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Chapter

Exploring the Different Types of Innovation for Firm Competitive Advantages

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Abstract

Over the past several decades, there has been much debate on innovation and how innovation contributes to a firm's competitive advantage and firm performance. Innovation can be competence-enhancing or competence-destroying. From a firm perspective, innovation can be classified into at least two broad categories, namely technological innovation, which is predominately new product development (product innovation) which includes architectural innovation from a product perspective and non-technological innovation, which includes at least process innovation, organizational innovation, marketing innovation, and service innovation. From an industry perspective, there is transformational innovation which is of such a nature that it destroys whole industries and changes the nature of society. In this chapter, we explore how the different types of innovation can be better understood and how they complement each other so that the firm can derive competitive advantages from the different types of innovation and improve firm performance.

Keywords: technological innovation, non-technological innovation, product innovation, architectural innovation, process innovation, organizational innovation, marketing innovation, service innovation, transformational innovation, firm performance improvement

1. Introduction

There is an abundance of literature on technological innovation, and it is not the intention to give a comprehensive overview of the vast body of knowledge in this field. What, however, is essential is to expose readers to the different types of innovation and how innovation can be used to create firm competitive advantages. From a firm's perspective, firms are faced with significant change, primarily when operating in an environment subject to high volatility, uncertainty change and ambiguity (VUCA). Others like [1–3] also refer to this as how the firms co-exist in such an environment and refer to this as the firm's organizational and environmental evolution (OEE). Firms need to continually innovate to stay ahead of the competition. From neo-Schumpeterian economic growth theory, economic growth arises from

competition among firms. The development of new technology and innovation has increased rapidly over the last few decades giving rise to intense competition [4]. This is because innovation creates opportunities to improve productivity, reduce waste and thus improve competitive advantages [1]. Firms react to changing environments through innovation [5]. However, many firms have failed to seize innovation opportunities [6]. Innovations introduce change, and not all firms are able to adapt to these changes. Firms that introduce innovations instigate change, and this disrupts the status quo. Firms that initiate innovation are referred to as disrupters because the firm penetrates the market and introduces new technological and or non-technological innovations, which other firms (competitors) must react to. These new innovations disrupt the market. Disruption tends to create new markets, which will eventually capture existing markets. Disruptive technological innovations cause a change in either of the following two areas: technological and non-technological innovation.

Technological innovation is of such a nature that it is based on fundamental new and different technological solutions, and these technologies revolutionize the existing marketplace, fundamentally giving the firm competitive advantages as the new technological innovations place other firms at a disadvantage. This is what is referred to as product innovation, also called new product development (NPD). Another way that a firm creates disruption is when the firm uses novel combinations of existing technological innovations to create new technological shifts in the market, which here again, through the combination of existing technologies, novel technological innovation is created, giving the firm the ability to create competitive advantages putting other firms (competitors) at a disadvantage. The firm that introduces the new technological innovations that is, the firm which creates new markets through these technological innovations, is referred to as a disruptor, while the firms that are being affected by these changes are being disrupted. For firms to stay ahead of the game, they need to be disruptors creating new technological innovations or new markets, which result in competitive advantages for themselves.

Figure 1 gives a graphical representation of how innovation can be introduced. Disruption occurs in two ways either a new technological innovation is introduced in an existing market, causing technology disruption; this is also referred to as product (component) or architectural innovation. In cases when a new market is created with existing technology, in this case, the market is disrupted; this is also referred to as sustaining innovation where the market is disrupted. Both these changes occur independently of each other they are mutually exclusive. In situations where firms introduce new and emerging technologies while, at the same time, they create new markets, this is referred to as radical innovation. In radical innovation, two things occur at the same time new technological innovations are introduced, and new markets are created simultaneously. When firms create technological innovations through using existing technologies in existing markets, this is referred to as evolutionary or incremental innovation. Innovation can either be technological or non-technological. Where technological innovation focuses on products, and non-technological innovation focuses on innovation initiatives outside of products, for example, process innovation, organizational innovation, or service innovation. **Table 1** gives some examples of the different types of innovation.

Further to this, these technological innovations can either be competence-enhancing or competence-destroying. Competence-enhancing is when new and emerging technologies enhance existing competencies and capabilities, and competence-destroying is when new and emerging technologies fundamentally destroy existing competencies and capabilities, and the firm must develop new competencies and

