International Journal of Electronic Commerce Studies
Vol.13, No.2, pp.49-98, 2022
DOI: 10.7903/ijecs.1967

A Mathematical Model to Support Sharing Economy Concept in B2C Ecommerce Systems

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ABSTRACT

This study proposes a mathematical model that makes it possible to rewrite the general architecture of business to customer (B2C) e-commerce systems to use sharing economy models and mechanisms to extend the commerce system and increase its accessibility. To this end, while presenting the utility function of e-commerce systems, developing this function has been proposed as the function to respond to customers' requests. In the function of response to the customer demands, the activities of each business enterprise are investigated to meet the customers' needs inside and outside the commerce system. To derive the utility function of the B2C e-commerce system, by considering the concept of activities in the local business system and other business systems, while examining the e-commerce system descriptors, each index is analyzed

based on how it influences and is influenced by running the activity in the local business system or other business systems. Analyzing the descriptive indicators of sharing economy, the functional architecture of the sharing economics is presented as well. Based on the functional architecture of the sharing economy and the mathematical function of the e-commerce system functionality, a model for utilizing sharing economy in B2C e-commerce systems has been proposed.

Keywords: B2C Ecommerce Systems, Sharing Economy, Mathematical Model, Activity, Indicator

1. INTRODUCTION

E-commerce systems are designed to reduce the cost of trading activities by removing time and location constraints governing traditional business systems. These types of business systems aim at trading via using the capabilities of distributed systems, such as the Internet. Utilizing the features of scalability, communication with other systems (openness), and keeping users away from the complexities of performing activities (transparency), e-commerce systems should be able to trade on behalf of the user and the business so that they can consider all the available resources in the system as their local resources. In such a situation, the business is open to the customer at any time and location, and the customer can receive services or purchase goods from the business. This is especially important in B2C e-commerce systems, where there is a large number of customers with a broad geographical spread [1-4].

In this type of business system, as in traditional business systems, the business should respond to customers' requests by considering customers' conditions and limits. Defining concepts such as time, location, and social value for customer requests will make the customer quit trading with the given business and start selling with another business if the business in question fails to respond to the requests and demands by preserving the stated benefits [5, 6]. Among the values governing the customer space, the concepts of time value and commerce openness have a higher priority from the customer's point of view.

Openness is one of the most important differences between conventional and e-

commerce systems. In traditional commerce systems, trading takes place at a specific location. Although traditional commerce systems attempt to expand the scalability of the business activities based on a set of functions, the nature of the products and goods or the business capability to offer services makes it impossible to provide goods and services at any place. In e-commerce systems, due to transmitting the business from the traditional space, with time and space constraints, to the Internet platform, which is potentially scalable, the customer expects the business to be capable of providing a system with high openness, compared to traditional commerce systems. From the business perspective, it can be available and open to the customer when it is scalable. One of the most essential and efficient mechanisms used to make the e-commerce system scalable is to use the concept of communication with other systems. In this sense, the concept of an e-commerce system can use other commerce systems to respond to the customer's requests in the domain of services and goods to increase commerce openness [7, 8].

In a commerce system, regardless of whether it is implemented electronically or traditionally, the primary purpose is to use infrastructure and share sources to increase the openness of the system or increase the ability to respond to the customers' requests in time units. In traditional commerce systems, when the trade has a broad geographical spread, numerous patterns, such as business partners, outsourcing, changing the supply chain structure, representatives, establishing regional branches and delegation of authority, sharing infrastructures, and partnership-based economies are used [9]. This increases the commerce system, and consequently, business openness. In this situation, the business will provide services and sell goods to customers in multiple markets. Employing the patterns defined in sharing economy will enable the business to develop the market concept and use the infrastructures of other enterprises to respond to the customers' requests in the shortest possible time.

In traditional trading systems, the patterns defined in the sharing economy are used as strategies to increase the scalability, and consequently, the openness of the commerce system, and reduce the responding time. On the other hand, the Internet system, as a distributed system, is scalable and can use different systems to run activities and manage requests. However, in the architectures and frameworks provided for e-commerce systems, no solutions and indices have been provided for using other systems, mainly for employing sharing economy models to reduce the responding time for customers' requests and increase scalability, and consequently, improve the commerce system

openness. The main reason is the computerized part of the e-commerce system. Due to utilizing computing and processing systems (high-performance computing systems) as well as the Internet communication system, the concept of sharing economy to develop the market or reduce the responding time is not discussed. In these types of commerce systems, activities needed to create the market or reduce the response time must be supported by high-performance computing systems and the Internet.

The architectures and frameworks provided for e-commerce systems mainly focus on performing components of the customers' requests that must be responded to by computer systems. As a result, the provided architectures and frameworks mainly focus on parts of the business, and subsequently, parts of the response structure conducted by computer systems and on the Internet platform. However, in an e-commerce system, requests related to the electronic and non-electronic sectors not only affect each other, but they also influence various concepts such as whether or not to use infrastructure and share resources to increase the openness and market development or to enhance the ability to respond the customers' requests and reduce the response time.

While examining the descriptive indicators of B2C e-commerce, this paper also investigates the descriptive indicators of sharing economy as a strategy to share resources and infrastructures for trading to develop the market and increase openness. To analyze the functionality of an e-commerce system, based on matrix algebra and mapping utility functions, the space of responding to customers' requests is analyzed locally or in the form of using other business system resources and globally. Meanwhile, based on the extracted mathematical functions, descriptive indicators of sharing economy and the e-commerce system focusing on how to perform the activities related to responding to customers' requests will be analyzed locally or globally. This analysis will lead to extracting descriptive functions of the e-commerce based on the indicators affecting scalability, and to using sharing economy models. The analysis also leads to presenting the communication architecture of the descriptive elements of sharing economy and using the extracted architecture as an e-commerce system tool for market development. Consequently, by redefining the general architecture of e-commerce systems, this paper introduces a mathematical model that allows using the sharing economy concepts as strategies to increase openness and market development in B2C e-commerce systems.

2. Basic Concepts

This section will examine the basic concepts governing e-commerce systems and the

sharing economy. This paper uses the concept of sharing economy as a solution for utilizing the capabilities and structures outside the e-commerce system. The sharing economy can be considered as a tool for scalability and increasing the openness of the business activities to respond to customers' requests. Examining these two concepts provides an accurate scheme of the functional nature of e-commerce systems. Consequently, activities or times when the concept of sharing economy can be used as added value for these types of commerce systems. To this end, while analyzing the functional indicators of the e-commerce system, it should be possible to analyze the situations in which the sharing economy indicators can be used to increase the ability to respond to customers' requests or the e-commerce openness. An overall approach should be able to examine useful indicators in outsourcing, collaboration, and any activities that reduce time and cost and make it possible to offer services or sail goods for the business in a broader geographical or numerical range. On the other hand, in a sharing economy, it is also essential to investigate what indicators are considered as the criteria for sharing and shared use of resources. Matching these indicators allows offering a shared B2C e-commerce architecture.

2.1 What Does an Activity Mean in E-Commerce Systems?

The underlying assumption in designing e-commerce systems is that the existence of a widely distributed system such as the Internet enables businesses to exploit the capabilities of this system to achieve a broader range of customers or improve the business performance indicators from the customer perspective. The Internet makes the concepts of openness and market development of e-commerce systems radically different from marketing concepts and transparency and market development of traditional commerce. In e-commerce systems, due to the existence of technology, and in particular the Internet, new frameworks, models, and mechanisms are proposed in the area of openness and market development and based on the two traditional commerce concepts as well as the fundamental concept of technology and the distributed Internet platform [1, 4]. In this area, the two concepts of scalability and openness, which are themselves the result of the broadness and technology-based nature of e-commerce systems, are considered key indicators of the different structures, mechanisms, and patterns of e-commerce market development compared to traditional commerce systems. These two concepts are known as fundamental concepts of market development and entering new markets in e-commerce systems.

Because of the technology-based nature of e-commerce systems, businesses can respond to customers' requests based on their technological capabilities. In these commerce systems, each customer request is turned into a set of requests that can be responded to by computer systems, and into traditional requests. If the business faces a challenge concerning the requests converted into answerable requests and fails to respond to a specific number of requests per time unit, it will enhance its responding capability via high-performance systems. If the business cannot respond to traditional requests, it can use the traditional patterns utilized to improve and execute this set of requests at a specific time unit.

In e-commerce systems, a business must manage and execute technology services and traditional activities in such a way that adopts the customer value space, especially customers' values spaces, especially time value space of the commerce from the customer. From the customer's perspective, if the business is available to the customers at any time and place based on its mechanisms, in both traditional activity and technology services, the business has the openness feature. Business openness means its presence in any market where the customer is present. From a business perspective, reducing the response time means using technology tools and services to perform traditional trade-related activities. An e-commerce business, like conventional commerce systems, is providing services or selling goods to customers. The process of doing business activities stemming from traditional commerce and the nature of the business is known as Traditional Activity. On the other hand, the business has to do a set of activities associated with changing the commerce environment from traditional to e-commerce. This set of activities is performed using computational and communicative tools based on distributed systems such as the Internet network to trade without time and space constraints. These activities are known as Technology Services [6].

In e-commerce systems, the business must manage and execute both Technology Services and Traditional Activity in a way that is consistent with the customers' value spaces, particularly the time value space of the trade and the value of making the business from the customer's perspective. In traditional commerce systems, only Traditional Activities are performed for a specific customer spectrum at a particular time slot and a specific location. In contrast, in e-commerce systems, both types of activities are performed for a broad range with a high geographical spread with no time and location limits. Therefore, the business in this type of commerce system uses multiple models to

provide the infrastructure for both kinds of activities.

Typically, in designing the patterns and models of e-commerce systems, especially the B2C e-commerce model, the focus is on the customer's requests that can be responded to by computer systems. However, in real e-commerce systems, the nature and function of answerable requests and traditional requests affect each other. This impact also influences both the number of answerable requests per time unit and the business openness from the customer's perspective. From the customer's point of view, if the business is open to the customer at any time and space based on its mechanisms in both Traditional Activity and Technology Services areas, then the business has the openness feature. From the business point of view, this means scalability or communicating with other business systems to meet the customers' requests. One way to enhance openness and use other resources to increase the number of answerable requests per unit of time is to use the concept of geographical scalability in the commerce system. The most critical impact of scalability on the e-commerce system is market development, and consequently, increased number of customers, increased customer satisfaction due to receiving services in a broader geographical area, and the possibility of increased customer loyalty due to the increased probability of the customer using the business's services or goods.

