

A STUDY OF THE IMPACT OF THE DEVELOPMENT OF E-COMMERCE OF NANOPRODUCTS FOR THE ENVIRONMENTAL APPLICATION BASED ON IT ABSORPTIVE CAPACITY THEORY

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Abstract

Information and communications technology have a significant impact on many aspects of human life. One of the ways through which IT has transformed human social life is through the use of e-commerce. Nanotechnology as a novel field of science is developing at a high rate. As a result, today more than 1200 companies around the world are manufacturing and distributing nanoproducts in the market. Some of these companies specialize in manufacturing nanoproducts that can be used for environmental applications. Nanotechnology, as a scientific field, can play a significant role in the world economy in near future. In terms of the science of Information Technology and IT Absorptive Capacity Theory, the findings of this study confirm the overall positive impact of the development of e-commerce on environmental nanoproducts. This study, while introducing IT Absorptive Capacity Theory, provides an experimental study of the impact of the development of e-commerce for nanoproducts for environmental applications. The study findings indicate that the absorption capacity of e-commerce of the nanoproducts for environmental application has a positive impact on the development of e-commerce of environmental nanoproducts.

Keywords: E-Commerce, Information Technology, Environmental Nanoproducts, IT Absorptive Capacity Theory, Business.

1. Introduction

In recent years, the use of Information Technology has played a significant role in the economic development of developing countries. Information Technology introduces a great opportunity for growth in developing countries (Kumar et al. 2021). On the other hand, due to the economic problems that resulted from the economic sanctions on many developing countries, the focus on the development of Information Technology has increased significantly.

To further develop environmental nanoproducts, it is important to make great use of marketing tools such as e-commerce (Das et al. 2019).

In recent years, climate change and the resulting environmental problems have amounted to become some of the most urgent challenges faced by world politicians. On the path to the attainment of global growth at a sustainable level, it is important to pay attention to the damages caused to the environment as a result of such efforts. Today, many countries, while taking domestic

measures to control pollution, enforce international measures to reduce pollutants. Environmental efforts continue to gain momentum, and as a result, they are now highlighted even more in the political agendas (Saleem et al. 2018). Various scientific methods have been employed to improve environmental conditions around the world; each of which represents unique principles and provides unique results (Pramanik et al. 2021; Jasrotia et al. 2020). However, so far few studies have expounded on the development of e-commerce for environmental nanoproducts which will without a doubt bring financial benefits for those involved in this trade. E-commerce provides an efficient value chain for the developers of environmental nanoproducts, which delivers their products to the market and increases the revenue for environmental nanoproducts. As a result, these products can be sold in the market at a much lower price and multiple new job opportunities will be created in marketing for environmental nanoproducts. E-commerce improves the overall performance of companies. IT Absorptive Capacity Theory introduces the appropriate grounds for studying the impact of the development of e-commerce for environmental nanoproducts. This study examines the impact of the development of e-commerce on environmental nanoproducts according to the IT Absorptive Capacity Theory.

2. Theoretical Foundation

2.1. E-Commerce

2.1.1. E-commerce: Definition

E-commerce is the act of buying and selling products using electronic means (Turban & King 2009). E-commerce is not restricted to buying and selling goods on electronic networks; indeed, it includes the delivery of products or services using computer networks, including the internet, intranet, and extranet as well. Understanding the concept of e-commerce is the first step toward developing clear principles for this form of trade, especially when it involves digital transactions and payment systems (Mexmonov 2020).

2.1.2. E-commerce: Key Concepts

E-commerce is the type of commerce that is done via electronic networks. Commerce involves transactions that create revenue for the company in the outside world (by creating value for sponsors and clients) (Kumar et al. 2021). Undoubtedly, e-commerce can positively impact any business's revenue and productivity. The relatively low cost of e-commerce has allowed the companies to be in direct connection with their suppliers and customers through long-distance phone calls and support systems. Small businesses can also benefit from low-cost computing power and invest in a wide range of technological developments. E-commerce facilitates information exchange and business transactions in companies (Mexmonov 2020). E-commerce is mostly focused on business or monetary transactions. According to the National Center of Statistics and Information, e-commerce is the pathway for product requests through an electronic medium. In the early 1990s when commercialization was introduced to the global networks and E-commerce was created. In recent years, the widespread use of the internet and its ease of access to most people around the world, has promoted E-commerce as a valid form of trade (Turband & King 2009). While the term 'E-commerce' is familiar to many scholars and researchers, they have

not yet reached a consensus about a standard definition for it (Hasan and Tibbits 2000). Due to its widespread use in the business world, Internet Commerce is another term used to refer to Electronic Commerce.