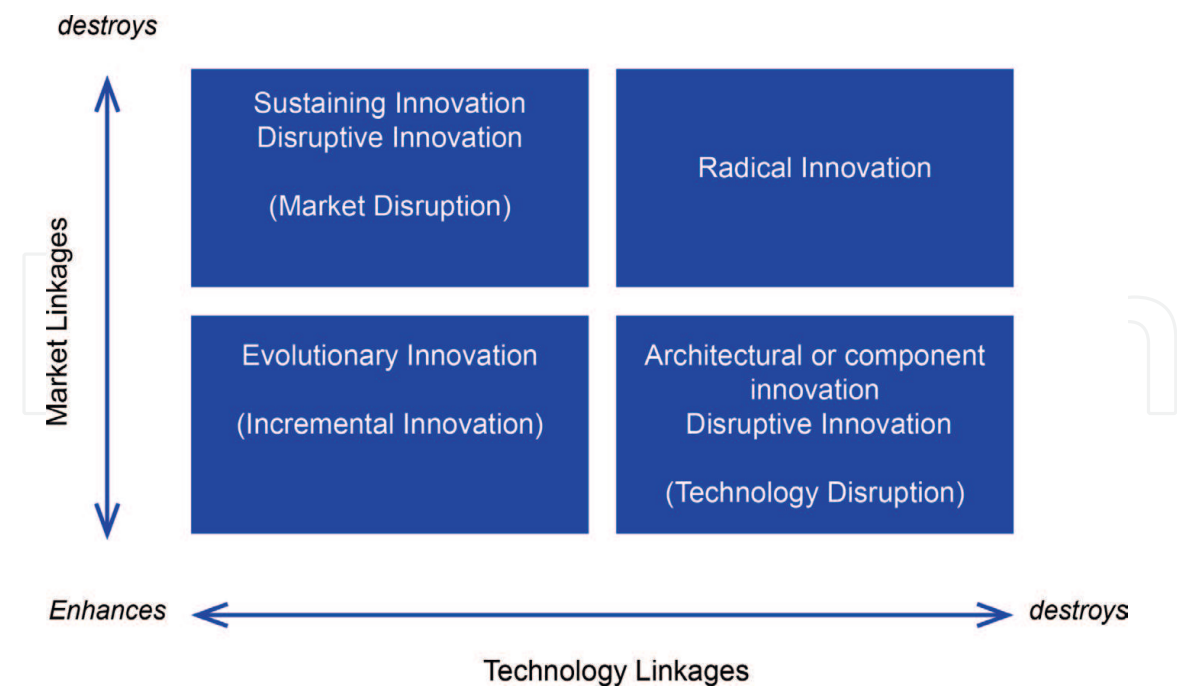


Figure 1.
Classifying technological innovation.

Innovation Type	Technological or Non-Technological	Examples
Evolutionary or Incremental Evolution	Technological or Non-Technological	Technological: face-uplifts on vehicles, upgrades on smartphones, washing machine washers and dryers which can handle larger loads, etc.
Disruptive Innovation Technology Disruption	Technological	Electric vehicles, Digital cameras, iPads, Kindle, etc.
Architectural or component innovation Market disruption	Technological Non-technological	Photocopiers and printers, smartphones with photographic capability, solar-cell and inverter technology for backup power systems, etc. Uber, Music subscriptions such as Apple Music,
Radical innovation	Technological or non-technological	3D Printing, self-driverless vehicles, Apple's Air pods, etc.

Table 1.
Examples of the different innovation types.

capabilities to compete in the market. As an example, Gillette blade innovations have been competence-enhancing for Gillette. They helped Gillette deepen its existing capabilities. Another competence-enhancing technology is software languages which build on existing capabilities and skills. New software programming languages enhance the skills and capabilities of existing software programmers and software engineers. Competence-destroying is when avionic systems in an aircraft replace fight engineers. New technology has displaced the flight engineer. Another example of competence-destroying was in the agricultural area where plows driven by horses were replaced by a tractor. The skills required to develop harnesses etc., became redundant, and these people could not be skilled to build tractors. A further example of competence destroying is the switch from coal-fired power stations to renewable

energy sources like wind, solar etc. The skills required to design, build and operate coal-powered power stations are different from that required for renewal energy sources, and as such, these skills will become obsolete.

While firms are faced with new and emerging technologies all the time, they must decide how they are going to react. They can either react by introducing other new and emerging technologies into the market, or they can develop new competencies and capabilities through other types of innovation. Firms can also compete based on novel combinations of existing technology products; this is referred to as architectural innovation, which one may argue is a subset of product innovation. Firms, however, do not need to rely solely on product or technology innovation to compete. These other types of innovation include process innovation, where firms look at new methods and techniques on how they produce the products they sell, adoption of process innovation thus allows firms to improve how soon they can take their products to market; process innovation can also improve the time to market and the cost to produce specific products so while some firms may not be the product technology leader they have mastered process innovation and can compete on aspects such as time to market and cost for example. On the other hand, other firms may choose yet other ways of competing; this may include, for example, organizational innovation, where firms experiment with different business models, and how they can take products to market, organizational innovation can also include, for example, centralized or decentralized structures. In terms of a centralized structure, the firm adopts a central organizational structure through which all decisions are made, whereas, in a decentralized structure, decision-making is distributed throughout the organization. Marketing innovation is another innovation opportunity where the firm uses marketing as a means of creating competitive advantages; this involves using different marketing communication channels to get products to the market or marketing data to exploit gaps in the market so the firm can react accordingly. Another innovation opportunity is service innovation, where firms develop value-added products and services to increase their existing portfolio of value-added offerings to the customer. As an example, firms can focus on how they conduct after-product sales services, so here they are competing on better servicing the market they already have.