In traditional commerce systems, in a situation where trading requires a broad geographic spread, and numerous patterns such as business partners, outsourcing, changing the supply chain structure, representativeness, establishing regional branches and delegating authority, and sharing infrastructures are utilized. Using the patterns mentioned above is based on specific protocols between the business and other firms or stakeholders so that performing the Traditional Activity is acceptable to the customer. The nature of e-commerce systems is such that due to using the Internet network, the customer expects that the business activities in any geographical area are acceptable. From the customer's perspective, in this type of commerce system, the geographic range of the market is equal to the geographic range of the Internet as an e-commerce platform. In the real world, the Internet network has the mechanisms and patterns to support the geographic spread intended by the business in the area of Technology Services. If the business provides the customer with a service or product, then other mechanisms are needed to support the geographic range intended by the business in the area of traditional activity. Hence, e-commerce systems need to consider mechanisms, structures, and models for geographic scalability in the field of Traditional Activity. These mechanisms,

structures, and patterns cannot be equivalent to traditional mechanisms and frameworks for geographic market scalability. This is because the nature of trade in e-commerce systems is a two-dimensional space of Traditional Activity and Technology Services, which influence each other. However, in traditional commerce systems, the trade space is a one-dimensional space resulting from Traditional Activity.

In e-commerce systems, both Traditional Activity and Technology Services must be scalable to achieve the concept of scalability. The scalability of both Traditional Activity and Technology Services should be aligned with the customer's value spaces and the commercial value from the customers' perspective. If any of the activities in the Traditional Activity or Technology Services activities do not correspond to the customer's time values and the commerce value the customer will terminate the trade. As a result, in e-commerce systems, the framework or architecture of the e-commerce system must satisfy equation 1.

$$F(ECommerce):$$

$$\left[\begin{array}{c}\sum_{i=1}^{Cmplete\ Operation} Customer\ Request_{\text{Technology Services}}, \\ \int Customer\ Request_{\text{Traditional}}\text{Activity}\end{array}\right]^{\left[\begin{smallmatrix}Time,Location\ Value,\\ Commerce\ Value\end{smallmatrix}\right]}_{\rightleftarrows} Answer_{Operation}\ Eq.1$$

As shown in Eq.1, the e-commerce system framework or architecture must be able to map Traditional Activity and Technology Services of the customers at any time of the transaction process into responding requests under the two concepts of customer value and time and location value. In the architectures and frameworks introduced for e-commerce systems, Technology Services are typically discrete, and Traditional Activity is continuous. The reason is that the activities related to Traditional Activity depend on the nature of receiving a response and meeting the customer's needs, and Technology Services activities are event-related. In Eq.1, customer response operations can also be examined in Technology Services and Traditional Activity. Taking into account commerce value and time and location values provide concepts such as customer loyalty, market development, openness, the number of answerable requests per time unit, and commerce scalability for the e-commerce architecture.

In e-commerce systems, Eq.1 typically focuses on Technology Services operations. As a result, the architecture and framework of the e-commerce manager focus on performing parts of the commercial operations, which are technology-based. On the other

hand, concentrating on Technology Services activities makes the introduced architectures and frameworks focus on two features of doing the operations in the shortest possible time. Consequently, the time values govern the commerce, and scalability of the commercial operations, and hence, the location value. Therefore, in these types of e-commerce systems, the mapping function is based on the concept of time and location value.

Since mapping focuses on time and location values, if the e-commerce system faces a situation where it cannot respond to a certain number of requests in a single time unit, or it needs market development to increase openness, it will utilize the system scalability pattern and communication with other systems to perform the operations related to Technology Services.

However, an e-commerce system comprises a two-dimensional space, consisting of Technology Services and Traditional Activity, which influences each other. In this regard, Eq.1 can be stated as Eq.2.

$$F(ECommerce):$$

$$\overbrace{\left[\begin{bmatrix} TS_{1,1} & \dots & TS_{1,n} \\ \vdots & \vdots & \vdots \\ TS_{m,1} & \dots & TS_{m,n} \end{bmatrix}, \begin{bmatrix} TA_{1,1} & \dots & TA_{1k} \\ \vdots & \vdots & \vdots \\ TA_{z,1} & \dots & TA_{z,k} \end{bmatrix}\right]}^{\overleftrightarrow{Dependency}}{}^{[Time,Locaion\ Condition]} \rightleftarrows Answer_{Operation}{}^{Scalibility}_{time} \quad Eq.2$$

As can be observed, Eq.2 is a redefinition of Eq.1 based on the matrix form of the e-commerce activities and their correlation. In Eq.2, the elements of the first matrix are the variables that define Technology Services activities. Each variable represents activity from a set of activities performed in Technology Services operations. Some of these activities are conducted on most e-commerce systems and others on a particular type of e-commerce. In $TS_{i,j}$, i represents the run time of $TS_{i,j}$ and j indicates the location where the activity is run. This is also true for $TA_{i,j}$. Based on Eq.2, the e-commerce system manager defines an example from Eq.2 for each commerce operation. The start-up time of the transaction is considered as the starting point of presenting Technology Services and Traditional Activity operations.

The starting point of the commerce location is where the customer requests are introduced to the business. The local starting point can be a website, an application, or any other place where the customer submits the initial requests to the business. As the commerce starts operating, and over time, the customer receives a set of $TS_{i,j,}$ and $TA_{i,j}$

activities from the business. For both activities, the index i represents the time of the activity. The value of this index is an integer, which indicates the interval between operating and commerce initiation. TSi,j, and TAi,j are likely performed at a given time when i = t. On the other hand, j indicates the activity location. Its value is one of the acceptable locations to do commerce. TSi,j, and TAi,j are likely performed at a specific location such as j=Location. In Eq.2, each of the two matrices is not mapped directly into the customer's request-response operation based on the concept of time and location constraints. According to Eq.2, in the function domain, first, the influence of $\begin{bmatrix} TS_{1,1} & \dots & TS_{1,n} \\ \vdots & \vdots & \vdots \\ TS_{m,1} & \dots & TS_{m,n} \end{bmatrix}$ and $\begin{bmatrix} TA_{1,1} & \dots & TA_{1k} \\ \vdots & \vdots & \vdots \\ TA_{z,1} & \dots & TA_{z,k} \end{bmatrix}$ matrixes on each other is calculated, and then the result is mapped to the response space of the customer request. Having analyzed how the matrices influence each other, the scenarios of continuing commerce can be extracted based on the two concepts of time and location. Given the extracted scenarios and considering the features of response space to customer requests, decisions can be made on whether to perform the commerce inside or outside of the business.

In Eq.2, the customer response space can be defined by the two concepts of scalability and time. The concept of time for the response space in Eq.2 is regarded as a limit. The e-commerce system must be able to manage the implementation of Technology Services and Traditional Activities in a way that they can respond to customer requests within a specific time condition. In this equation, the time condition can be true for any of the constituent sub-activities of the commercial activity or the entire commerce operation. If the time condition is related to any of the constituent sub-activities, then it is written in its matrix form. In Eq.2, the scalability concept is used as a tool to reduce the response time or expand the market and increase openness.

Given the repetitive nature of commerce activities for a specific type of business, it is possible to calculate Eq.2 with a good approximation for most transactions running in the business. As a result, when designing an e-commerce system for a business, having extracted the domain matrices of Eq.2, the scenarios for continuing the commerce can be extracted based on two propeller concepts of time and location. Given the response space, decisions can be made on two concepts of openness and scalability.

Taking into consideration these two concepts, the customer's request-response space can be described, as illustrated in Eq.3.

$$Answer_{operation}: \left[\left(\begin{bmatrix} L_{1,1} & \dots & L_{1o} \\ \vdots & \vdots & \vdots \\ L_{p,1} & \dots & L_{p,o} \end{bmatrix}, \begin{bmatrix} S_{1,1} & \dots & S_{1q} \\ \vdots & \vdots & \vdots \\ S_{w,1} & \dots & S_{w,q} \end{bmatrix}\right)^{time}\right] \overset{[Time,Locaion\ Condition]}{\rightrightarrows} \begin{bmatrix} A_{1,1} & \dots & A_{1g} \\ \vdots & \vdots & \vdots \\ A_{h,1} & \dots & A_{h,g} \end{bmatrix} \quad Eq.3$$

As observed in Eq.3, the response function domain is a conjugate matrix, which influences each other based on the independent variable of time. $\begin{bmatrix} L_{1,1} & \dots & L_{1o} \\ \vdots & \vdots & \vdots \\ L_{p,1} & \dots & L_{p,o} \end{bmatrix}$ demonstrates the activities that are locally responded to in the e-commerce system. In this matrix, L_{ij} represents the set of activities (both Technology Services and Traditional Activity) performed locally by the commerce system management element at the time i and location j. The local activity is a set of activities performed in the local commerce system without requiring other systems. $\begin{bmatrix} S_{1,1} & \dots & S_{1q} \\ \vdots & \vdots & \vdots \\ S_{w,1} & \dots & S_{w,q} \end{bmatrix}$ indicates activities performed non-locally and outside the local commerce system. The system manager needs to use other commerce systems to carry out $S_{i,j}$ at the time i and location j. This paper has used the operating and communicative mechanism of sharing economy to perform $S_{i,j}$. In the domain space shown in Eq.3, first, the influences of matrices $\begin{bmatrix} L_{1,1} & \dots & L_{1o} \\ \vdots & \vdots & \vdots \\ L_{p,1} & \dots & L_{p,o} \end{bmatrix}$ and $\begin{bmatrix} S_{1,1} & \dots & S_{1q} \\ \vdots & \vdots & \vdots \\ S_{w,1} & \dots & S_{w,q} \end{bmatrix}$ on each other are extracted according to the independent variable of time. Then, they are mapped into $\begin{bmatrix} A_{1,1} & \dots & A_{1g} \\ \vdots & \vdots & \vdots \\ A_{h,1} & \dots & A_{h,g} \end{bmatrix}$ under time and location conditions. $\begin{bmatrix} A_{1,1} & \dots & A_{1g} \\ \vdots & \vdots & \vdots \\ A_{h,1} & \dots & A_{h,g} \end{bmatrix}$ indicates activities performed to respond to the customer's requests. In this matrix space, each $A_{i,j}$ element represents doing activity A at the time i and location j. In e-commerce systems, the set of activities that must be performed in $\begin{bmatrix} A_{1,1} & \dots & A_{1g} \\ \vdots & \vdots & \vdots \\ A_{h,1} & \dots & A_{h,g} \end{bmatrix}$ to respond to the customer's request is typically specified when designing the system. Hence, in Eq.3, the function domain is regarded as the specific and defined part of the equation. Since $\begin{bmatrix} A_{1,1} & \dots & A_{1g} \\ \vdots & \vdots & \vdots \\ A_{h,1} & \dots & A_{h,g} \end{bmatrix}$ matrix is specified, the e-commerce system designer knows about

the activity $A_{i,j}$ and can make decisions on the corresponding activities of $S_{i,j}$ and L_{ij} by mapping time and location conditions. To make this decision, the e-commerce system designer needs to have precise and detailed information about the e-commerce model features, the business capabilities, the features of the mechanism of performing the activities non-locally, and the commerce nature as well. This decision implies identifying a set of activities that must be performed locally inside the e-commerce system or non-locally and outside the system lead to performing the activity $A_{i,j}$.

