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REVIEW PAPER ON TECHNOLOGICAL INNOVATION MANAGEMENT

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ABSTRACT

Innovation and technology management is an inevitable issue in the high end technological and innovative organizations. In order to lead in the market, organizations continuously focus on the innovative product development. For developing the product, innovations play a crucial role in any organization in order to grow business faster, increase productivity and that helps to any organization to lead in global market. In the current situation, every organization tries to implement technology at workplaces to give better path to innovation that helps to any organization to beat their competitors. The technological innovation directly affects the business of any organization that's why effective management of innovation and technology is very important within the business. Effective management can help to any organization to sustain leading position in the market. This review provides an overview of innovation in business focusing on innovation types based on different parameters, technological innovation in the digital business environment, barriers, and management of technological innovation.

1. Introduction

The importance of research in the fields of technology management, innovation and change is of high significance in a competitive global environment, with

constant and rapid technological growth and development. Technology and innovation are the two main factors that helps to businesses to achieve global competitiveness in the market. Why is management of technological innovation so important? The importance of technology management lies in: (i) the high rate of changes in technology that involve multidisciplinary approaches; (ii) quick technological advancement that reduced the life cycle of the product; (iii) the need to minimize time for product creation and make companies more agile; (iv) the need to make good use of emerging technology to optimize competition; (v) the value of changing management tools triggered by rapid changes in technology [1]. The policy and strategy built for businesses, markets, national economies, regions, sectors, etc. focuses on technology and innovation.

Technological innovation for manufacturing companies is the most critical type of innovation as it can increase efficiency, overcome problems and deliver added value. [2]. The change in products, services and production processes are attributed to technical advances, but while perhaps the most obvious form of innovation is the charming one, not every organization is able to innovate technologically [3]. The review examines how technological innovation in digital business environments is managed. The following sections will include an overview of technological innovation, the digital business paradigm, its challenges, approaches and best practices in the business world to achieve technological innovation.

2. Overview of Technological Innovation:

Innovation is about incorporating new concepts through their incorporation into services and goods. Innovation is the way new concepts are implemented, and design makes these innovations are functional. The world of work is revolutionized by emerging technology. They are already now an integral part of organizations, guiding the development of the two most increasingly influential emerging powers in the world's cyber- and computer-based sector. Such technical advances, in effect, bring enormous new improvements for organizations and workers. An organization must adopt a technology or process to enhance the performance of any organization in terms of productivity or to hold a position in the market. The underlying purpose of implementing a new technology or method is usually the intended contribution to the success or output of the implementation organization [4]. The economic role of emerging technologies in production and consumption is technological innovation. This includes understanding the latest technical opportunities, coordinating and supporting the necessary human and financial capital to turn them in practical products and processes. This is critical because technological innovation has been essential in dramatically raising living standards [5]. Innovation includes innovation in products and processes, while non-technological innovation involves marketing and organizational innovation [6]. This segment offers an insight into the issues associated with the management of technical advances within digital businesses by professionals, managers and scholars. An analysis

of the six common developments based on the method adopted and the business functions they involve is given in the following section of this chapter.

3. Types of Innovation

Types of innovation can usually be categorized in different groups but two of the most widely used are based on the innovation methodology and second one is innovation based on the function.

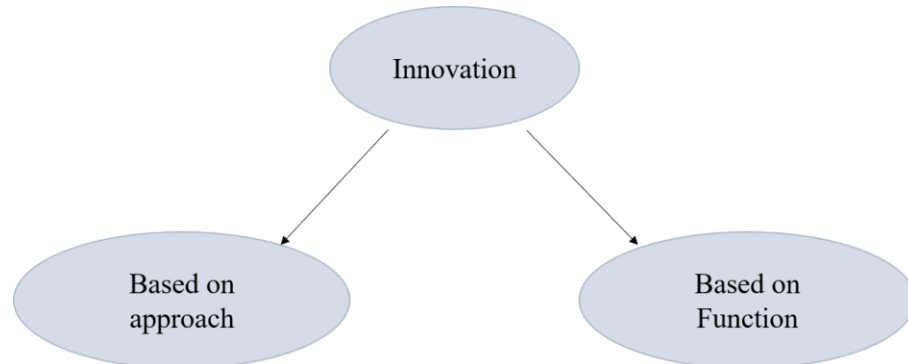


Figure 1: Types of Technological Innovation in any Organization for Business Growth

3.1. Innovation Based On Approach

Proactive and reactive innovation are the most common innovation categories in this category.