Transformational innovation is when whole industries or society is transformed, and this could be either technological or non-technological. For example, the whole world was subject to transformation through the COVID-19 epidemic. It is not something that was anticipated, but it is an unexpected shock to the industry and society and firms, and markets must react either through technological or non-technological innovation, which in such a case is probably competence enhancing and competence destroying. Other examples include, for example, the creation of the internet, the invention of the aircraft, the invention of automobile vehicles, etc.

Having painted the innovation landscape, it is prudent to dive further into the different types of innovation. Section 2 explores the different types of innovation.

2. Different types of innovation

2.1 Technological innovation: Product innovation

Firstly, let us commence the discussion with product innovation. Many firms are product-driven and have focused on NPD to compete. There is an abundance of such firms to mention at least the following with no order or preference: Siemens, whose

vision is as follows: “A world of proven talent delivering innovative solutions giving our customers a unique competitive edge enabling societies to master their most vital challenges and creating sustainable value”, [7]. GE’s purpose is “We rise to the challenge of building a world that works” [8]. Apple’s vision statement is “to make the best products on earth and to leave the world better than we found it” [9]. Such firms focus on NPD innovation. They continually seek to develop new products and compete by being at the forefront of innovation. Technology innovation is complex, causing many firms to fail and new products to fail. Scanning through the TOP technology companies in 2010 and comparing that list to the TOP technology firms in 2023. Only 2 of the TOP 10 firms from 2010 appear in 2023, namely: Apple and Amazon. Thus, one can say that it is challenging to maintain one’s ranking. It requires consistent innovation and being able to meet market needs, **Table 2**. It requires one to stay ahead of the competition. NPD is not easy, and it requires firms to look at opportunities for NPD continually. Moreover, [12] highlighted that “Nearly 85% of companies say that innovation is critical, yet 75% of the world’s 1000 largest publicly listed corporations report that they are failing to out-innovate their competitors, and 42% of companies fear they are at risk of being disrupted”.

From an NPD perspective, let us understand how product innovation occurs. The theory on technology S-Curves (Foster curves) is well known and is widely published. Let us consider **Figure 2**, where the Technology S-curve is illustrated. Technology A goes through a period of infancy, then it goes through a growth phase, and thereafter a phase of plateauing and decline which occurs when the technology reaches its ultimate performance limit and no further product innovation is possible. The market has a certain level of performance demand, Technology A supersedes this demand, and the mainstream market receives technologies which are beyond what it can use. For example, consider high-performance automobiles. These vehicles can reach top speeds which we cannot drive at as there are specific road ordinance regulations which prevent us from doing so. Notwithstanding this, automobile manufacturers continue to innovate, bringing new high-performance vehicles to market. The reason for this is because of consumption. Consumers buy these high-end products because it appeals to them as a nice-to-have, despite them being unable to extract the total value of the automobile.

TOPTechnology Firms 2010 [10]	TOPTECHNOLOGY Firms 2023 [11]
Facebook	Apple
Amazon	Alphabet
Apple	Microsoft
Google	Amazon
Huawei	Samsung Group
First Solar	Tencent Holding
PG&E	Meta Platforms
Novartis	Cisco Systems
Walmart	Oracle Corporation
HP	Broadcom Inc

Table 2.
TOP technology firms comparing 2010 to 2023.