2.2 B2C Indicator

Given Eq.3, and that among the information required by the e-commerce system manager for deciding on performing local and non-local activities is the e-commerce characteristics, B2C e-commerce attributes and indicators, and their impact on doing the commerce locally or non-locally will be discussed. Figure 1 illustrates the general functional architecture of the B2C e-commerce system [10].

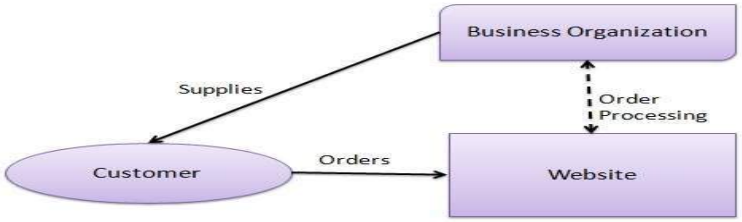

Fig.1: The architecture of the B2C e-commerce system

As illustrated in Fig.1, like traditional commerce systems, the business organization structure exists in the functional architecture of this type of commerce system. This business organization should be able to do a set of activities that will ultimately lead to traditional and technology activities. In the architecture shown in Fig.1, business organizations represent the activities originated from traditional commerce and websites represent activities derived from technology, and the customer, who is the most critical element in B2C e-commerce, seeks to receive services with two features of response in the shortest possible time and high openness.

In the architecture shown in Figure 1, all three represented elements have the potential to interact with other systems in e-commerce and scalability to reduce the transaction time and increase openness.

If the customer element is the focus of communicating with other systems, then the customer will be a link between several e-commerce systems. When the customer is present in more than one e-commerce system, this means that either the nature of the request was such that could not be responded to by an e-commerce system or one of the e-commerce systems in which the initial request was formed had been unable to respond the customer's requests. The former occurs when the nature of the request is such that a single e-commerce system cannot be used to respond to it. In this case, the customer is aware of such a situation, which is called the e-commerce system inability from the customer's point of view and divides the request into several small requests responded in different e-commerce systems, and in this way, the needs are fulfilled.

In the latter case, the customers submit their requests to a primary e-commerce system, but the e-commerce system cannot respond to them. On the other hand, the system cannot communicate with other e-commerce systems to respond to the requests. In such a situation, the customers are aware of the inability to communicate with other e-commerce systems. They must, as in the first case, split their requests into several sub-requests and send them to various e-commerce systems. It is not an ideal situation for an e-commerce system because the inability to respond to the customer's requests leads typically to leaving the e-commerce system and decreasing the number of customers. Due to the customer awareness of the e-commerce system's inability to respond to the requests, the customer element cannot be the starting point for e-commerce scalability. The customer's knowledge of the process of running the activities is also inconsistent with the nature of e-commerce systems, which try to keep the customer away from the complexities of running the activities.

In Fig.1, the business and the website are two aspects of the business. In the business organization shown in Fig.1, Traditional Activity and website are aspects of Technology Services.

It can be assumed that in the architecture displayed in Fig.1, the concept of communicating with other systems, sharing resources and services with others, and using the resources and services of others exist. In this case, the business or the website element must have the capability of sharing, especially time-sharing, in using the resources and services available in the business, whether in Technology Services or Traditional activities. The website also needs to be able to use the resources and services of other systems.

In using resources and time-sharing services, if the focus is on the website as a business organization's representative, then the e-commerce system management element can define Time-Sharing Transparency. In Time-Sharing Transparency, the website, as the business representative, receives the customer rights regarding responding to customer requests by other businesses or using services and resources of other service providers. It also uses the services and resources of other systems shared in e-commerce to receive customers' needs from resource and service providers and deliver them to the customers.

Although using the concept of Time-Sharing Transparency makes trading easier in the customer's view, it complicates the website implementation. In this paper, achieving the concept of time-sharing aims at Time-Sharing Transparency.

In such a situation, in addition to performing its regular duties, the business organization should also regulate the policies for utilizing time-sharing resources and services. It also needs to provide infrastructures and control and manage the time-sharing process of resources and services. As the business representative, the website should be able to provide services related to sharing or to use the time-sharing of resources and services. Through developing the concepts of scalability and communication with others, the website should be able to create a model and a framework to offer and receive time-sharing of resources and services from other systems (or to offer to others). Therefore, Openness and Scalability are the most critical indicators of e-commerce systems in the field of sharing. Only if can it develop Openness and Scalability indicators in the areas of Traditional Activity and Technology Services, the e-commerce manager can use the concept of sharing. Due to the implementation of e-commerce systems on a distributed system platform such as the Internet, it is easier to achieve Openness and Scalability indicators in these systems in the field of Technology Services activities. The e-commerce system manager should be able to develop the concepts of Openness and Scalability in the area of operations related to Traditional Activity.

Typically, in the area of Traditional Activity of traditional business systems, mechanisms such as supply chains, inter-business markets, and customer service are like offering the same services in other different markets, which have been done to increase scalability and communicating with other systems traditionally and without utilizing e-commerce concepts.

The most critical challenge in using such concepts in e-commerce systems is to

redefine the e-commerce architecture governing e-commerce considering the way of interaction and communication of scalability mechanisms with other systems in two areas of Traditional Activity and Technology Services.

On the concepts of extensibility and connectivity with other systems in the Traditional Activity field, taking into account the nature and behavioral differences in the two traditional e-commerce domains that interact directly with the customer and the customers. Traditional business is weaker, which can be noted.

About the concepts of scalability and communicating with other systems in the Traditional Activity field, taking into consideration the differences between the nature and behavior of traditional and e-commerce, it should be noted that e-commerce systems have direct contact with the customers and customers also have interactions with each other. Still, in traditional commerce systems, this interaction is weaker. Fig.2 illustrates the functional pattern of both traditional and e-commerce in the B2C model.

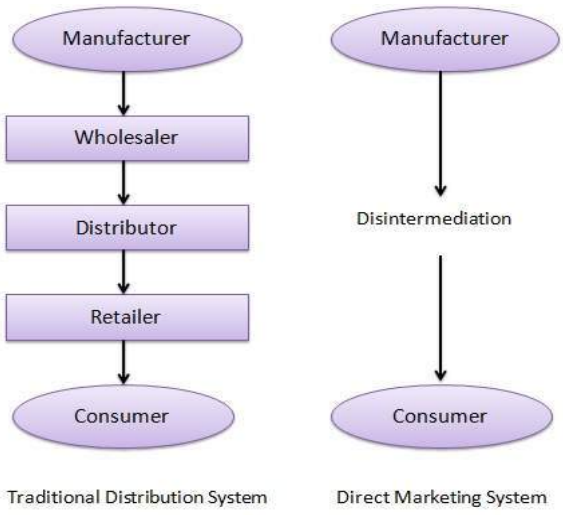

Fig.2: The difference between traditional and direct commerce

As illustrated in Fig.2, the functional and communicational structure of e-commerce systems is associated with fewer elements than traditional commerce systems [10]. However, intermediate elements extend the relationship between the customer and the business and are considered scalability tools, and they even cause customer interaction with other e-commerce systems. If the e-commerce system management element wants to use a model similar to that of traditional commerce systems for scalability and communicating with other systems without matching it to its difference with traditional commerce systems, then this will be inconsistent with the nature of the e-commerce

system, which is removing time and location constraints. Therefore, to achieve both Openness and Scalability as indicators of the possible use of the concept of resources and services' time-sharing, the concepts used in the area of Traditional Activity and even Technology Services should be reviewed by taking into account the functional purpose of the e-commerce system.

A. Trust

Trust is considered as the necessary foundation of commerce systems, whether traditional or technology-based. Due to the notion of trust in e-commerce systems, which leads to resource sharing and is also a part of sharing economy, in both Traditional Activity and Technology Services spaces where local and global activities are performed, time and location conditions are removed [11-14].

In Eq.1, trust is one of the main conditions that should be considered in customer value spaces, especially the time value space. On the other hand, in Eq.2, trust has a direct impact on both Traditional Activity and Technology Services matrices to respond to the customer request space. Thus, trust is one of the critical parameters in sharing systems for performing local and global activities based on time and location conditions. Without the trust index, the commerce space will not be mapped into the customer request space in Eq.3. On the other hand, trust, as a concept, is a function of openness. The higher the openness of the website as the business manifestation for the customer, the more the traditional and technology-driven operations will result in customers' trust in the presence in businesses and meeting the customers' needs. In Eq.3, trust is derived from the mental space of the customer and the business activities.

B. Sharing Information

The primary purpose of e-commerce systems is to provide a wide range of information about one (or more) commerce so that the customer can rely on this set of data to perform an acceptable trade from his/her point of view. The high volume of information on goods and services provided by the businesses would enhance the openness concept. Although challenges such as using the information provided by various business organizations are one of the most critical concerns in this area, shared information typically makes the businesses use $\begin{bmatrix} S_{1,1} & \cdots & S_{1q} \\ \vdots & \vdots & \vdots \\ S_{w,1} & \cdots & S_{w,q} \end{bmatrix}$ matrix to respond the customer requests in case they are unable to do it. The nature of information sharing

enables the business to discover information about service or goods providers through which customer needs can be met and responded at an appropriate time. Because of sharing information, combining the two matrices of local and global activities into the domain of Eq.3 leads to an increased likelihood of response and improved openness of the business. Given this approach, the sharing notion is the interface of the two matrices in the domain of Eq.3 [11, 15-18].

C. Information Quality

Although the concept of information quality is not offered as a quantitative indicator, it is of great importance both from the customers' point of view and in terms of interactions and communications between businesses. In traditional commerce systems, one of the conditions for successful commerce is having accurate and precise information about services and goods [11, 19]. This is more evident in e-commerce systems. Compared to traditional commerce systems in this type of commerce system, a more extensive range of businesses is available to customers. If the customers are not provided with high-quality information, they may leave the commerce process [20, 21]. On the other hand, if the business cannot receive quality information from the customer, then the likelihood of responding to the customer's request will decrease, and the space of choosing between goods and services will increase. Information quality does not directly contribute to openness and Eq.3. The concept of information quality is one of the factors affecting the concept of information sharing, reducing the response time, and deciding whether to use the local or the global activity matrix.

D. Website Usability

The website represents the business presence in the e-commerce system. In this type of system, customers usually have no perspectives of the business, and the business website is the only representation of delivery of services and selling goods for the customer. On the other hand, the business website is a manifestation of technology services offered by the e-commerce system to the business and the customer [19, 22, 23]. In Eq.2, one of the critical elements of the technology service providers is $\begin{bmatrix} TA_{1,1} & \dots & TA_{1k} \\ \vdots & \vdots & \vdots \\ TA_{z,1} & \dots & TA_{z,k} \end{bmatrix}$. The more a business website can be used more effectively by the customer or the greater ability it has to define the services offered by the business, the more the customers are bound to do commerce activities in the business. If the business

website is designed based on internet engineering principles, the business website openness will be more likely to increase. Besides, if the business website is designed according to the principles of software engineering, it can be utilized by other e-commerce systems by providing appropriate API (s) for other websites.