2.1.3. E-Commerce: Adaptation

Several studies have expounded on E-commerce, its benefits, and standard procedures. While the benefits of E-commerce have been clearly defined, the application of E-commerce as a novel business model is still faced with many obstacles. Today most industries, while leaning towards the application of E-commerce, express concerns about its application in their business model (Sarлак et al. 2009).

2.1.4. E-Commerce: Key Models

There are four key models introduced for E-commerce, including Business to Business (B2B), Business to Consumer (B2C), Consumer to Business (C2B), and Consumer to Consumer (C2C). Each of these models will be discussed in the following (OECD 2000).

When a large company uses the entire body of its resources to invest in the internet, its business model is called B2B. Information exchange in B2B models takes place via electronic means Cisco is a great example of a B2B. Cisco is the supplier of internet hardware products which provides a platform for both buyers and suppliers to finalize their transactions using the internet.

The B2C model facilitates the relationship between the sellers and the host and allows the sellers to purposefully target their desired customers by providing detailed information about them. It is through the internet that the desired customers are targeted and their desired services are provided for them.

The C2B model allows the customers to be in direct contact with the business. Today, C2B is one of the most popular business models since it allows the customer to get directly connected with the business owner and ask for its desired services. *Priceline.com* is one such service which allows customers to interact with other customers. The best examples of such sites are auction websites in which people or sellers can put up items for sale. The consumers who wish to buy these items can place their bargains. These websites form a mediating platform between buyers and sellers to facilitate their business transactions. Figure 1 demonstrates various e-commerce models.

	Consumer or civilian	Business or organisation	Government
Consumer or civilian	Consumer-to-Consumer (C2C)	Business-to-Consumer (B2C)	Government-to-Consumer (G2C)
Business, organisation	Consumer-to-Business (C2B)	Business-to-Business (B2B)	Government-to-Business (G2B)
Government	Consumer-to-Government (C2G)	Business-to-Government (B2G)	Government-to-Government (G2G)

Figure 1. E-commerce and various internet applications (OECD 2000)

Governments in developed and a few developing countries have identified popular shopping platforms online which encompass around 10% of the Gross Domestic Product (GDP) by introducing new means of conducting their business or opening doors to the Business to Government (B2G) model. This platform or technology, while facilitating business transactions, helps information exchange as well (G2C, G2B). These methods have proved to be useful for many, as they introduced people to these technologies that were accompanied by effective payment systems. The payment systems followed tax laws and business considerations by providing post-purchase services and creating a direct line from the manufacturer to the market (OECD 2000).

2.1.5. E-Commerce: Benefits

The reason for the employment of E-commerce is best explained through the benefits of this business model. The benefits of this model are what encourage the companies to accept the use of the internet in their business with open arms. The benefits of E-commerce can be divided into direct and indirect benefits. The direct benefits can be estimated through the data of new customers after the employment of E-commerce. And the indirect benefits include customer loyalty which results from the added value that is created by the use of E-commerce.

Other benefits of E-commerce are listed in the following:

- Higher information exchange between the customers and suppliers.
- Better customer service
- More accessible business model
- Access to new and global markets
- Lower costs
- E-commerce introduces benefits to both the buyers and sellers resulting in a win-win situation.
- Higher revenues and lower sales costs
- Even a small business can promote its products at the global level
- Having the ability to reach regions in other parts of the world

- Finding new and cheaper suppliers and new business partners
- The high pace of business transactions reduces the costs for both the buyers and sellers.
- The buyers can buy from a wide range of products that were not available in the previous business models.