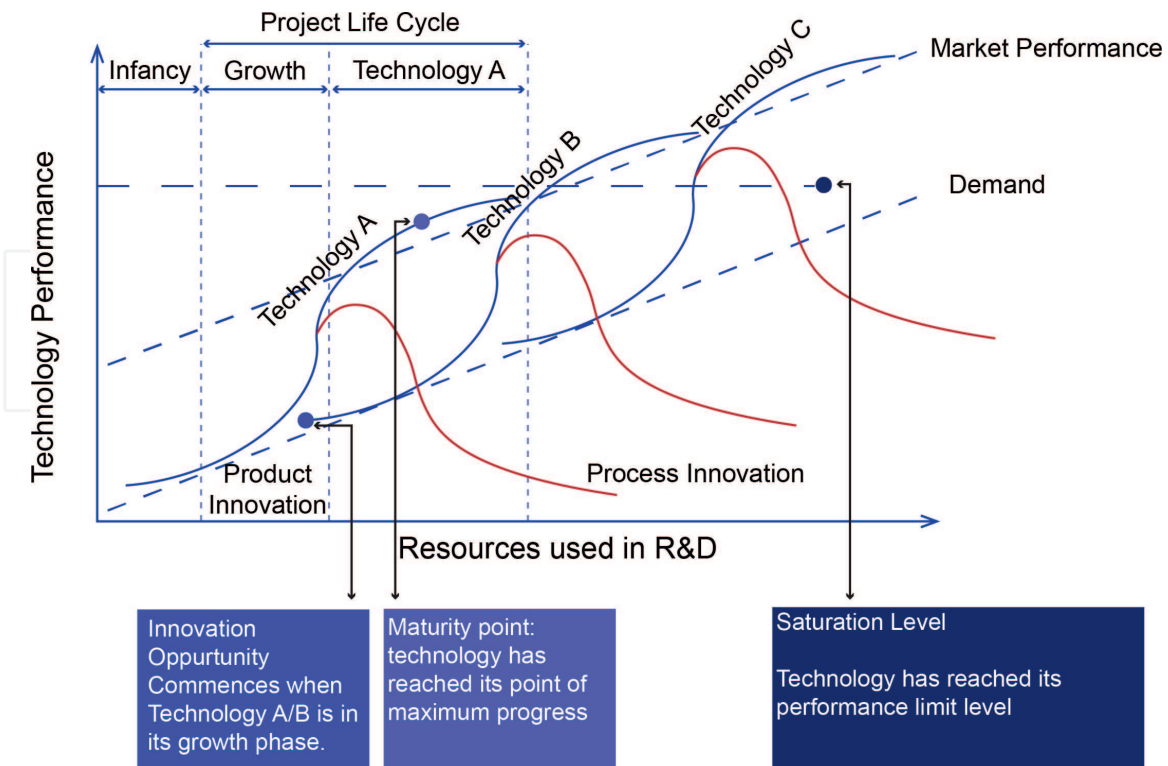


Figure 2.
Technology S-curves.

These manufacturers innovate because of market demand, customers demand more, and firms continue to innovate more than what the market can use. Firms continually innovate to compete and leapfrog other firms (competitors). Now consider Technology B, from **Figure 2**; while Technology A is still in its infancy, Technology B is developed by competitor firms; therefore, for a certain period in time Technology A and Technology B are competing, Technology A is seen as the older technology soon to be replaced by Technology B. Technology B promises even more technological innovations beyond what the market requires; in the same way, Technology C is developed to replace Technology B, which is a continuous cycle of innovation. However, one must be cautious of the market needs.

2.2 Technological innovation: Architectural innovation

Architectural innovation is described as combinations of existing technologies to create novel innovation solutions. Different technological components are integrated to create a novel system of technologies which, once integrated, offer a different value to customers. Architectural innovation only affects a product's architecture without changing the fundamental components. Architectural innovation enables firms to create solutions that enable them to maintain or expand their customer base without developing new technologies or products. Moreover, it comes at a lower cost and less risk than NPD. Note that architectural innovation has risks of diminishing returns; there is only so much novelty one can extract from the existing combination of technologies. Note that architectural innovation is about re-configuring existing technologies or products to offer more value to an existing market or a potential new market.

Some examples of architectural innovation include:

- a. Desktop photocopiers: these photocopiers are mobile and suitable for office and home use. Traditionally photocopiers were large devices suitable for the corporate office environment where one photocopier served an entire floor. In the digital era, photocopiers are multi-functional and perform many tasks; previous technological versions of the photocopier were a single standalone device providing only one function, namely photocopying. In the digital era, photocopiers offer many added functions, from photocopying, scanning, etc.; you can even print wirelessly from your mobile phone or iPad. Therefore, desktop copiers are an architectural shift compared to the traditional photocopier.
- b. Smartwatches: These offer many more functions than a traditional watch, and it is built on existing smartphone technology. Therefore, the smartwatch is an architectural shift from the traditional watch. Its added functions are based on smartphone technology, which includes at least the following: alarms on incoming calls to the mobile phone, email alerts, early warning notifications of meetings, heart rate monitoring,
- c. Multi-core processing: combining many processes onto one chipboard. Increases processing computation speeds at lower power utilization.
- d. Tablets: iPad uses smartphone technology packaged into a Tablet. It replaces traditional paper-based notebooks. It is based on smartphone technology.

2.3 Non-technological innovation: Process innovation

Now let us consider process innovation; when technology is in its growth phase, and a dominant design has been reached, there is not much additional benefit from the novel emerging technology, so firms start focusing on process innovation. The dominant design is what the mainstream market demands an acceptable product that conforms to the norms and beliefs of society. Process innovation is when firms have exhausted economic benefits from product innovation and now seek opportunities to extend the product life cycle (PLC) so that they have a longer window to exploit the market. In process innovations, firms focus on how to manufacture and make innovations in terms of manufacturing at a lower cost, improving speed to market, etc. They explore opportunities, including how to improve quality, improve reliability, be more flexible to customer demand etc. Many firms can gain much additional revenue by focusing on process innovation. Process innovation spans 50% of the PLC. Therefore, while product innovation is essential, so is process innovation. There are many opportunities in the second half of the PLC which firms need to exploit from a process innovation perspective.

2.4 Non-technological innovation: Organizational or business model innovation

There are many definitions of organizational innovation, [13] states that this type of innovation enables the firm to achieve better performance thresholds. [13] discuss that organizational innovation is about how managers do what they do. [14] cited the Oslo Manual Organization for Economic Co-operation and Development (OECD: 2005), where organizational innovation is “the implementation of a new organizational method in a firm’s business practice, workplace organization or external

relations". Given these definitions, organizational innovation may be seen as the firm's ability to re-organize itself so it can better respond to market needs. Organizational innovation may be viewed as the ability to improve and increase a firm's performance through reducing administrative practices and transaction costs, improving the workplace environment and, as such, laying the foundation for better productivity and improving firm competitiveness.