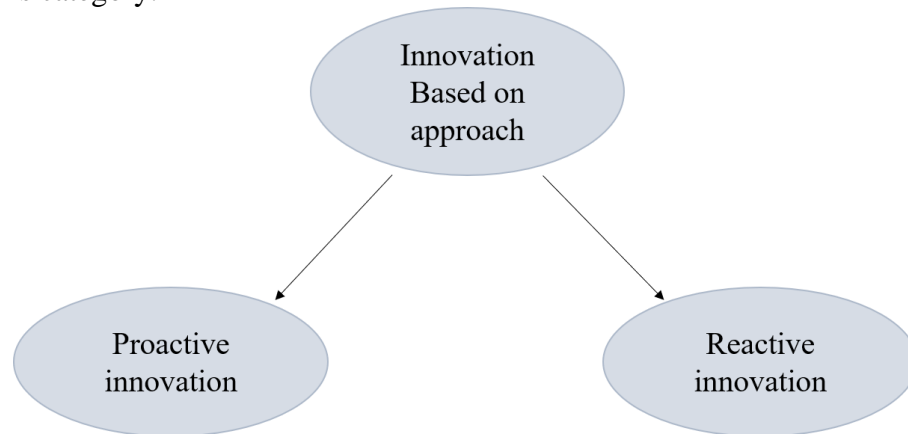


Figure 2: Types of Innovation Based on Approach

3.1.1. Proactive Innovation

Companies focused on the innovative product development that helps to any organization to lead in the market. They have access to information and take major bets/high risks from a number of sources. Proactive creativity is also about discovering new ideas and promoting them. Proactive innovation means that the firm identifies new opportunities and challenges constantly and uses the ideas created for developing new products and services that are focused on these challenges[7]. In order to innovate, organizations must analyze and find out the problem or challenges related to current product and then develop brainstorm or other approach to come forward with innovative ideas that are based on these known challenges. It's important to build a team context and

concentrate on their thoughts as they start to innovate. The context makes to understand what kind of ideas firms require, draws simple guidelines to help to meet, evaluate, and shows how ideas are used-to prove their interest. Active early quest for ideas is also evidence of our contribution to the cycle of innovation[8].

3.1.2. Reactive Innovation

Not all businesses have the requisite capacity to become market leaders and implement innovative technical innovations on the market regularly. However, it is critical that these firms respond to innovations implemented by other companies, usually competitors, and develop their own innovation strategy to effectively compete against competitors and ensure sustainable market share. Reactive innovation is a strategy which ensures the company's survival and which reacts to competitors' innovations. Thus, reactive innovation is an immediate response to an outside occurrence or transition, usually unplanned and can be conservative or progressive [9]. Reactive innovations can help businesses that hold poor position in market to obtain and sustain competitive advantages over their competitors. Reactive innovation is directly related to the brand launch by competitors. Although proactive innovation more aligned with a strong consumer focus, reactive innovation calls for comprehensive competitive focus[10].

3.2. Innovation Based On Functions

There are four types of innovations under functionality category as shown in the figure 3

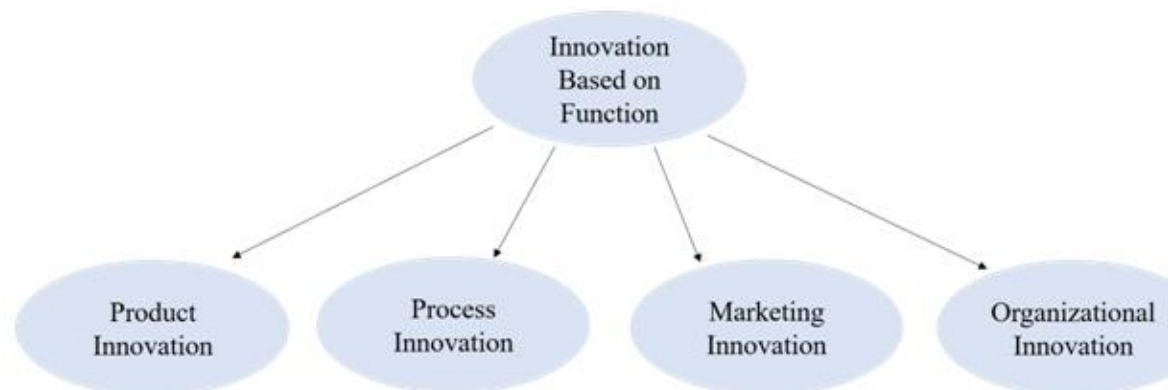


Figure 3: Types of Innovation Based on Function

3.2.1. Product Innovation

The standard view of product innovation is a method for companies to refresh their product portfolios. Product innovation not only allows businesses to sell new goods, but also encourages organizations to develop their technologies[11]. Innovative products are the introduction of new products, improvement in product design or the use of modern technologies and equipment in traditional manufacturing methods. In other words, the product is based on the existing consumer markets and differentiates by functionality and functions not present in current products. However, on the internal side of product innovation it depends on the expertise, ability, capital, and technology

used in the business and on customer needs and the owner's expectations. The external side of product innovation it focuses on[12].