Moreover, some obstacles are formed in the path of using E-commerce for the sales of products:

- Lack of suitable technical education
- Lack of cost-friendly e-commerce software
- Lack of general access to the resources
- Cyberphobia
- The complexity of the enforced changes
- Inter-organizational motivations and supply and support costs
- Prioritizing e-commerce innovations

2.1.6. E-Commerce Maturity Models

In the following, some of the major e-commerce maturity models are enlisted:

1. Asia-Pacific Region Maturity model

In this model, Wescott introduces six stages of e-government in the Asia-Pacific region, including Setting up an email system and internal network, Enabling inter-organizational and public access to information, Allowing 2-way communication, Allowing exchange of value, Digital Democracy, and Joined-up government.

2. Gartner Maturity Model

In 2002, a model was introduced by Gartner's team that consisted of four stages: presence, interaction, transaction, and transformation (Sergi et al. 2019).

3. Dhingra and Misra Maturity model

Dhingra and Misra introduced a model that has an organizational approach to e-government maturity. This model stresses the stages that organizations go through to enforce e-commerce. This model introduces six stages for e-government maturity: Closed, Preliminary, Initial presence, Perceived, Institutionalized, and Optimized (Sartelli et al. 2017).

4. Utah State Maturity Model

In 2002, Windley introduced a model for e-government maturity based on the needs of Utah as a state. According to this model, e-government maturity has the following stages: simple website, online government, integrated government, and transformed government (Scheer 2012).

5. Deloitte and Touche Maturity Model

In 2000, Deloitte and Touche introduced a model for e-government maturity. In this model, e-government maturity was introduced within six stages: The 1st stage is information publishing. The 2nd stage is an official-two way transaction. The 3rd stage is a

multipurpose portal. The 4th stage is portal personalization. The 5th stage is a clustering of common services, and the 6th stage is full integration and enterprise transaction.

6. United Nations EC Maturing Model

In this model, five stages are introduced for e-government maturity: (1) Emerging presence, (2) Enhanced presence, (3) Interactive presence, (4) Transactional presence, and (5) Seamless or fully integrated presence.

Most of these models examine e-government maturity within the governments or agencies by conducting limited interviews and studying the websites of these agencies. These models do not follow specific steps and only provide a general overview of the system. Therefore, one of the flaws of these models is not following a specific structure based on which one can study the multiple aspects of e-commerce within a government or an agency (Milicich et al. 2021).

7. E-commerce Roadmap Model

The E-commerce Roadmap Model showcases the present and desired situation of a business, indicating the process of e-commerce maturity within a business in five stages:

- I. First Stage – lack of capacity: in this stage, the company does not have a website and it does not have access to the websites of other companies either. In this stage, data and documents are stored non-electronically within physical documents. And the companies exchange information using telephone and fax.
- II. Second stage – Access: in this stage, the company still does not have a website but it has access to the websites of other companies. In this stage, data and documents are stored non-electronically and by the use of physical documents.
- III. Third Stage – Stationary: in this stage, the company has a website and the companies exchange information electronically. However, the data and documents are still stored non-electronically and by the use of physical document.
- IV. Fourth Stage – Interactional: in this stage, information exchange takes place more actively and forms are filled out electronically. The data and documents are still stored non-electronically within physical document. However, a limited number of documents might be stored electronically and singlehandedly.
- V. Fifth Stage – Transactional: in this stage, information exchange takes place in a more sophisticated and active form and documents can be exchanged electronically as well. However, since the transactional level is the first level of the electronic exchange of documents, this transaction might not take place completely or it might only take place between two companies and lack the essential integrity. In this stage, purchases and payments take place online. In this stage, electronic monetary transactions can take place.
- VI. Sixth Stage – Integrated: the integrated level is the desired level for the maturity of the electronic exchange of information, data, and documents. The developments made at this stage compared to the previous stages allow the information to be exchanged not

only within two agencies but within all related agencies as well. In this stage, an integrated transaction between the agencies takes place. Before employing the E-commerce Roadmap Model, it is important to recognize where your business stands at the present level and where you are willing to go in the e-commerce world. In other words, to employ e-commerce within a business, one must first examine its current situation and the factors that impact its current and future states. Then, while aiming at the desired future for one's business, one must plan and act accordingly (Chuang & Shaw 2005).