In Eq.2, the effect of the matrices $\begin{bmatrix} TS_{1,1} & \dots & TS_{1,n} \\ \vdots & \vdots & \vdots \\ TS_{m,1} & \dots & TS_{m,n} \end{bmatrix}$ and $\begin{bmatrix} TA_{1,1} & \dots & TA_{1k} \\ \vdots & \vdots & \vdots \\ TA_{z,1} & \dots & TA_{z,k} \end{bmatrix}$ on each other shows the capabilities of the e-commerce system examined. These capabilities show what set of activities the e-commerce system can perform and, consequently, what kind of requests it can meet. The effect of these two matrices on each other shows what kind of requests the e-commerce system can respond to and what activities it can execute based on the capabilities of the traditional business system as well as the capabilities obtained from technology. Given this and that the website is the representative of the business in the e-commerce system, and that the website is a manifestation of using technology in the e-commerce system according to the customer, one can state that the capabilities of a website show the capabilities of using technology and the capabilities defined in the traditional commerce system used in the e-commerce system. With this approach, the capabilities of the website - as the representative of the business in the e-commerce system are the activities that could be implemented and responded to by the business based on using both technology and the capabilities defined in the traditional commerce system.

Considering the concept of website capabilities, one can state that in the case of non-use of sharing economy concept, website capabilities describe the set of activities in the matrix $\begin{bmatrix} L_{1,1} & \dots & L_{1o} \\ \vdots & \vdots & \vdots \\ L_{p,1} & \dots & L_{p,o} \end{bmatrix}$ expressed in Eq.3. Each of the activities defined in $\begin{bmatrix} L_{1,1} & \dots & L_{1o} \\ \vdots & \vdots & \vdots \\ L_{p,1} & \dots & L_{p,o} \end{bmatrix}$ the matrix shows the ability of the website is responding to customer demand either based on using technology-driven features or the capabilities of a traditional business system. In the case of using sharing economy by the e-commerce system, the website capabilities can be examined after examining the effect of $\begin{bmatrix} L_{1,1} & \dots & L_{1o} \\ \vdots & \vdots & \vdots \\ L_{p,1} & \dots & L_{p,o} \end{bmatrix}$ and $\begin{bmatrix} S_{1,1} & \dots & S_{1q} \\ \vdots & \vdots & \vdots \\ S_{w,1} & \dots & S_{w,q} \end{bmatrix}$ matrices on each other, regardless of spatial

constraint and just by considering temporal constraints. Considering the effect of two matrices on each other as time constraints enable describing the set of activities that can be done by a business utilizing the capabilities of other businesses.

As already stated, a set of website capabilities are due to the capabilities of the traditional trading system used. These features can be used in the e-commerce system in case a) the stated capability does not cause a time and spatial constraint on the execution of the activity (activities) defined based on the mentioned capability, b) the website is technologically capable of providing the services, and c) does not violate the openness, scalability, and transparency features defined for the e-commerce system. These three issues may prevent the business from using all the features defined in the traditional business system and providing these features to customers as a website. Concerning the application of some capabilities and features of the traditional commerce system on the website, one has to redefine these features based on the concepts of e-commerce and technologies used in e-commerce to be used in business. This allows the website to define a set of capabilities resulting from matching the traditional trading system features with technology capabilities besides providing technology-driven capabilities and the features of the basic traditional trading system.

As already stated, another part of the capabilities provided by the website stems from the nature of the technology. These capabilities come from the three areas: the technologies affecting communications and infrastructure and network interactions, the technologies affecting customer interactions and communications with the website as the representative of the business, and the technologies affecting computing and processing customer requests. Each of these capabilities, besides being affected by temporal and spatial constraints, follows another constraint called the technology constraint. The concept of technology in the case of a website is discussed as the representative of a business in two areas: a) the possibility of technology and b) the cost-effectiveness of using technology. The capabilities of the technology used by the website should be able to improve one (or more) of the three features - openness, scalability, and transparency - about the website. The technology used by the website either improves the interaction and communication of the website with other websites or e-commerce and traditional structures, or makes it possible to expand the e-commerce system and remove the temporal and spatial constraints of performing activities related to trading, or improving, to keep users away from the complexities of either e-commerce or traditional trading systems.

On the other hand, the website, as the representative of the business enterprise, has to be able to provide a set of guarantees for the implementation of the activities stated in $\begin{bmatrix} TS_{1,1} & \dots & TS_{1,n} \\ \vdots & \vdots & \vdots \\ TS_{m,1} & \dots & TS_{m,n} \end{bmatrix}$ and $\begin{bmatrix} TA_{1,1} & \dots & TA_{1k} \\ \vdots & \vdots & \vdots \\ TA_{z,1} & \dots & TA_{z,k} \end{bmatrix}$ matrices to the user exactly like the traditional business systems. The need for quality assurance in various aspects of the implementation of trade-related activities is a necessity. In traditional trading systems, there are different mechanisms, like protocols and contracts to ensure the implementation of activities or the quality of services and products. In e-commerce systems, besides the need to have multiple mechanisms to ensure the implementation of activities, or the quality of services and products, as the two elements customer and the business are operating in an unreliable platform called the Internet, there is the need to define mechanisms to ensure the quality of technology-based services and activities. The assurance of services quality and activities performed because of technology is a set of protocols and contracts between the customer and the business to implement the technology-based activity, considering the restrictions governing that activity.

Thus, in both $\begin{bmatrix} TS_{1,1} & \dots & TS_{1,n} \\ \vdots & \vdots & \vdots \\ TS_{m,1} & \dots & TS_{m,n} \end{bmatrix}$ and $\begin{bmatrix} TA_{1,1} & \dots & TA_{1k} \\ \vdots & \vdots & \vdots \\ TA_{z,1} & \dots & TA_{z,k} \end{bmatrix}$ matrices, there is a need to consider the concept of quality of services and activities for each activity. In the ideal state, QoS ($TS_{i,j}$) and QoS ($TA_{i,j}$) should be able to be defined for each $TS_{i,j}$, and $TA_{i,j}$ activity. The nature of QoS is different for TA and TS. The concept of QoS emphasizes the centrality of trade for TA and for TS, the centrality of using technology in the execution of activities.

E. Security

Although the concept of security is not explicitly stated in Eq.3, it is considered an essential and main necessity in e-commerce systems. If security is not established in an e-commerce system, then trading makes no sense neither for the business nor for the customer [24]. From the business and the customer elements perspective, for any defined activity in any sharing system, security is of great importance in the interactions between the business and the customer. Establishing higher security in these systems will make stakeholders put more trust in this space [25, 26]. The nature of security is a non-functional concept; thus, the customer expects the security concept to be fulfilled in all the commerce activities on the website, especially financial activities. The nature of

security is an effective-impressible space. It is influenced by the technical functionality and the pattern of performing commerce activities.

When executing commerce activities on the website, the customer expects that employing the technology outlined in Eq.2 would facilitate the operation and solve the mental challenges related to non-functional issues such as security. From this perspective, security is impressed by the technology space and the technology matrix expressed in Eq.2. Security is also affected by the functions performed by the traditional activity matrix stated in Eq.2. If the activities are not designed to meet the security of commerce, then the concept of security is not expected to be established.

On the other hand, the concept of security affects all the activities and features mentioned in e-commerce. The security element is one of the factors affecting the extraction of the interactions of the two matrices of function three-domain. Security is a crucial element that influences trust. On the other hand, security is a two-sided concept, and both the customer and the business expect each other to manage the commerce system so that the concept of security is established.

In traditional commerce systems, the concept of security focuses on the implementation of activities related to the transaction because of the possibility of customer presence in the processes. In this type of business system, a set of legal, ethical, customary, and sharia contracts are defined and implemented to ensure the security of activities related to trade between the customer and the business. In e-commerce systems, the existence of technology, the impossibility of the customer presence in the activities related to trade, and most importantly the efforts of the e-commerce system to establish transparency and keep the user away from the complexities of the activities related to trade issues pose new security challenges.

Using technology in e-commerce systems exposes this type of business system to a set of challenges arising from technology as well as the adaptation of traditional business systems services based on the features of e-commerce systems in addition to the security challenges defined in traditional e-commerce systems. This makes the concept of security in e-commerce systems be raised in three areas: a) security of business activities, b) security of using technology c) security of technology-based services. In the security of trading activities, besides considering the security challenges defined in traditional trading systems, the security of trading without temporal and spatial constraints must be considered too. The most significant security challenge in this area is the lack of definition

of time and space for the presence of the customer and the business in trading. There is a need to use identity verifiers and the possibility of defining and searching for the digital identity of the customer and the business to eliminate the temporal and spatial constraints of the presence of the customer and the business. In technology security, challenges like the accuracy of technology-based activities, customer and business security in case of using technology, and technology capabilities to establish security regardless of whether the technology is used for business are on the agenda. In the field of security of services provided by technology, not considering the concept of security of using technology based on use in the trade as well as services provided by technology to carry out trading activities as a part of the activities related to trading can be cited.

F. Products

In addition to being the basis of the trade, products specify the commerce type. This concept defines different kinds of commerce [27, 28]. In general, Eq.3 can be set for any kind of commerce, and what makes it possible to identify it for particular commerce is the concept of the product. The concept of the product implies a set of activities that must be carried out by the matrices of Eq.3. The product concept also influences the concept of customer and business organization. Some characteristics of the business and customers are defined by the product concept and analyzed and evaluated accordingly. The product nature also affects the mapping constraints stated in Eq.3. In addition to the customer concept, time and location constraints and terms are also dependent on the product concept. Conditions are generally defined based on the product concept.

G. Communication Quality

In e-commerce systems, communication quality can be discussed from three approaches [29, 30]. The first approach is how the customer and the business communicate and traditionally interact with the business. E-commerce is an extension of traditional commerce, and in the e-commerce architecture, traditional commerce rules, interactions, and communications lie at the bottom layer. This can be discussed more tangibly in e-commerce systems that are based on product delivery. In any B2C e-commerce system, a point can be considered where the customer traditionally interacts with the business. The second approach is how the customer and the business interact from an electronic perspective. The nature of e-commerce is such that the customer expects to communicate with the website, as the business representative, at the electronic level, without time and location constraints, and with the highest quality. Like traditional

business-customer relationships, a set of indicators can be defined as the indicators of electronic communications quality. Besides taking into account standard indicators of quality assessment, Internet performance indicators are also considered. The third approach is the way business organizations interact with each other to use shared services and goods. The concept of sharing products and services is also discussed between different businesses in traditional commerce systems. In the e-commerce system, in addition to considering the activities required to share services and goods physically and at the traditional commerce level, operations related to managing this process at the e-system level are used as an e-commerce platform, should also be taken into account.