Organizational innovation also includes better work processes and business process re-engineering; it is about operational excellence. It is also inclusive of developing dynamic capabilities that will propel the firm into new ways of working that enable the firm to adapt to market requirements and hence develop competitive advantages to outsmart the competition. Re-engineering the supply chain, applying different sourcing methods and reducing input costs are all part of organizational innovation. Applying and adopting different production and operational methods are all part of organizational innovation. In organizational innovation, one can leverage many theories and models to mention at least the resource-based view (RBV) and transactional cost economic (TCE). Where in the RBV, one tries to obtain the best value from the resources of the firm and in the TCE view, one tries to reduce the costs of transacting.

Organizational innovation also involves new and emerging technologies and methods, for example, the 4th Industrial Revolution (4IR) technologies which many claim improve connectivity and improve the throughput of the firm. 4IR technologies also enable different organizational methods of working; for example, remote working reduces the need for offices, thereby reducing the firm's infrastructure costs.

Other examples are digitalization; many firms are employing technologies to streamline operations and business processes. This is all in an endeavor to improve efficiency and improve effectiveness.

2.5 Non-technological innovation: Marketing innovation

Marketing innovation can be described as the firm's ability to adopt different marketing approaches that will enable more effective use of channels of communication to facilitate the delivery of products and services to serve its customers better [15]. Marketing innovation is essential for NPD; there is much uncertainty when new products are introduced into the market. Notwithstanding that new and emerging products have the potential to provide customer benefits with different core technology, there is much uncertainty for both the firm and the customer [16]. Marketing innovation can assist in reducing these uncertainties and enable the firm to develop new relationships with potential new customers and to understand their behavior and learning requirements. Leveraging marketing resources such as brand name, reputation, and loyalty can also play a significant role in driving product diffusion. Marketing innovation also involves lead user analysis. Lead user analysis is where a select group of early adopters of the product are leveraged to test the appetite for the new product or technology; they also help with product development, ensuring that the new product will meet the expectations of the mainstream market. Marketing innovation is not only about the diffusion of new products, but marketing innovation can also play a significant role in portraying to customers that incremental product innovations are indeed novel [16].

Marketing innovation goes beyond supporting the diffusion of NPD. Manufacturing firms have achieved competitive advantages such as product

differentiation and cost leadership through marketing innovation efforts [17]. This can be achieved through, for example, marketing organizational and process innovation initiatives and not to mention service innovation initiatives which are next discussed.

2.6 Non-technological innovation: Service innovation

Service innovation may be described as an innovation which includes the introduction of new services or incremental improvements of existing services [18]. Service innovation is not limited to the services sector; it goes beyond and equally applies to other sectors like manufacturing and others, which can benefit from the addition of other services to its current portfolio of value offerings. Service innovation may also be viewed as new innovative service offerings which are valuable to customers. Service innovation may be driven by new technologies or a firm's competencies that can create additional value for the customer. Service innovation is not limited to improving existing services and offerings; it also involves replacing existing products and services with more value-added products and services.

For clarity, let us consider the following examples:

- a. Traditional banking methods involve a customer going into the bank to obtain certain services; online banking has offered customers the option of obtaining banking services remotely. In this example, customers benefit from accessing banking services remotely; thus, they do not have to spend time standing in queues waiting to be serviced. Among other benefits, the customer benefits from convenience and ease of service, and the customer is not restricted in terms of when services can be obtained.
- b. High-end automobile manufacturers have also now introduced online platforms where you can order your new automobile online and customize the vehicle to your needs, view the manufacturing stages of your vehicle, and even once you receive your vehicle, you have alarms indicating when services are due and not to mention online booking of services.
- c. Online airline booking has tremendously reduced waiting times at airports.

Service innovation is about value co-creation where both the firm (service provider) and customer are involved in delivering the service. In service systems, the customer is a significant part of the service inputs. Service systems depend on people, technology, and the co-creation of value. Service systems involve the integration of people and technology to provide value to customers. Hence service systems are complex socio-technical systems. Service innovation integrates people, both customers (people) and service providers (people resources), technology and value. Value co-creation is a WIN-WIN situation for both the customer and the service provider. They both work synergistically to co-create the service offering.

2.7 Transformational innovation

As already pointed out in the introduction, transformational innovation is of such a nature that it has the power to transform entire industries and society at large. It is

a rare and powerful form of innovation that creates new value for many generations. It can fundamentally change industries, firms, and products completely. Innovation occurs out of necessity; in terms of transformational innovation, this becomes apparent as industries, firms and societies were affected by the COVID-19 pandemic and, as such, the whole had to change globally to adapt to the new way of working.

Transformational innovation seldom stems from existing industries, firms, and products because such entities have vested interests in established innovations; therefore, transformational innovation stems from outside entities that have no vested interest in existing innovation investments and infrastructure. Transformational innovation has both challenges and opportunities. Opportunities lie in that the change that is required does not rely on old ways of doing things, so one is free to innovate without any constraints. The challenges and risks with transformational innovation are so immense that, in essence, it can destroy the innovator; therefore, transformational innovations are scarce and transformational innovation usually stems from start-ups.