The introduction of a consumer product into the market that uses various technologies is technical product innovation[13]. The organizational performance can be improved by introducing new innovative product in the market that will help to give benefits to the customer as a result organization can sustain their markets shares. However, product innovation is more external and calls for more organizational activities to build awareness[14].

3.2.2. Process Innovation

Today, the dynamic manufacturing industrial sector encourages product innovation. A new product that effectively make businesses in their market. However, market competitor may manufacture similar goods at a lower cost as a result producer encourages to pursue more competitive advantages in terms of revenue generation. A way to gain a competitive advantage is to devise a production plan for sustainability, which improves the product outcome. It also focuses on new process technologies that can defend against imitators[15]. When businesses explore new and unknown technology options for the production methods that will offer competitive advantages, precision in comparing these technologies is difficult because of limitations in their specification of the process[16].

Furthermore, the introduction of emerging technologies depends on how well emerging systems and procedures are in accordance with current system capabilities. In order to attract customers, employee awareness required for production firms is enabled by the successful introduction of new technologies and processes often called creative processes. In addition, newly-developed production goods are made, improvements in productivity have been achieved, time is reduced and strong competitive barriers have been established, resulting in increased market share[17].

Process innovation is a necessity for a production plant to achieve profitability. Process innovation is characterized as the process of technical and organizational change that involves the improvement of the production processes of a business. Process advancement involves improvements in both organization and technology and is a significant source of improved efficiency in a business. It can also enable businesses to achieve a competitive edge and to promote equipment deployment, new management strategies and improvements to production processes. The ability to obtain, assimilate, transform and use technologically linked tools, processes, and information for process innovation purposes is the capacity for improvement in a company's operation. Despite the advantages of incorporating process innovations in a production system, work has quickly recognized the difficulties of uncertainties that affect the characterization and efficiency of a production system.[18].

3.2.3. Marketing Innovation

The capacity of the organization to retain competitive advantage is a key component of marketing innovation skills. Marketing innovation is very important for many types of innovation, especially for product innovation, where marketing innovations almost always include major changes in product

structures, packaging , product delivery, promotional goods and price creation.[19]. Marketing innovation introduces product usage details to the product development process , which helps the product development process to work better from the stage of the concept to all other stages of production[20]. Innovation in marketing builds on the idea that compliance alone with the latest marketing rules is not enough in crowded markets to ensure sustainability and profitability. Innovation in marketing is based on creative thinking that is playful, boundless and provocative[21].

3.2.4. Organizational Innovation

Innovation plans need to be organized through the whole enterprise. Without a creative culture and leadership, no innovation policy can be applied. Organizational creativity is also another important factor that influences the success of creativity. The process of adoption, adaptation, acceptance, systematization and fusion must move through the organizational innovation before any outcome is seen. Organizational innovation can be called to adopt processes and techniques, including research, development and implementation of new technologies and conduct which is important in order to promote the promotion of new product innovations[22]. In order to promote innovation, organizational changes must have a strong organizational sense of mission and faith. This involves innovative organizational tools and skills, while teamwork and cross-sectional collaboration must be valued, their tasks performed, creative ideas and resources exchanged, and suggestions can be made available and involved. All these contact, sharing, views and attitudes are important elements for consensus building[23].

Organizational innovation is defined as an effective capacity of an organization to introduce, execute regularly technological and functional technologies with more integrated creativity than its key competitors[24]. It is therefore fair to say that 'organizational innovation' must take up and implement the other three forms, goods, processes and marketing strategy, of technologies that have been addressed.

4. Technological Innovation in The Digital Business Environment:

As companies and their way of working shift from their conventional operating mode to new and technology-oriented operating modes, transformations are known as digital transformation or disruption. Digital transformation has become important for any single, small, medium-sized company because change is the only constant. Different digital technologies become a significant element of the growth in any of the sector such as automation, distribution, apps, retail or medical. To provide consumers and workers with good digital business experience, a new creative business technology must be used. In today's world, in order to lead in the market companies must have to produce innovative custom applications. The aim of digital transformation is to reduce operating costs and improve customer experience. The digital transformation is about a shift in the mindset and corporate culture, not only adopting the latest technologies. Organizations need to tackle shifts in market conditions, complex business demands and creative ways to meet these evolving needs quickly[25].