H. Customization

In traditional commerce systems, the concept of customization and offering a customized commerce system are typically for particular customers. In these types of commerce systems, the physical nature of the commerce system does not allow the creation of flexible response structures suitable to each customer, except in special circumstances. However, in e-commerce systems, due to defining the concept of responding to the customer on the business website, it is possible to provide customization for each customer [31-33]. The concept of customization is usually regarded as a challenge in the interactions and communications between businesses. When a customer sets up a response structure proportional to his/her request, these structures are defined in the local e-commerce system of the customer and it is not necessary to follow customizations in other business organizations [34]. When a business proposes a mechanism for customization, it must be able to create customization structures in businesses with which it needs to interact in case it is unable to respond to its customers' requests. In this regard, rules and regulations are required to allow the concept of customization to be developed among businesses. These operations, laws, and regulations necessitate broader interactions and more significant operations among business organizations to create the concept of customization.

Given the explanations of the set of benchmarks affecting the B2C e-commerce system, Eq.3 can be rewritten in the form of Eq.4.

$$Answer_{operation}\left[\left[\overbrace{\left(\left[Trust, Security\ (T, Tech, Service), QoS(TA,TS)\ \right]\begin{bmatrix} L_{1,1} & \dots & L_{1o} \\ \vdots & \vdots & \vdots \\ L_{p,1} & \dots & L_{p,o} \end{bmatrix}, \left[Trust, WebSite\ Utility, Security\ (T, Tech, Service), QoS(TA,TS), Customization\right]\begin{bmatrix} S_{1,1} & \dots & S_{1q} \\ \vdots & \vdots & \vdots \\ S_{w,1} & \dots & S_{w,q} \end{bmatrix}\right)^{time}}^{Sharing\ Data\ (Data\ Quality), Product\ Attributes}\right] : \overset{\supset}{\overset{trust, Security, Product\ Attributes}{[Time, Localon\ Condition]}}\begin{bmatrix} A_{1,1} & \dots & A_{1g} \\ \vdots & \vdots & \vdots \\ A_{h,1} & \dots & A_{h,g} \end{bmatrix}\right] \quad Eq.4$$

As is seen in Eq.4, this Equation is a development of Eq. 3 by taking into account the effect of e-commerce indices on Eq.3. Eq.4 states that to respond to a customer request in business-to-customer (B2C) e-commerce systems, two matrices of activities must be performed locally and globally under Sharing Data constraints. Quality), Product Attributes interact with each other. The space from the interaction of two matrices performing activities locally and globally by the business to respond to the customer request must be mapped in time and space with the concepts of trust, Security, Product Attributes on each of the spatial and temporal constraints to the customer request-response matrix.

As Eq. 4 shows, the three concepts [Trust, Security (T, Tech, Service), QoS (TA, TS)] are as the coefficients and matrices weights of activities related to responding to customer requests at the local trading system level. One can consider a value for each of the variables Trust and Security (T, Tech, Service), QoS (TA, TS) that is between zero to one hundred showing the significance of each of these variables for the customer in trading. These two variables are defined based on the independent variable of the customer and the type of e-commerce. Trust concept can be evaluated by a set of indices like social proof, notable clients, security certifications, live chat support, and location map. The concept of security is considered in three areas of security: a) business activity, b) using technology, and c) services that can be provided by technology. Concerning QoS, the indices related to QoS in both traditional and e-commerce systems have been taken into account.

For activities that need to be performed by the businesses outside the local e-commerce system, [Trust, Website Usability, Security, QoS, Customization] variables are regarded as useful variables and the coefficient of each response activity by using other commerce systems. A value between 0 and 100 can be considered for each of these variables, indicating the importance of each variable to the customer in commerce. Trust and Security variables are defined in terms of the independent variables of the customer and the commerce type. Website Usability is determined based on the independent variable of organization capability, technology, customer, and commerce type. QoS and Customization are defined in terms of the independent variables of the customer, the space of customer request (or requests) constraints, as well as the technology. Determining the scope for doing the operations outside the local commerce system is based on these variables results from the interaction of the two e-commerce systems. In the interaction between the two e-commerce systems, some components of the operations need to be

performed in e-commerce and some other components in the area of traditional commerce systems. These variables affect the interaction and communication between the two e-commerce systems in both traditional and electronic areas. Some of these variables, such as Website Usability, directly affect the electronic domain of interactions between the two commerce. Others, such as QoS and Customization, affect both the traditional and electronic domain of interactions and communications of the two commerce.

The mentioned variables can be considered as the relationship between the two types of B2B and B2C commerce from the customer's perspective. These variables indicate what parameters are essential and have priority in B2B e-commerce systems from the customers' perspective. However, from the business perspective, the parameters that influence the process of B2B commerce operations are not necessarily included by the mentioned set of variables and may include other variables. These variables indicate that if the business wants to act on behalf of the customer in other e-commerce systems, then from the customers' point of view, what parameters are essential for performing commerce operations between the businesses to meet the customer's request.

As stated in Eq.4, the customer request matrix, which is responded to by the local business, and the customer requirement matrix, which must be responded by businesses other than the local business, affect through Sharing Data (Data Quality) and Product Attributes variables. To extract this matrix, both matrices are rewritten based on the two mentioned independent variables, and the resulting ones mentioned are combined. The Sharing Data variable is defined based on the independent Data Quality variable.

The Product Attributes variable represents the business nature as well as the type of products or services. The product or service attributes determine the pattern of combining local and non-local activities. When the parameters of both matrices are rewritten in terms of the Product Attributes variable. Local and non-local activities will be described in terms of the product attribute concept. This description of the matrices listed in terms of product attributes enables providing a single definition of the activity and result for the activities performed in terms of a specific product attribute, whether in a local system or outside it. This variable allows defining a single matrix or the result in the traditional commerce domain. The Sharing Data variable represents the quality and the way of interactions and communications between business organizations. When the matrices related to local and non-local activities are rewritten in terms of two variables of data sharing and product attributes, then decisions can be made on how local and non-local

activities can influence each other according to data sharing and product attributes. When $l_{i,j,}$ and $S_{k,m}$ are rewritten in terms of sharing data and product attributes variables, $l_{i,j}$ (S, P) represents an activity that is conducted locally to respond to customer requests in the local system, and in so doing, S information has been shared between business organizations based on the B2B model. This activity is also responded to based on the P attribute of the service or product.

The result of combining the matrices of performing activities locally and outside the local system is the total activity matrix or set of activities performed from the customer's perspective. This matrix is based on one of the two policies: customer awareness of the activities or keeping the customer away from the interactions needed to respond to requests. Typically, the pattern of keeping customers away is used in most businesses. In this policy, the business operates so that the customer thinks all response activities have been carried out only in the business. In this situation, from the customer's view, the total activity matrix represents a set of activities performed by the business organization to execute the customer's request(s). In this policy, although the matrices of local and non-local activities are combined based on product attribute and data sharing variables, the final matrix can only be described in terms of product attribute variables.

In the customer awareness policy, the customer knows that part (or parts) if the request is made outside the local system. In this situation, the customers may even interact with other business organizations in the process to run their activities. In this policy, the total activity matrix is described in terms of both products attributes and data sharing variables.

In Eq.4, the operation of mapping the matrix of performing the operations into the matrix of responding operations is based on rewriting time and location conditions and based on Trust, Security, and product attribute variables. In this case, the time and location conditions are first rewritten according to the mentioned variables. Then, the total activity matrix is transferred to the matrix of the customer request-response according to these conditions. Each $LS_{i,j}$ entry is rewritten based on time and location conditions and mapped to the corresponding $A_{i,j}$ entry in the user response matrix. In the case of a response operation, the customer's request is completed from the business point of view only if there is an entry-to-entry and value-to-value correspondence between the two matrices.

According to this equation, the e-commerce activities are successful from the customer's point of view if Eq.5 is also true for Eq.4.

$$\forall \mathrm{LS}_{ij}\ and\ A_{ij}$$

$$:: \mathrm{LS}_{ij}\ (Location\ (Security, Trust, Product\ Activity), Time\ (Security, Trust, Product\ Activity)$$

$$= A_{ij}\ Eq.5$$

According to Eq.5, e-commerce transactions are successful from the customer's viewpoint when for each entry of the total activity matrix, after considering the value of the entry based on time and location conditions rewritten based on security, privacy, and product attribute, a corresponding entry exists in the customer response matrix. Each entry of the request-response matrix represents a specific activity that must be performed by the e-commerce system, whether locally or non-locally, which meets part of the customer request.

In some e-commerce systems, the nature of the transaction and the type of service or goods are such that Eq.5 cannot be applied for a part of the total activity and customer response matrices. In these types of e-commerce systems, a concept called satisfaction level is defined, indicating that business operations are acceptable from the customer's perspective, without fulfilling Eq.5.

Eq.4 describes the business performance in B2B e-commerce systems. This equation provides a model for the functioning of these types of systems, taking into account the concepts of data sharing, interaction, and communication between businesses to meet customer requests (or requests). The nature of the request is such that the business is incapable of responding to all (or part of) the customer's request. Therefore, Eq.4 can be considered as the extension of Eq.3, where interactions and communications with other firms are taken into consideration.

2.3 Sharing Economy

As many scholars in the sharing economy have pointed out, sharing is not a novelty; exchange systems (bartering) and collective life have a long history [35-37]. However, there has been a growing debate on economic collaboration and sharing economy [38].

At the heart of the growing concept of sharing economy is the role of digital technologies. In many respects, sharing economy system relies on a type of efficient and scalable technology that connects large networks of businesses and customers and adapts them to goods or services they need [39-41].

The sharing economy is typically used for exchanges, communications, and interactions between two businesses operating in a particular field. In the sharing

economy, both businesses utilize resources and services in a specific market. Sharing economy structures are created to facilitate sharing resources and services [42]. Due to the nature of sharing economy and its general definition, it can be used in systems developed based on e-commerce systems [40]. Systems such as Uber and Airbnb are examples of implementing the sharing economy in e-commerce systems. In sharing economy structures, one or more resources are typically shared by businesses (or customers), and resource ownership changes based on one of the patterns of shared use, such as time-sharing or event sharing between resource (s) users [38, 43]. One of the most critical challenges of sharing economy is determining the pattern of resource (or resources) to meet the resource sharing goal. Although the primary purpose of resource sharing in sharing economy systems is to develop the resources of each of the beneficiary systems, other objectives such as productivity, market development, and utilization of unused resources can be considered.

The nature of sharing these kinds of economic systems can be the interaction and communication platform of any type of system, including e-commerce systems. These systems objectively provide a platform for system scalability [43, 44]. The nature of the parameters governing sharing economy is that both Traditional Activity and even Technology Services can be used as a platform for e-commerce scalability and utilizing other systems' resources.

In sharing economy systems, typically, multiple systems (or elements) exploit shared resource (s) [43]. From a managerial point of view, each system has its management structure and no centralized structure can be created to use the concept of sharing economy. Creating a centralized structure means violating management systems and enforcing laws that may contradict the local system rules. Although the lack of centralized structures improves the scalability of sharing economy-based systems, it also makes implementing the concept of openness more complex. The existence of diverse structures and multiple systems in decentralized structures that are based on the sharing economy makes it necessary to have communication protocols in the field of Traditional Activity and Technology Services. Paper [45] outlines Owyang's Honeycomb framework. This paper illustrates the sharing economy as a flexible honeycomb structure for openness, sharing, and resource growth within a collaborative group.