Large firms often do not attempt transformational innovation single-handedly. They often rely on technological advancements of start-ups or other partners or suppliers to initiate transformational innovation because the risks associated with transformational are just too high, and often transformational innovation requires capabilities and expertise that the firm does not possess [12]. Therefore, transformational innovation initiatives take an open innovation approach. Open innovation is the preferred approach because it allows for collaboration with external firms and other entities and, as such, is seen as the most effective and efficient way to achieve transformational innovation [12].

Some examples of transformational innovation over the last, say, 50 years include at least the following:

- a. The birth control pill affected how society at large behaves and has prevented a world population explosion. It has also affected our values, beliefs and norms about people and society.
- b. The cellphone has fundamentally changed the way we work and live; we can now be continuously available. It has displaced fixed-line network operators making fixed-line technologies and operators obsolete.
- c. Fiber optics which gave rise to the internet, improved communication and real-time information.
- d. The railroads transformed transportation and logistics throughout the world.
- e. The automobile enabled more efficient and effective transportation of people. It displaced the horse and cart transportation system.
- f. Electric vehicles have the potential to displace current internal combustion (IC) engine technologies (specifically in passenger vehicles), especially in automobiles making many jobs and skills redundant.
- g. 3D Printing has the effect of displacing current manufacturing firms and be replaced with manufacturing firms with a different skill set. It could have the potential to destroy current manufacturing capabilities.

3. What are the implications of innovation

3.1 Innovation in context

Now that we understand the different types of innovation, what do we do? It is essential to understand that firms do not exist in isolation; they are part of a wider systems environment [2]. Further to this, the firm must co-exist with this wider environment; that is, it is about the firm's OEE [1–3]; it is how the firm is able to compete and leverage opportunities in the marketplace. From a firm perspective, innovation can be either technological or non-technological innovation. **Figure 3** gives a graphical representation of how firms may consider exploiting innovation. Firstly, let us consider innovation in the green circle; there are technological and non-technological innovations. Firms bring technological and non-technological innovations to market. Notwithstanding innovation, firms need to ensure innovations cumulate in solutions which serve market needs. In other words, innovation must be value-adding. Solutions are depicted in the blue circle. These solutions must be done timeously. Time is reflected in the orange circle. Innovations must result in solutions that meet customer needs, and innovations must be done timeously; otherwise, the competition will surpass the firm. Firms are in a continual race to be better than other firms. Firms adopt innovation to be better than their competitors, but innovation alone is not sufficient. Innovation must be solution driven and be done timeously; otherwise, firms will not be able to derive competitive advantages from innovation. Where the 3 circles intersect is the sweet spot of innovation. Firms need to strive to hit the sweet spot of innovation to be competitive and outsmart the competition.

3.2 Collaborative innovation

While some researchers believe that a firm's ability to innovate is Idiosyncratic [19], others argue that there is a different paradigm in terms of open innovation, that is, the firm's ability to innovate and collaborate with external parties [20, 21], while the firm possess a lot of internal innovation knowledge for innovation propensity, exploring and utilizing the external environment is significant in developing capabilities [22]. This external knowledge can only assist the firm in developing capabilities that will drive competitive advantage. This view on collaborative innovation and

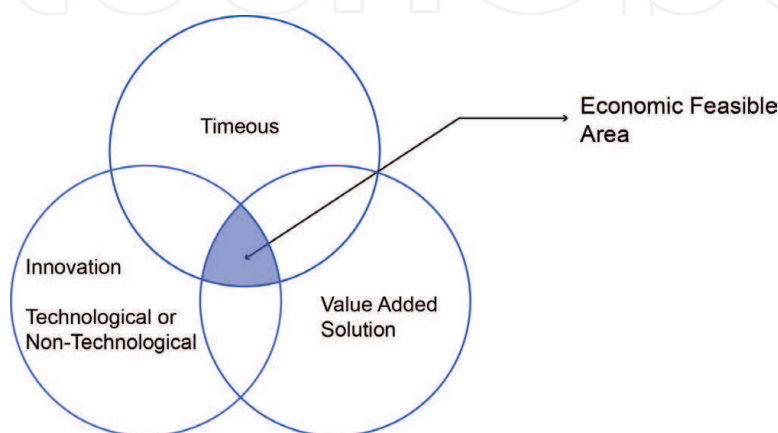


Figure 3.
Economic sweet spot for innovation success.

acquiring external knowledge is consistent with the view on marketing innovation, which was discussed in Section 2.5.

Why is collaborative innovation necessary? There are many responses to this question. Some responses are as follows:

- a. Firms are too large, and they are restricted when it comes to the speed of innovation. Large global organizations have large innovation capacity in terms of people, funding, and infrastructure, so they can deploy resources as required to foster innovation, but at the same time, they may not be able to react fast enough; hence they can leverage networks through collaborative efforts with other firms who are smaller, more flexible and able to react faster.
- b. In smaller firms, resources are constrained and limited, so investment in innovation is limited, and continual investment in innovation is lacking. Therefore, engaging with other entities, such as universities, may provide an opportunity to increase innovation capacity.
- c. In the case of transformational innovation, the risks are just too high, so it makes sense to partner with smaller start-ups to initiate transformational innovation activities.
- d. The firm may not possess all the capabilities and skills, and other firms (partners) may possess these capabilities and skills. Therefore, collaborating in this regard makes sense.
- e. The firm may not have complete knowledge of the market, especially when entering unknown markets and foreign countries collaboration with a resident firm makes sense.

