (taken from bank for land and building)

4. THE MANAGEMENT OF INNOVATIONS: R&D AND PERSONNEL

The Proprietor of MRPC Company, Dr. Anand Khare's background of teaching and research in engineering at the university and multidisciplinary interests helped in providing efficient and economic management to the company and well planned training to the teams working in manufacturing, marketing and r & d divisions of the company.

As a technological innovation requires an R & D team and an environment capable of a successful innovation which means the R & D team must have interdisciplinary interests and knowledge and have research interest to be capable of innovating a technological item with a commercial value.

5. BUSINESS MANAGEMENT

The success of the technological innovation is due to the factors listed below:

1. The background of innovator in technology and management of Innovation.

2. Non requirement of high investment but rotation of profit as re-investment.
3. Local availability of manpower.
4. Focused market with high demand.
5. No competitive product.
6. Attractive package of "after sale services" of the company which included:

i) Replacement of defective piece by new during warrantee period. (ii) Long warrantee period. (iii) Discounts for quantity purchase. (iv) Delivery and training at the user's premises (v) No advance payment. (vi) Rates kept constant for 2 years. (vii) Rates approved through tendering (viii) Performance reports from the users compiled and circulated to buyers to give confidence in the product. (ix) Book published on the subject to enhance user's knowledge about the equipment and cable related problems. (x) Providing training in the usage and maintenance of the equipment. (xi) Extensive branch network all over India to provide quick service. (xii) Staff training, sale related incentives to engineers, travel allowances, quick promotions, and resolution of their difficulties. (xiii) Planned production and quality check. (xiv) Continuous feedback and improvement as per the user requirement. (xv) Assistance in field work by localizing the existing faults in their cables. (xvi) 24x7 Call Centre Services. (xvii) Quick delivery from ready stock.

6. PRODUCT LIFE CYCLE AND DIVERSIFICATION:

Every technological innovation has a life and a peak market span after which the market slopes down or it becomes obsolete, because of market saturation, competition, new product inventions etc hence it is necessary to search for new ideas before the company collapses. In recent years MRPC has taken up another innovation called AC Network Analyzer. This is designed for electrical engineering department as a teaching aid for engineering colleges. This is an original design and no similar product exists. This innovation is going through the process of "Management of a Technology Innovation" discussed in this paper. Prototypes have been sent out and demand is growing. This is high value product as compared to the Master Cable Fault Locator. With engineering education gaining importance globally, the innovations in the field of teaching laboratory are in demand.

7. CONCLUSIONS:

With the right kind of innovation a new industry can be set up with phenomenal growth. The management of a technological innovation for quick & high growth needs team work of technical people trained in different areas to suit the innovation. Here, a management that understands the personnel, trusts them and helps in ways to meet their emotional, financial needs like promotion, motivation, job satisfaction, incentives and above all a friendly environment contribute in achieving the targets. Innovations in many cases enhance the national resources by import substitute, thereby save foreign exchange, generate employment and provide secured future. The efforts involved in any innovation are enormous, therefore evaluating the objective and scope of an innovative idea becomes important.

Not only innovation requires interdisciplinary technological efforts but also management of commercial aspects apart from financial investments and study of risk factors as all innovations do not succeed either technologically or commercially.

Conception of an Innovation is a miracle boost to an industry. A single innovation is capable of establishing a new industry in the shortest time, say a year. The case history discussed here confirms that if the innovation is managed well it can cause phenomenal growth of an organization. Of course there are several difficulties in creating an innovation. There are tough problems to be solved but it is worth it in the end. The development of the innovation of Master Cable Fault Locator of the case history needed to overcome several technical and commercial difficulties. In this case, the types of fault in the cables comprised: low insulation with or without the foreign potential, short, earth faults, break faults in different length and cross sections of the faulty cable. A new technique had to be worked out and was finally achieved. 1. The technique of potential distribution was perfected for locating the low insulation faults. 2. For break faults method of capacitance charge and discharge was developed.

AUTHOR

Ramleela Khare graduated from Osmania University, Hyderabad, India in the subjects of computers and IT in 2008 and he subsequently joined The MRPC Company. He conducted seminars at universities on the topic of

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1. Ramleela Khare, Filipe Rodrigues E Melo (2012), "Economic and Efficient Management of Transmission and Control of Electrical Power Design of a SCADA Power System Monitor" *Sinhgad International Business Review, Vol. - V, Issue - II, January 2012 - June 2012.*
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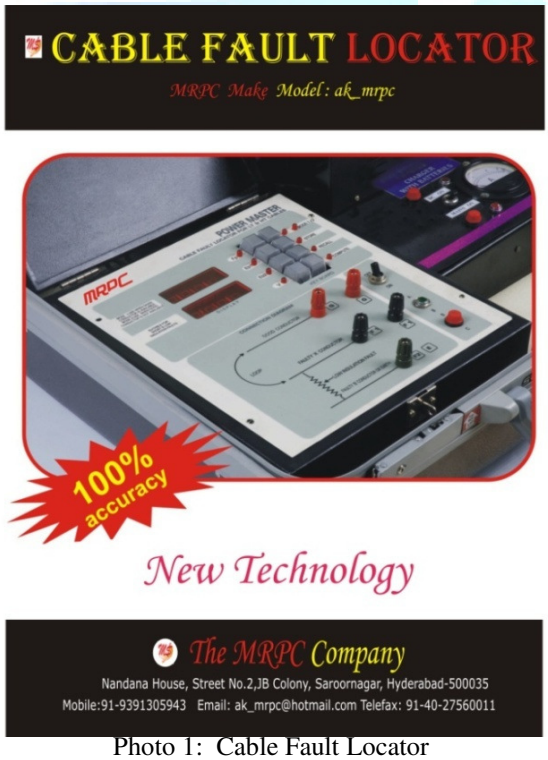

Photo 1: Cable Fault Locator

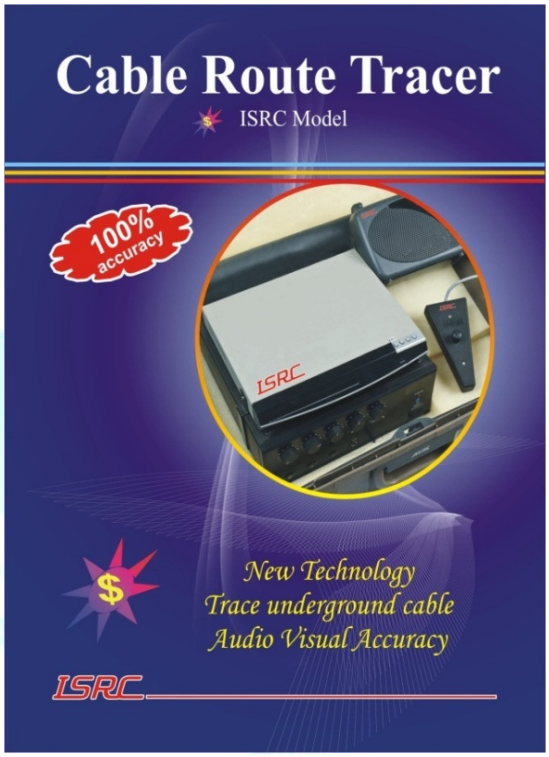

Photo 2 Cable Route Tracer