2.4 Sharing Economy Parameters

The nature of sharing and collaborative use in sharing economy systems requires

defining indicators to evaluate their performance. The nature of shared resources and the purpose of sharing resources are the two main variables of creating such systems. Given that sharing economy can serve as a platform for interactions between e-commerce systems to meet customers' requests (or requests), the key indicators of these types of systems are analyzed in the following. Investigating these indicators enables us to create a model for e-commerce system architectures using the concepts of the sharing economy.

I. Obligation

In sharing economy systems, obligation refers to two concepts. First, it refers to terms imposed by the element (or system) which attempts to share resources so that other systems can use the shared resource (or resources) once these conditions are established. Second, it indicates the conditions and conditions that must be observed by systems using the resource (s) so that they can use the resource (s) under these conditions [11, 14, 46, 47].

In these systems, the concept of obligation goes beyond the concept of time and location conditions and refers to a set of activities within the sharing system framework. When a system commits itself to operate in a sharing economy, there is a guarantee for other beneficiary systems in the sharing economy that the committed activity (activities) will be carried out. The obligation is the basic concept of sharing, and the sharing system makes sense, either to the element or the system sharing the resources or the elements utilizing the shared resources when both beneficiaries commit themselves to perform the activity (activities).

II. Collaboration

In sharing economy systems, collaboration means the commitment of more than one system to work together so that all the stakeholders of the collaborative activity participate in its implementation [46, 48, 49]. Although collaboration is not considered a critical condition for the implementation of sharing economy systems, it is an operational concept that increases the probability of sharing economy systems' success. Collaboration directly affects the performance of the sharing stakeholder systems. It is regarded as a tool for scalability in the sharing economy systems.

III. Availability

In sharing systems, availability means how beneficiary systems interact and access shared resources or resources. In its most general state, the availability pattern reflects the

policies and mechanisms shared by the element (or system) that initiated the resource sharing to gain access to the resource (s) [44, 50, 51]. The nature of the resource type or sharing may be such that the sharing policy and mechanisms are determined by the beneficiary systems of the sharing economy system. Given that all systems utilizing the sharing economy system have in common the shared resource (s), how to access the resource (s) reflects the interaction pattern between the beneficiary systems.

IV. Infrastructure

Infrastructure refers to all the technical and technology activities that enable the sharing economy [52, 53]. Infrastructure should be able to serve as a platform for interactions and communications and meet the needs of beneficiary systems of the sharing economy. Infrastructure is a hardware and software concept. It is directly related to the nature of the sharing type and the resource type. Many features of the resource type and a sharing pattern are manifested in the infrastructure. It demonstrates the specific attributes of each of the sharing economy beneficiary systems as well as the system that requests to use the shared resources.

V. Economic Factor

In sharing economy systems, the economic factor illustrates the functionality of the concept of economics in these types of systems. The constraints, conditions, and capabilities of the sharing economy system in meeting economic needs are displayed in economic factors [54, 55]. Economic factors represent the economic attributes of sharing economy. Concepts such as system justifiability, system value, and economic functions are discussed in economic factors.

VI. Social Values

Although sharing economy systems enhance the capability and efficiency of beneficiary systems through sharing resource(s), they may be incompatible with the structure of social values governing the systems that request to use the shared resources [5, 56]. Social values represent the dos and don’ts of the sharing economy system. These values are directly derived from society and affect the type of resource and sharing.

Given the above-mentioned materials, it can be stated that sharing economy follows a functional architecture similar to that shown in Fig.3.

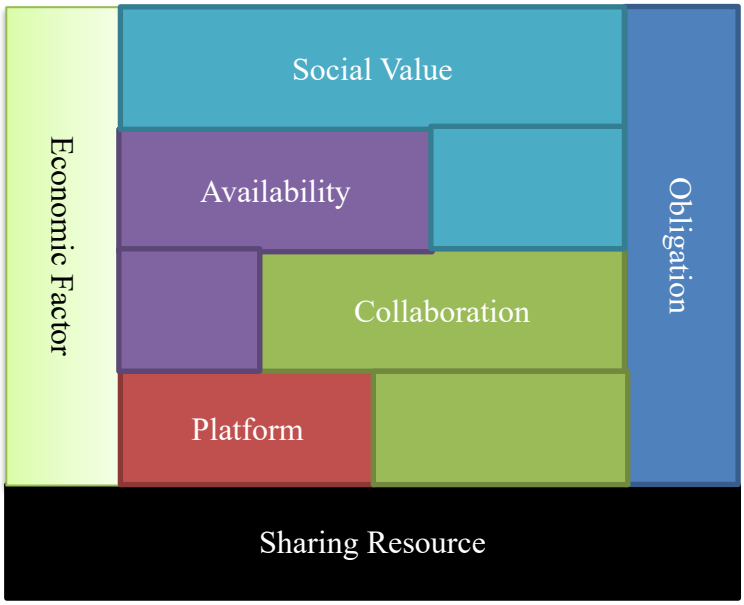

Fig.3. Functional architecture of the sharing economy system

As illustrated in Fig.3, in the functional architecture of sharing economy, obligation and economic factors are considered central elements. Obligation represents the pattern of resource (or resources) sharing in the sharing economy system. It also shows how the beneficiary systems interact and communicate. This element illustrates the shared part of sharing economy. Economic factors represent commercial rules and regulations governing the system. This element indicates the economic sector of the sharing economy. At the bottom, the shared element and the sharing pattern are displayed. The shared resource type means what services are available in the system. It suggests what the purpose of the system is and what structure the system can create for the system beneficiaries.

3. Related Works

In his study, Belk [36] discusses sharing, its types, theories, and applications and compares it with gift-giving and exchange. In his research, Cheng [38] provides an objective, systematic, and comprehensive review of the scientific literature of sharing economy to discover theoretical foundations and critical themes of the field through content analysis. The study identifies three broad areas of sharing economy research: 1) the business models of sharing economy and their effects; 2) the sharing economy nature, and, 3) sustainable development of sharing economy. Constantiou et al. [41] discuss the economic platforms and define them as combining organizational and market mechanisms with innovative approaches towards competitive advantages. In this paper, four sharing economy models of Franchiser, Principal, Chaperone, and Gardener are addressed in two dimensions of strong and poor control over participants and high and

low competition among participants. Each model focuses on different value propositions and specific strategic goals. Using the sharing economy allows businesses to identify threats and opportunities through sharing the economic platforms. In their study, Ranjbari et al. [57] define sharing economy as an economic system in which the online platform connects supply and demand parties to facilitate temporary access transactions for idle resources. In sharing economy, businesses utilize information technology to connect consumers and demands to providers with overcapacity [58]. In his research, Schor [59] divides sharing economy products into four main types: selling goods, such as eBay and Craigslist; increased use of durable assets, such as Airbnb and Uber; exchanging services, such as TaskRabbit and Zaarly; and sharing manufacturing assets, such as Hackerspace and Skillshare. In their study, Habibi et al. [60] refer to the development of sharing economy and regard it as an umbrella for a wide range of non-ownership forms of consumption activities such as trade-in, bartering, transaction, renting, sharing, and exchange. Referring to the broad field of sharing economy, their findings offer appropriate recommendations to managers and those involved. In [61], Frenkena and Schor develop a conceptual framework that defines the sharing economy and its related fields. They have noticed a sharp rise in its historic-economic perspective. This paper evaluates the sharing economy platforms in terms of economic, social, and environmental impacts. In [62], Eckhardt et al. discuss the impact of the sharing economy on marketing. This paper defines the sharing economy as a social-economic system activated by five main features (i.e., temporary access, economic value transfer, platform mediation, expanded consumer role, and passionate crowd support). It also examines the impact of sharing economy on traditional marketing beliefs and practices in terms of the three main marketing challenges: institutions (e.g., consumers, firms and channels, regulators), processes (e.g., innovation, branding, customer experience, value allocation), and value creation (e.g., consumers' value, firms' value, society's value. In their study, Zieba and Durst [63] discuss and analyze the possible knowledge-related risks that organizations potentially encounter in the sharing economy. This paper deals with the risks resulting from awareness and knowledge of the sharing economy attributes, which encourage individuals and organizations to share their goods and services. However, sharing not only does not lead to business interests, but it also jeopardizes the business interests in particular circumstances. Hawlitschek et al. [64] discuss the importance of trust in sharing economy platforms, such as Airbnb or BlaBlaCar. This conceptual paper first presents an experimental framework for targeting trust in the sharing economy, which is based on

empirical economics, and in particular, the trust game. It then uses this framework for specific cases to examine trust in sharing economy platforms. Gazzola et al. [65] explore the different users' motivations to participate in the sharing economy considering external, intrinsic stimuli and monetary, and indirect benefits. The conceptual and structural model commences a motivational axis, which started with profitability and moved towards sustainable development. It also includes factors such as social, environmental, economic, and instrumental benefits.

As a result, sharing economy enables businesses to share their resources and products, increase value, reduce costs, and create synergy. Sharing the businesses' resources creates new revenue resources for businesses. Decentralized communication is one of the most crucial features of sharing economy that provides an indicator of the possibility of sharing and utilizing resources and services. Due to the existence of decentralized communication, systems formed based on the sharing economy can support the notion of scalability.

4. Using Sharing Economy in B2C Model

Through sharing a resource (or resources) with a given system, the sharing economy system enables other systems to use the resource (or resources). The pattern used by these systems is such that by creating scalability for systems using shared resources, they provide some conditions for them to use shared resources easily. The resource (or resources) sharing enables this system to develop and enhance the resources available to the beneficiary systems of the sharing economy based on two concepts of obligation and economic factors. On the other hand, using decentralized structures, and in some cases, distributed structures allows sharing economy systems to develop beneficiary systems and the systems that used the shared resources without going into the details of their management model.

One of the commerce systems that can use sharing economy as a system that enables scalability is a B2C e-commerce system that needs high scalability. In these types of systems, if the local commerce system is unable to respond the customer requests, the system manager must extend the system and respond to the requests using other systems. The nature of a B2C e-commerce system is such that it can serve as a beneficiary and even a resource sharer. Unlike distributed systems, the e-commerce system does not expand itself and find a resource capable of responding the customer request in only one dimension. The nature of e-commerce and performing part of transactions is such that some parts must be carried out in the traditional e-commerce system and at the bottom

layer of e-commerce.

On the other hand, due to the infrastructure concept, and because of separating this concept from the concepts of economic factors and obligation, the sharing economy system can meet this need.