These are just some examples of why firms should collaborate to foster innovation. Collaboration also enables a broader view of opportunities and not be restricted by the operational processes and thinking processes within the firm. Collaboration allows for cross-pollination of ideas.

3.3 Synergy between the different innovation types

It is important to note that firms have a portfolio of innovations ranging across the different types of innovation. Some products are in the product development phase others are in other phases like architectural, process, marketing, and service innovation phases. Organizational innovation is when the firm re-innovates itself to cope with market demands. Sometimes some firms may adopt different organizational structures for certain products, especially if the product is of such a nature that it is high risk and high reward. The risks are so high that it could have a catastrophic effect on the firm, so in such circumstances, the firm may spin out another entity to develop and take such products to market. This is referred to as open innovation, where innovation is a collaborative effort involving different entities.

It must, however, be also noted that the different types of innovation are not mutually exclusive; they are complementary to each other. In the PLC, NPD is 50% of the PLC; the other 50% is the rest of the life of the product, which requires process,

marketing, and service innovation initiatives so the firm can achieve its return on investment (ROI). **Figure 4** and **Figure 5** reflect how the different types of innovation fit into the PLC curve. It is implausible, and not uncommon, though, that the firm can achieve ROI on the first half of the PLC. However, there is much benefit that also is achieved from the second half of the PLC and not exploiting the second half of the PLC is not extracting full potential from the product innovation. Therefore, firms should also strive to invest in innovations beyond product innovation. Architectural innovation also provides many opportunities to extend the life of different products; these products can be combined to offer different benefits to the market. For example, desktop photocopiers have become multi-functional; they offer many different functions, such as photocopying, scanning, remote printing etc. In addition, there have become more standalone and mobile compared to the initial innovation that was more standalone, serving the corporate environment and single functional. To understand how products diffuse across the market, one needs to understand the PLC as well as the different categories in the diffusion curve.

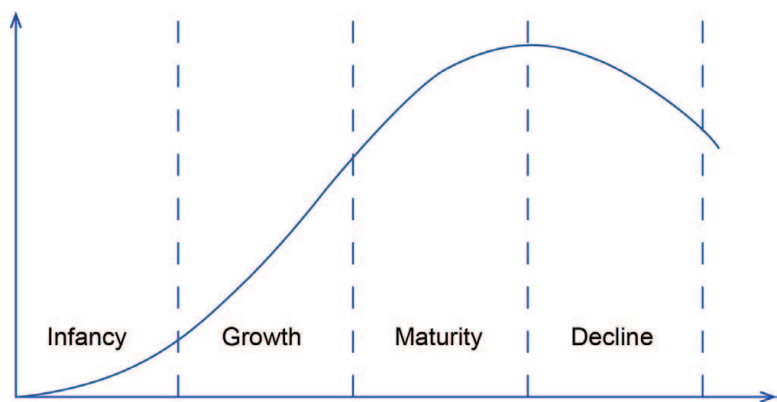


Figure 4.
PLC.

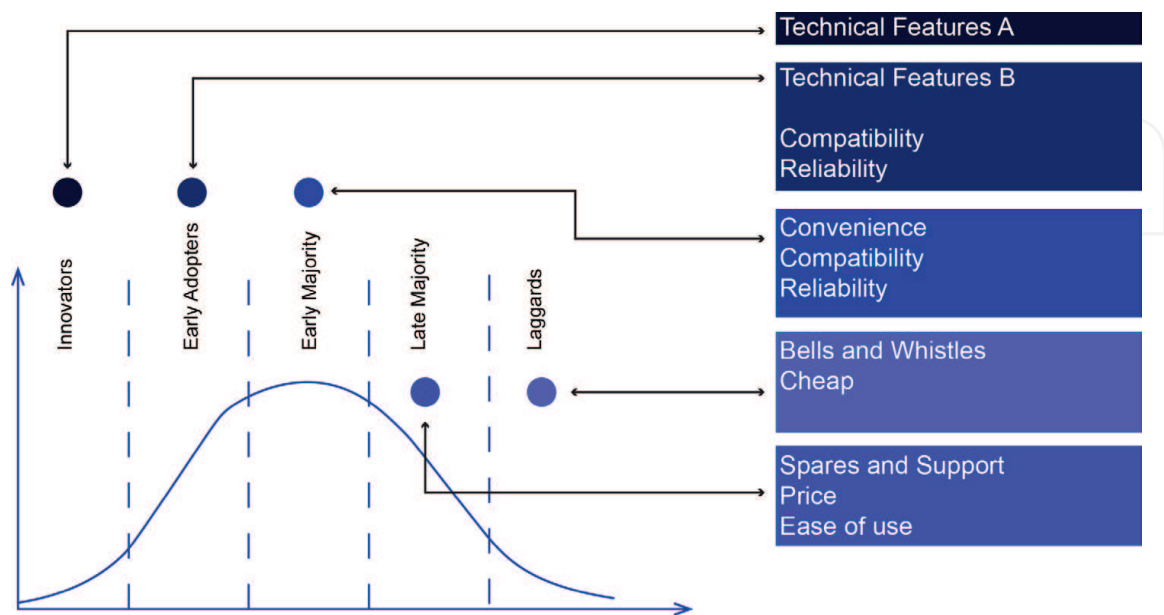


Figure 5.
Diffusion curve.