In order to achieve business objectives, digital technology is becoming more and more relevant and its ultimate effects have contributed to the drastic transformation of the entire industry. The digitalization process has intensified the trend toward more comprehensive commoditization and has impacts on all facets of art, culture, industry and society, and has become a significant factor in the design, development and distribution of goods. Digitalization is constantly growing and more future benefits to global business have brought new possibilities and consequences for innovation that are so important as the original industrial revolution[26].

Innovations in technology lead to changes in systems. The business cycle is moving away from conventional processes to new technologies like a cloud. Big knowledge, IoT etc. Such and other advances in these developments are then implemented and appreciated around the business. It adds value to the market, speeds, lowers effort and costs and produces better performance[13].

4.1. Management of Technological Innovation

The way goods and services are organized and designed has changed drastically in digital innovation and this generates new value development that tends to contribute to more customer loyalty and company income. Digital innovation includes complex groups of players in the corporate world and in the overall market climate. As organizations are becoming more digital, with different priorities and resources, created a new wave of innovation and, more generally, transformed whole sectors[27]. Companies also face problems related to efficient digital innovation management. Efficient management of innovation helps businesses to concentrate on profitability and good results.

The nature of digital innovation processes and different stakeholders made the management of innovation processes in an enterprise a real challenge for managers and a problem that must be solved in some way. Innovation skills are a series of methods used by organizations to evaluate innovation, for example, approved innovations, in order to develop benchmarks to assess progress in various phases of innovation projects. Processes of innovation are an structured and regulated sequence of work, in which inputs are transformed into outputs through innovation[28].

Digital innovation is more difficult to handle in companies that developing technologically innovative goods. The introduction and use of more digital technology in production facilities of companies enables new ways of interaction and communication, which increase their interactive complexity. Managers within organizations, who are responsible for the use of emerging technology and the need to develop effective innovation strategies and implement them in the right way, require a range of leadership skills. Business lead times are shorter and companies have to quickly handle digital technologies where innovative systems and performance improvement across the entire enterprise can be handled. In modern digital pro-managing technologies for digital business environments, businesses are required, given the longer period of time needed for designing certain parts or goods that may be of benefit in the future, to provide products and services within conventional

schedules. The modern digital technologies and processes suggest substantial business-to-company changes[29].

4.2. Managing Innovation and Technology in Developing Countries

Today, most of the advances in the field of innovation & technology management remain confined to developed countries such as USA, Japan and Europe. However, it is also becoming a problem in developed countries for fast progress and growth. Developing country innovation and technology are of course problematic, marked by weak business models, political instability and the conditions of governance, poor level of education and a shortage of world-class academic universities and underdeveloped and inadequate physical infrastructure, as well as a lack of effective human resources.

4.2.1. Issues and challenges in developing countries:

In the developmental companies, the phase of innovation and technology management are emerging. Developing countries' innovation and technical climate is by default poor business model, government conditions, low levels of education, weak technological management and poor infrastructure conditions. Enterprises in developing countries often do not have an accurate understanding or information about the technology needed[30]. Often businesses were unable to establish their local technology infrastructure and environment for the assimilation of import technology because of unavailability of technical managers.

In order to deal with any form of technological tool and equipment, manufacture or selection of any suitable technology, at least basic training is necessary. In this respect continued development of human capital will play an important role. Developing countries have very low levels of education[31]. It also poses a major obstacle to innovation and technology management and growth. Indeed, a clear link between education needs and the different phases of industrialization can be created. At the pre-productive point, education needs require only basic literacy while more technological and specialized skills are required in the post-industrial period. Of course, one of the solutions is education institutions, which is the root of new ideas or innovations. The world's leading universities are in the developing world[32]. The academies of the top universities also have close relationships with entrepreneurs and most academies are themselves entrepreneurs.

In today's highly competitive markets, a well-deepened economic and social infrastructure is important to ensure efficiency and growth. Innovation and technology management are also key to weak infrastructure conditions in developing countries[33]. Although most countries have played an important role in the development of new technology and innovation management (like India), this is not sufficient and must evolve further.

4.3. Barriers to Technological Innovation

Innovative output varies from company to company and depends on internal, external, stimulating and limiting factors which have a major impact on the conception, implementation and dissemination of innovation. Innovation barriers can be described as internal or external factors that reduce or prevent the company's innovative inclination, reduce its capacity to implement and

maintain a new or significantly improved product or process, affect innovation[34].