In B2C e-commerce systems, when using the sharing economy model (s), the interactions and between businesses are based on obligation and commitment. Obligation clarifies all terms and conditions of resource sharing between businesses, and the guarantee that comes with obligation and trust will sustain the commerce. The concept of obligation explicitly includes information sharing, information quality, information security, and product indices in Eq.4. In this equation, the concept of obligation can be considered, as shown in Eq.6.

$$Answer_{operation}\left[\left[:\left[\left(\overbrace{\left[\begin{array}{c}[Security\ (T,Tech,Service),QoS(TA,TS)]\begin{bmatrix}L_{1,1} & \dots & L_{1o}\\ \vdots & \vdots & \vdots\\ L_{p,1} & \dots & L_{p,o}\end{bmatrix},\\ [Trust,WebSite\ Utility,Security\ (T,Tech,Service)\ ,QoS(TA,TS),Customization]\begin{bmatrix}S_{1,1} & \dots & S_{1q}\\ \vdots & \vdots & \vdots\\ S_{w,1} & \dots & S_{w,q}\end{bmatrix}\ (Obligation)\end{array}\right]}^{Sharing\ Data\ (Data\ Quality),Product\ Attributes}\right)^{time}\right]\right]_{\substack{\overrightarrow{[Time,Locaion\ Condition]}\\ trust,Security,Product\ Attributes}}^{\Rightarrow}\begin{bmatrix}A_{1,1} & \dots & A_{1g}\\ \vdots & \vdots & \vdots\\ A_{h,1} & \dots & A_{h,g}\end{bmatrix}\right]\quad Eq.6$$

In this equation, the obligation is considered as an independent variable defining the space of non-local activities. The reason is that obligation determines how a local business should interact with other businesses. Considering the concept of obligation as an independent variable results in rewriting the set of $[Trust, WebSite\ Utility, Security, QoS, Customization]\begin{bmatrix}S_{1,1} & \dots & S_{1q}\\ \vdots & \vdots & \vdots\\ S_{w,1} & \dots & S_{w,q}\end{bmatrix}$ based on the obligation pattern and the conditions defined in it. For instance, this changes the concept of trust from a fixed concept into a concept dependent on obligation, and in some cases, makes it be considered as a variable.

According to the architecture presented in Fig.3, the economic factor is an effective component in defining the functional space of the sharing economy, and consequently, the interactions between systems utilizing the sharing economy model (or models). This concept influences both the set of activities performed in the commerce system and those carried out in other commerce systems. If the business decides to use the concept of the sharing economy to utilize the resource (or resources) of other business systems, it will first need to change its functional function from Eq.4 to Eq.7.

$$Answer_{operation}\left[\left[\left(\overbrace{\begin{matrix}[Security\ (T,Tech,Service),QoS(TA,TS)]\begin{bmatrix}L_{1,1} & \dots & L_{1o}\\ \vdots & \vdots & \vdots\\ L_{p,1} & \dots & L_{p,o}\end{bmatrix},\\ [Trust,WebSite\ Utility,Security\ (T,Tech,Service)\ ,QoS(TA,TS),Customization]\begin{bmatrix}S_{1,1} & \dots & S_{1q}\\ \vdots & \vdots & \vdots\\ S_{w,1} & \dots & S_{w,q}\end{bmatrix}\ (Obligation)\end{matrix}}^{Sharing\ Data\ (Data\ Quality),Product\ Attributes}\right)^{time}\right]\right]_{\substack{Economic\ Factor\ (o)\\ Economic\ Factor\ (t)}}^{:} \quad Eq.7$$

$$\overrightarrow{\substack{trust,Security,Product\ Attributes\\ [Time,Locaion\ Condition]}}\begin{bmatrix}A_{1,1} & \dots & A_{1,g}\\ \vdots & \vdots & \vdots\\ A_{h,1} & \dots & A_{h,g}\end{bmatrix}$$

As seen in Eq.7, the response function is rewritten based on the two concepts of Economic Factor (o) and Economic Factor (t). Economic Factor (o) represents economic factors defined based on the sum of activities that must be performed to meet customer demand. Economic Factor (t) represents the economic factors at a given point in the business to meet customer demand. This variable changes at any time during the response process depending on what parameters are considered as economic factors. Changing the value of the Economic Factor (t) will cause the customer response function to be calculated again. In the absence of economic justification, the parameters used to respond to the customer request will be reviewed.

On the other hand, in Eq.7, the concept of social values and the parameter of collaboration can be considered in the form stated in Eq.8.

$$Answer_{operation}\left[\left[\left(\overbrace{\begin{matrix}[Security\ (T,Tech,Service),QoS(TA,TS)]\begin{bmatrix}L_{1,1} & \dots & L_{1o}\\ \vdots & \vdots & \vdots\\ L_{p,1} & \dots & L_{p,o}\end{bmatrix},\\ [Trust,WebSite\ Utility,Security\ (T,Tech,Service)\ ,QoS(TA,TS),Customization]\begin{bmatrix}S_{1,1} & \dots & S_{1q}\\ \vdots & \vdots & \vdots\\ S_{w,1} & \dots & S_{w,q}\end{bmatrix}\ (Obligation)\end{matrix}}^{Sharing\ Data\ (Data\ Quality),Product\ Attributes}\right)^{time}\right]\right]_{\substack{Economic\ Factor\ (o)\\ Economic\ Factor\ (t)}}^{:} \quad Eq.8$$

$$\overrightarrow{\overbrace{\substack{trust,Security,Product\ Attributes\\ [Time,Locaion\ Condition]}}^{Social\ Value,collaboration}}\begin{bmatrix}A_{1,1} & \dots & A_{1,g}\\ \vdots & \vdots & \vdots\\ A_{h,1} & \dots & A_{h,g}\end{bmatrix}$$

As shown in Eq.8, the two concepts of social values collaboration parameters are considered conditions for mapping the set of activities performed by businesses in the local system and other systems to respond to customer requests (or requests). Proper adherence to social values enables businesses to work together according to the conditions governing the social values of each other and the terms governing the customers' social values. Given that the purpose of Eq. 8 is service delivery to the customer and the customer is not conventionally within the process of implementation of activities among the businesses, the concept of social values is considered only when the space of activities performed by the business is mapped on the space of response to customer requests. If the nature of the business is such that the customer is involved in the process of interactions between businesses to respond to the customer's request (or requests), then the concept of social values is considered as a variable in the process of mapping activities done for responding customer request (requests) into the response space and as a factor

affecting the interactions and communications between businesses as well. In such a situation, by focusing on the concept of social values governing the customer, business organizations using the sharing economy model must interact and cooperate.

In Eq.8, the concept of collaboration parameters is considered as the variables of technology type that govern the mapping of the businesses' operations to respond to the customer request (or requests) into the response space. This parameter implicitly includes information sharing, information quality, security, products, and customization indicators. In e-commerce systems that employ the sharing economy concept, as the collaboration parameters increase, businesses will be able to access the shared information and resources by other businesses. Thus, they can use the services and goods defined in other businesses to meet their customers' requests. The collaboration parameter emphasizes that businesses can share products and information individually or together.

5. Discussion

The concept of market expansion and extending customer service based on B2C e-commerce systems is a challenge in various commerce areas. Typically, a cost-effective and viable solution in traditional commerce systems is to use sharing economy-based models to expand service areas and utilize the resources of other commerce systems for responding to customer requests. It allows that businesses can operate in new and emerging areas, and subsequently, develop the market. Traditional commerce systems attempted to provide services to customers in the areas where the business is not capable of responding to them through partnership contracts and the use of obligation concept in service delivery and using the solutions introduced in the sharing economy. If a business fails to respond to new customers' requests either through strategies such as the establishment of new branches or sharing economy strategies, then it can only provide services in a specific area.

In e-commerce systems, because of the technology concept and removing time and location conditions that govern the commerce, failure to respond to customer requests in geographical, managerial, and high numbers of users is not acceptable to the customers. In these commerce systems, the customer considers the market space to be compatible with the Internet space and expects to receive service or purchase goods from the business in any part of the market regardless of time and location constraints. Failure to respond to the customers' requests in various geographical, managerial areas, and even to respond to a large number of requests, is considered a weakness and inability to use the technology

concept. The nature of market development in these commerce systems emphasizes the increased openness of businesses in both time and location spheres.

The primary policy to achieve this goal is expanding the business structure, and consequently, entering new markets and defining customer request-response structures. Although this policy could be a solution to market development and increased openness, it requires making investments and creating response structures in new markets. Much of the investments for market development in e-commerce systems focus on enhancing the capability of computer systems used to process and manage customer requests and create real response structures to deliver services and goods to customers. Applying an investment-based market development policy and shaping and defining new response structures increases the costs associated with businesses, and consequently, increases the cost of services and goods. On the other hand, this policy is not efficient and effective for small businesses and businesses whose primary purpose of using e-commerce is to increase competitiveness.

The second policy focuses on resource sharing and communicating with other systems defined on the Internet. In this policy, every business tries to respond to customers' requests by using services and goods available in other businesses and exploiting their response structures. In the traditional commerce system, it is used under the name of sharing economy. In the concept of the sharing economy, businesses respond to the customer's requests using resources shared by other commerce systems and response structures created by other businesses. The concept of sharing economy is used implicitly in e-commerce systems and is regarded as a link to other systems in the platform used for the implementation of the e-commerce system. Through examining the architectures, frameworks, and mechanisms used in e-commerce systems, especially B2C systems, it can be concluded that in these types of systems, no mechanisms have been considered for shared use and utilizing sharing economy.

On the other hand, using sharing economy mechanisms and models in two cost and time dimensions has an overhead for the e-commerce system to implement response operations for the customers' requests. Because of employing sharing economy, the process of implementing response operations is transferred from the local e-commerce system to other e-commerce systems. This transfer may increase the time and cost of running the response process. When a request (or part of a request) is transferred from an e-commerce system to other systems to be responded to using the response structures

available in that system (or systems), then the rules governing the business system (or systems) may not be in line with the time and cost rules of the current commerce system. In this case, transferring the request (or part of the request) from the local system to other systems may increase the cost or time of running the request. On the other hand, in other commerce systems, rules and values may govern the system that either conflict with the local system or fail to conform to some parts of its values and regulations. Managing such a situation and using sharing economy models to exploit the resources available in other commerce systems has a cost and time overhead for the local e-commerce system. As a result, a mathematical model needs to be defined, which can enable the B2C system manager to use and exploit other e-commerce systems to meet customer needs.

The mathematical function presented in this paper enables the e-commerce system manager to make decisions on whether to use the sharing economy to meet the customer request or not by considering effective indicators in transactions in B2C e-commerce systems as well as descriptive factors of sharing economy parametrically, regardless of the type of goods or services traded. The central premise of this paper is that the set of operations performed in the local e-commerce system cannot be tailored to the customer's requests. Therefore, based on sharing economy and one of the models of this economy, the business attempts to use the resources and facilities available in the business (or other businesses) to respond to the customer request-response space. In this paper, the e-commerce system is considered the extension of the traditional e-commerce system, where time and location conditions are removed. Thus, the operations that need to be carried out in the e-commerce system to respond to the customer request are categorized into two areas: the operations resulting from the commercialization of the e-commerce system; and the operations derived from technology utilization.