The PLC curve shows how the product goes through the different phases, infancy, growth, maturity and decline. This is the Foster S-Curve. Note that when one mathematical integrates the S-Curve, the area under the curve is obtained; this is the diffusion curve. The area under the curve is the market. The market can be categorized into different sections, namely early adopters, early majority, late majority, and laggards. Moreover, innovation is not a linear process. Understanding the diffusion curve is important because it is how a product diffuses across the market because competition changes across the diffusion curve. By understanding how the product diffuses through the market, one can obtain a better understanding of how the different types of innovation complement each other. Let us consider each of the different categories in the diffusion curve.

- a. Innovators: in this phase, the product is still in its infancy; you are selling to innovators; all they are interested in is technical features. This is the product development phase; it is where product innovation takes place. In this phase, you are selling your product to another innovator, somebody who is keen to know how the product functions; all this category cares about are technical features; they will even help you develop the product. Innovators care about product superiority; they want to be the first to get the new stuff.
- b. Early adopters: In this phase, it is also about product innovation; early adopters look for how they can match the emerging technology with a strategic opportunity. They are not looking for an improvement in technology; they are looking for a breakthrough. They are not price sensitive; they are a hidden source of venture capital. They are hard to please but easy to sell to once they see the advantage. They are very demanding, so customer management is essential. They are very similar to lead users. They are very technical literate and sometimes specialists in their own field. They are prepared to test products, not too concerned about technical glitches. One can only afford to work with one or perhaps two early adopters while they bring many benefits to the product innovation phase; they are also a considerable drain on resources; therefore, finding a suitable early adopter to partner with is a challenge and marketing innovation can also step in here. While in this phase, product innovation is primary, secondly marketing innovation is also essential.
- c. Early majority: in this phase, we are dealing with pragmatists who care about convenience, compatibility, and reliability. In this phase, they want to know your reputation and who else is using this product; in this phase, it is about marketing innovation. They are looking for long term relationships. Note also from the PLC in this phase, your product is in the maturity phase, so in this phase, it is also about process innovation. Early adopters are price sensitive and also about aftermarket support and service. Therefore, in this phase, it is about process innovation, marketing innovation and service innovation.
- d. Late majority: In this phase, it is about the conservatives; from the PLC curve, note that for every pragmatist, there is a conservative. This is a large sector of the market, so you cannot ignore them. In this phase, the product is in its maturity phase, so it is about process innovation, marketing, and service innovation. They look at products as commodities. You cannot penetrate this category with new products. They are an essential cash cow in the late stages of the PLC, so marketing innovation and service innovation are of paramount importance here.

- e. Laggards: In this phase, the product is in a declining phase; the product has already been replaced by other products, either by yourself or another market entrant. Therefore, in this phase, sometimes product innovation is about adding in the bells and whistles to grab onto the last phase of the PLC. This typically happens when the product is being replaced through technologically destroying innovation. So, it is about trying to survive so that you will find product, process, marketing and service innovation here. Many firms will, however, abandon innovation here and have already moved on to other NPD initiatives.

In this section, we discussed how the different types of innovation fit together and complement each other. Note, however, that organizational innovation is not really part of the PLC or diffusion curve apart from a new entity or partnership that is being established for transformational innovation initiatives.

4. Conclusions

In this chapter, we pointed out that innovation is complex, and many firms fail at innovation; we outlined the different types of innovation from technological innovation, which included product, architectural, and non-technological innovation, which includes process, organizational, marketing and service innovation. It was highlighted that the different types of innovation all contribute to a firm's competitive advantage. It was also demonstrated that there is synergy between the different types of innovation and that they are complementary to each other and not mutually exclusive. It was also pointed out that firms should not rely solely on product innovation (NPD) alone for competitive advantages, as the other innovation types also provide opportunities for creating competitive advantages.

We also highlighted that innovations, whether technological or non-technological, must meet market needs and be value-adding, and, at the same time, it should be timeous so firms can develop competitive advantages.

The importance of innovating through collaboration was also highlighted as necessary. Innovation is not idiosyncratic but open, as firms should collaborate with other firms and other entities to foster innovation. Often innovation does not occur in isolation; it is part of the firm's wider environment. Firms evolve and grow in the broader system; it is about the firm's OEE. OEE is about how the firm co-exists with the broader environment.

It was also emphasized that product innovation (NPD) is only half of the PLC, and the second half can be exploited through architectural, process, organizational, marketing and service innovation. The importance of understanding the PLC and diffusion curve was highlighted so firms can leverage the different categories in the diffusion curve to take products to market.

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Conflict of interest


The authors declare no conflict of interest.

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