2.2. Environmental Nanoproducts

The environment is one of the main aspects of sustainable growth. That is why; we must enforce the principles of sustainable growth (e.g. economic and technological growth) in such a way as to combat the shortcomings of the previous models. The present models should outwit the past models when it comes to sustainability and growth and the patterns of development must be laid out in such a way that does not disturb the natural order of the surrounding environment. The term "sustainable development" was first introduced in the 1980s to the science of economy. So far, multiple interpretations have been introduced for this term. There are three approaches to sustainable development: the first approach is the "market-based approach," which believes the cornerstone of sustainable development is economic and technological development. According to this approach, the economic ability which has resulted from economic and technological development is the most important factor in the preservation of the environment since in less-developed and poverty-stricken countries it is the environment that hits hard when the economy collapses (Fulekar & Pathak 2017). The second approach which is called the "neo-Marxist approach" believes that sustainable development in the current political and economic state of the world cannot be achieved and believes that sustainable development can only be achieved if a fundamental change in the political-economic system of the world and the relations between the developed countries occurs. Finally, the third approach which is called the "environmental approach," believes that economic development is fundamentally rooted in the destruction of the environment; therefore, it suggests to preserve the environment, all production and consumerism must be seized (Wiesner & Bottero 2017). Therefore, the countries that are in their first stages of development, or are underdeveloped, will drain their natural resources and create pollutions and pollute the environment through their efforts to reach higher states of development such as agricultural development and mining using dilapidated infrastructure in terms of the technology and industry that is needed for these actions. The results of such endeavors reaffirm the Environmental Kuznets Curve (EKC) (Fulekar & Pathak 2017). Based on the market-based approach, the development of technology will cause less pollution. However, that is if the technologies that are enforced are environment-friendly; the growth that is caused by these technologies in developed countries is called "green growth." In the 1990s, multiple studies took place to test the hypothesis of the Environmental Kuznets Curve (EKC) and the factors that impact the environment, including the use of technology, using Adhoc models. This process was

continued in the 2000s, which was able to successfully attest to the credibility of EKC on the grounds of logic. In this framework, Copeland and Tyler introduced a model to examine the relationship between the environment and technology. In their model, two products X and Y were introduced each of which has high productive capacities (Hannah & Thompson 2008). These two products have different rates of creating pollution. Product X creates Z pollutants while being manufactured, while product Y does not create any pollutants while being produced (Das et al. 2019). So far, multiple studies have taken place on the impact of nanotechnology on the environment of which Motiei and Khayat (2011) is one which examined the effectiveness of nanotechnology in the fight against pollutants and reducing air pollutants. Motiei and Khayat (2011) discovered that nanoproducts have a positive impact on resolving environmental problems. Moreover, Alizadeh and Shahvardi (2006) studied the application of nanotechnology in environmental concerns and reusable energies and discovered that nanoproducts remove pollutants from the environment. The United States Environmental Protection Agency 2002 studied the application of nanoproducts in the environment and declared that nanotechnology plays an important role in the identification, examination, and removal of air and soil pollutants. It is also responsible for the discovery of green industries that reduce the production of pollutants to the bare minimum.

2.3. IT Absorptive Capacity Theory

IT Absorptive Capacity Theory is a ring in the entire chain of life and especially in IT studies and the adaptation of IT and its applications (Liang et al. 2007). The absorptive capacity of IT impacts the profits made by the investment in IT resulting in a consensus about the value of IT (Nevo & Wade 2010). IT Absorptive Capacity Theory is derived from the field of Macroeconomic Research which refers to the studies about the capacities to use and absorb external resources and information (Adler 1965). Years later, this concept was formally introduced by Cohen and Levinthal (1990). They believe that the absorptive capacity relates to the organization's capacity to identify, absorb, and employ external information for business purposes, including cognitive and practical abilities. On the other hand, many scholars believe that the absorptive capacity can be divided into two separate capacities (Zahra & George 2002):

1. The potential absorptive capacity
2. The actual absorptive capacity coordinates innovative inter-organizational actions with external opportunities (Makhloufi et al., 2021). Indeed, IT absorptive capacity is considered the normal procedure in which the internal and routine procedures within an organization take place (Purvis et al., 2001). In general, IT absorptive capacity is the procedure of adaptation, management, and application of IT in organizations which indicates the impact of IT which is highly observed in organizational and business transactions (Sodero et al. 2013).