Some of the significant obstacles to the digital technology process management include: transactional business process growth, digital information computability (physical data); effective data interoperability; challenges in search for suitable qualified employees with the required practical application skills and digital technologies; challenges in knowledge transfer due to inadequate information management[35]. The common factors which are hurdles to the technological innovation are mentioned in the table 1[36].

Table 1: Barriers to Technological Innovation

Lack of Funds within any enterprise or group	Economic factor
Lack of finance from sources outside enterprise	
Innovation cost too high	
Lack of qualified personnel	Knowledge Factor
Lack of information on technology	
Lack of information on markets	
Difficulty in finding cooperation partners for innovation	
Market dominated by established enterprises	Market Factor
Uncertain demand for innovative goods or services	
No need due to prior innovations by any enterprise	Reasons not to innovate
No need because of no demand for innovations	

These barriers can be categorized and grouped as exogenous (or external) and internal (or endogenous in the usual way related to problems implementing changes within their organizational processes) by businesses as companies gain capital or information externally. These barriers are the internal barriers that include the following: (a) lack of qualified personnel in the firm; (b) bureaucracy; (c) lack of Research & Development, design, testing and other technical problems in the organization; (d) long timeline process for return on innovation; (e) mindset of innovation as risky; (f) facing problem in controlling innovation costs; and (g) financing innovation. Meanwhile, the external barriers include the following: (a) patent and license policies in organization; (b) lack of government support; (c) foreign trade policy; and (d) competition. As written in the above-mentioned table, the barriers or limiters to technological innovation can be categorized into (i) economic factors, (ii) knowledge factors, (iii) market factors and (iv) reasons not to innovate.

The economic factors are most important for its innovation in effect and are closely linked to an absence of domestic and external investment, increased funding and increased financial risk[37]. The role of funding challenges in

creating new products and the role of bureaucracy as the main challenge to the development of innovation. The high cost and lack of funding have been described as the most common barriers to the delays and non-development of Innovation projects by industry firms[38]. Other than high prices, there are significant barriers to the understanding of unnecessary risks and to legislation and standards. The high investment costs which affect the innovative process constitute the key obstacle to the creation of technological processes of innovation. Economic considerations are also highly significant because budget limitations and the uncertainty of innovation ventures impact companies' incentives to invest in innovation[39].

Knowledge factors related to the principle of absorptive ability include a shortage of trained employees, a long-term view of leadership and organizational bravery, a shortage of technology and business knowledge, and the challenge of seeking cooperative partners for innovation ventures [40]. With regard to innovation, the shortage of trained workers plays a crucial role in the innovation cycle that can determine the company's strategy. For example, the perceived risk of job loss after the implementation of an invention may create a high resistance from employees. This resistance can be minimized by guarantee or compensation provided to employees prior to innovation or by reducing the costs of innovation[41].

Innovative processes are hindered by the absence of technical and market knowledge mainly due to the pressure currently placed on companies by demanding and sophisticated clients, which gives strong incentives for competition and innovation[37]. Innovations are discouraged by consumers who are not open to new ideas and replacing client goods with competing products. The lack of receptivity of consumers to new goods contributes to a decreased willingness to innovate for businesses. A organization that perceives that the consumer is not interested in new products does not have the opportunities to innovate[38].

The challenge of seeking collaboration partners on Innovation projects is an extremely significant obstacle to innovations because one of the main criteria of innovative projects is the financial incentives for innovation. Collaboration between businesses and their clients , vendors, scientific and technical systems organizations and competitors is a factor driving innovation[42]. Communication with outside information sources has a huge effect on firms' innovative skills. Companies who have ties with external partners may launch new products more likely. It should be noted, however, that many companies innovate without having to rely on partners in cooperation which implies that strategies based on business ability are considerably greater than those involving international partners[43].

5. Conclusion

This paper has reviewed existing articles which examined the determinants of technological innovation in any organization. This article mainly focused on the different aspects of the technological innovation i.e, types of technological innovation, concept of digital business, management of technological

innovation and barriers to innovation etc. By the implementation of innovation at technology adopted workplaces, the organizations can grow faster. Innovation applies at every stage of business that's why it is very important to create and manage innovation effectively. Proactive innovation helps to any organization for developing new and innovative products as a result organization become industry leader in the market while reactive innovation involves continuous improvement in existing product.

There are some limiting factors are also discussed related to technological innovation such as economic factors, knowledge factors and market factors. For any business, economic factors are very important because it has direct impact on innovation. In order to make stable business in the market, overcoming of these barriers are very important for any organization. Financial motivations the most important, whether manifested by obtaining direct and indirect gains, resulting in the improvement in the market position, competitive advantages etc. In the same time, innovation capacity conditioned by economic and political environment in which the company operates organizational culture and social context and the financial resources available.

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