Indeed, IT absorptive capacity is a general overview of the documents which includes the process of adaptation of e-commerce from being introduced to it to making it a part of the routine procedures in the company which is highly supported by the company members. Saga and Zmud

(1994) introduced six stages for the process of IT absorptive capacity which include establishment, purchase, layout, adaptation, normalization, and internalization. Moreover, multiple researchers have conducted multidimensional research on Cohen and Levinthal's view. They defined absorptive capacity as the relationship between organizational learning and the absorptive capacity, innovation and absorptive capacity, information exchange, and absorptive capacity.

Many researchers believe that IT Absorptive Capacity directly impacts the effectiveness and productivity of business transactions within the organizations which can improve the rate at which the company responds to the market needs. The more the capacities to identify, absorb, and organize external information, the better the performance of the IT Absorptive Capacity. This theory provides the essential argument for this study. It lays out the difference between "adaptation" and "absorption" of e-commerce of agricultural products: adaptation relies on recognition, acceptance, and application of e-commerce for agricultural products while absorption focuses on the normalization and internalization of e-commerce within the organizations. In this study, the concept of IT absorptive capacity of e-commerce for environmental nanoproducts reflects the entire process from the adaptation of e-commerce of environmental nanoproducts to the normalization of e-commerce of environmental nanoproducts and its internalization and integration within the organization (Lyu et al. 2022).

3. Conclusion

Today technology is developing every aspect of human life at a high pace. The ease and comfort that technology has brought to our lives introduce dire consequences for the environment. Some of the benefits of E-commerce include lowering sales costs since with the use of E-commerce there is no need for mediatory figures to connect the buyers with the sellers. As a result, products and services, including insurance, health, and financial services will cost less. The lower costs of these services will improve the management skills of the heads of product lines while promoting the supply chain, increasing the competitive value of the products in the market, lowering the products' prices, and developing the market. E-commerce allows both buyers and sellers to develop their businesses by exchanging information and promoting the market. E-commerce affords customers more choices and ease of purchase which facilitates customer trust. A customer that has faith in the system is more willing to purchase and this is how the market develops. In recent years, nanotechnology as a novel field of science has been used to create environment-friendly nanoproducts. The ever-growing field of nanotechnology has facilitated the use of nanoparticles in many products. However, so far no studies have expounded upon the impact of e-commerce on environmental nanoproducts. This study is an attempt to examine the impact of the development of E-commerce of environmental nanoproducts based on IT Absorptive Capacity Theory.

The study findings suggest that IT Absorptive Capacity Theory can positively impact the e-commerce of environmental nanoproducts; however, more studies need to be conducted to determine its effect. By promoting the E-commerce of environmental nanoproducts and merging E-commerce resources and the process of manufacturing and management of nanoproducts, the

positive impact of E-commerce is highlighted. Based on the different stages of E-commerce absorption, the effective variables in the different stages of E-commerce absorption of environmental nanoproducts will compel the manufacturers of environmental nanoproducts to further develop the positive impact of E-commerce on their trade. Therefore, based on Absorptive Capacity Theory, it can be suggested that merging resources at any stage can play a key role in the development of E-commerce for environmental nanoproducts. Moreover, the creative solutions proposed by the policy-makers are another key factor in the development of e-commerce of environmental nanoproducts according to Absorptive Capacity Theory. At the first stage of E-commerce absorption, the marketability of environmental nanoproducts can increase its impact. In the middle stage, using internet shops can promote the impact of e-commerce. In the advanced stage, advanced maintenance services, retaining your loyal customers, creating a logistic sub-warehouse, and forming an expert e-commerce team can increase the impact a great deal. Therefore, when the new environmental nanoproducts arrive each within different stages logically distributes different resources, determines the standard space, and follows up with the e-commerce model stage by stage.

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