This classification is a measure for separating the business’s activities in technology and traditional fields. It enables the e-commerce system manager to determine what activities typically need to use other business systems. In this paper, the activities are classified based on two axes: the activities arising from the electronic nature of the commerce system and those deriving from the commerce nature of the e-commerce system. However, considering other indicators in separating the activities, it is possible to extract additional information on the activities that the local commerce system is unable to respond to and requires to use of other commerce systems.

In this paper, assuming that the local commerce system is not capable of responding

the customer request (or requests) and needs to use other systems, the business activities are classified into two groups of activities in the local businesses and other businesses. The classification is parametric and can be divided into subcategories. For example, each category can be divided into traditional and technology-based activities.

The mathematical model presented in this paper focuses on matching the space of activities performed by the business (or businesses) to respond to the customer request to the final space intended by the customer, which is regarded as customer response. This mapping represents what activities (whether local or global) should be carried out in the business (or businesses) so that a one-to-one correspondence can be created by mapping them to the customer request-response. Once this correspondence is established, it can be stated that the business (or businesses) have started responding the customer requests.

In this paper, the descriptive parameters of the e-commerce system are discussed to analyze the functional mapping of the system. Then, this functional function rewritten is defined based on defining the descriptive indicators and their impact on the space of doing local and global activities.

In analyzing the impact of the descriptive indicators of the e-commerce system, it is implicitly examined that on which type of local or global activities each indicator has a higher impact. Among the indicators describing the e-commerce system, two indicators of security and trust affect both global and local activities. This is due to the electronic nature of e-commerce system operations. In e-commerce systems, unlike traditional systems where the customer element is involved in a large part of the commerce process, the customer either does not have a direct presence in the system or has delegated the task to another element. On the other hand, in e-commerce systems, the business element is not physically involved in the transaction process or is only present in the final part of goods and service delivery. Thus, the customer needs to have some cases on the security of e-commerce system, especially the business security, as well as the instances that can guarantee the customer's trust in business. This issue should be considered both in the relationship between the customer and the business and in the interactions of the businesses with each other in carrying out the customer-related activity(s). This is especially more evident when the customer is executing its activities based on the sharing economy models. The customer expects the interactions and communications between businesses to be such that they not only create security and trust between businesses, but they also establish security and trust for customers. Trust and security become meaningful

to the customer when no activity is conducted regarding security violation, in particular the customer information security, in the process of conducting inter-business activities.

In analyzing the descriptive indicators of e-commerce systems, indicators such as website capability as the business representative, assuring service and goods delivery, and customization is indicators that influence global and collaborative activities between beneficiary businesses in responding to the customer requests are effective. The reason is the nature of the interactions between businesses in the sharing economy. As the representative of the business, the website capability index is raised in two areas of website capability to respond to customer requests, as well as website capability in interactions and communications with other e-commerce systems. Website capability shows the services and solutions that each business provides for a) responding to customer requests and b) communicating and interacting with other businesses. As the business representative, website capability is all the activities that the website can do based on the capabilities of the traditional basic trading system or the technology used. Some of these activities are to respond to local customer requests and others to meet requests from other e-commerce systems. As this paper focuses on empowering the e-commerce system based on sharing economy, the focus of the website is on performing activities related to other business systems as rules and regulations of sharing economy.

Website capability to respond to the execution of activities related to other business systems is considered as the relative advantage in the paper. The effect of the website capability index in responding to the implementation of activities related to other business systems on any global activity performed to respond to the request (or requests) of the customer shows the relative capability of the firm performing the activity in responding to and performing that activity. The impact of this indicator on each activity in the global activity matrix shows that what relative advantages the business will have, compared to other businesses, if it takes part in the sharing economy and shares resources. This advantage allows the commerce system to respond to some parts (or all) of the customer requests that cannot be responded to by the local system. In this paper, due to the dynamic nature of e-commerce systems, the concept of relative advantage in implementing one (or more than one) customer-related activity is defined on a time-driven basis. An e-commerce system may be able to execute part (or all) of its customer response activities, and over time, may lack the relative advantage due to participating in global activities for the sharing economy or using resources. Accordingly, as a representative of a business, each website defines a set of capabilities if it wants to interact and communicate with

other e-commerce systems based on the principles, rules, and regulations of the sharing economy based on a) the capabilities of the basic traditional trading system, b) technology and website capabilities, and c) service capabilities available for other e-commerce systems. These capabilities are a relative advantage of the website in implementing activities related to other e-commerce systems. The concept of services quality assurance shows the level of service that can be provided by a business to the activity (or activities) related to responding to the customer request. The effect of this index on each of the elements forming the matrix of customer-demand response activities shows the quality and level of services that can be provided by the business. When the e-commerce system uses the concept of sharing economy, one can consider the concepts stated for other e-commerce systems.

In such a case, besides the need to define QoS in both aspects of trade and using technology to perform the activity, the concept of guaranteeing the execution of the requested activity among the e-commerce systems that work together should be taken into account. In such a state, the e-commerce system starting the request should set out a set of rules and regulations as sharing economy considering the patterns of cooperation and interaction in the sharing economy for communication and interaction between itself and other e-commerce systems. The definition should be such that includes the technological constraints besides considering the commercial constraints. Considering the effect of the quality assurance index shows the level of services that can be provided by the business where the business has a relative advantage and using business to perform the activity (or activities) related to responding to a customer request is justifiable and logical. The paper discussed the concept of services quality assurance generally, overall and parametric. The service quality space can be considered as a multidimensional space rather than a one-dimensional space in the presented equations. In such a state, one can consider the effect of each of the dimensions of the mentioned space on the activities carried out in the global activity matrix.

After the impact of website capability and service quality assurance on the elements of the global activity matrix, the resulting matrix demonstrates the feasibility of executing the activity considering the quality of running the activity in the target commerce system. This matrix can serve as the primary criterion for transferring part (or all) customer requests to other e-commerce systems. The matrix is a function of the independent variable of time and obligation.

The concept of customization is also applied to the equations offered for

investigating the utility function of the e-commerce system on the matrix space of response operations the businesses with an interactive and communicative model of sharing economy. Taking this concept into account in the functional equations of the e-commerce system utility function indicates the degree of the e-commerce system adaptability for each constituent activity of the global activity matrix for the customer request-response. This concept implies whether the e-commerce system has flexibility in executing one (or more) global activities to respond to the customer request or not. If it is flexible, what is its coefficient of flexibility in implementing the activity is. In this paper, flexibility and ability of customization mean that whether the local e-commerce system can make changes to the process of implementing the activities related to customer request response in other businesses or not. The presence of such a pattern for implementing one (or more) activity (activities) in another commerce system is an advantage to use that commerce system to increase market openness and development. When a business system other than the local business system can customize, then challenges such as social values, time values, and most importantly, cost challenges will be fixed by the local system due to the ability to change the implementation pattern. This concept, similar to other concepts, is a function of the independent variable of time and obligation.

Two matrices of global activities and local activities performed to execute the customer request by the local business or the business (businesses) interacting with the local business, are combined under two independent variables of data sharing and product attributes. The concept of the product type in the combination of two matrices causes that only product-specific attributes in two matrices will be combined so that the total activity matrix can be extracted based on these attributes. The most important feature of the presence of product type in mixing the two matrices is eliminating the activities that are not in line with the product type. In addition to the product type, combining these matrices is also due to the sharing economy concept, which includes the concept of data sharing under the independent variable of data quality.

As a result, the total activity matrix only consists of the activities that derive from the interaction of the initiating business with any businesses interacting with it and the activities performed in the local business. This is because the interactions and communications between businesses other than the initiating business do not need to be taken into account. The independent variable is data quality and the e-commerce system

manager can execute the combination of the mentioned matrices based on any data quality pattern. In this paper, it is assumed that if a sharing model is used for e-commerce systems when a request is sent from a local business to other businesses, then the other businesses should no longer submit requests to other businesses. The reason is how the other commerce system in the sharing economy of this paper has been chosen. In this paper, while considering the concept of relative advantage and quality assurance, the e-commerce system transfers part (or all) of the request to other commerce systems, from the local e-commerce system manager perspective, it means that the e-commerce system to which the activity is referenced has can respond part (or all) of the customer request. If a pattern other than relative advantage and quality assurance is used, there may be a pattern of interactions between other commerce systems or multiple transfer requests.

In this paper, the two matrix spaces of total activity and the request-response space are mapped based on the temporal and local conditions governing customer requests under the influence of security, trust, and product attribute concepts. This is because of the nature of commerce as well as e-commerce. The electronic nature of commerce has given rise to considering security and trust as factors that influence location and time. On the other hand, the product type influences location and time conditions. It results from the fact that the product is an element based on which transactions and all activities need to be carried out so that the customer and the buyer’s needs are met.

The final model presented in this paper for B2C e-commerce system functionality is based on data sharing, data type, and commerce at both local activities and those performed in other businesses. This model is based on the concept of sharing and utilizing the resources of other commerce systems. When the two sides of the mapping function used by the e-commerce system utility function are aligned, from the commerce system manager point of view, it means that the process of assigning part (or all) of the customer response activities to the local business and other businesses has been carried out correctly and the local commerce system can respond the customer request based on using the others' resources and to develop its markets based on this customized pattern.

In this paper, based on the definition of sharing economy indicators, a communicational and functional architecture is offered for the sharing economy. According to this architecture, economic parameters and obligation are the two central elements of sharing economy. The architecture is proposed by focusing on the concept of sharing and the shared use of others' resources. As a result, these two concepts are

considered critical concepts of architecture. Obligation focuses on the totality of sharing and using other people's resources. If the process of sharing and using others' resources is irrespective of the concept of obligation, then the requests cannot be executed by considering time and location conditions as well as security and trust. The concept of voluntary sharing may be used in sharing economy models, but using it in e-commerce systems means that there is no guarantee of mapping customer request activities and customer response space by considering time and location conditions based on trust and security variables.

The concept of economic parameters is also derived from employing the sharing economy in the e-commerce system. One of the most essential criteria to make decisions on using sharing economy for market development and other commerce systems to respond to customer requests is to consider the concept of economic parameters. Economic parameters indicate the set of factors under which two e-commerce systems create a sharing economy system. These parameters determine many of the interactive patterns between businesses and variables such as businesses' flexibility in executing the customer request activities.

In this paper, the concept of obligation is considered as a central element. Thus, due to its central role, the obligation is considered the independent variable of activities that must be performed by businesses, whether locally and in other businesses, to respond the customer requests. On the other hand, given the importance of the concept of economic parameters, each parameter, variable, and concept defined in the utility function of the e-commerce system must be rewritten to be used in the utility function of the defined e-commerce system that is based on the sharing economy. The function presented in this paper enables the e-commerce system manager to make decisions on whether to use one (or more than one) e-commerce system to respond to customer requests based on sharing economy patterns or not.

6. Summary

This paper proposes a mathematical model to decide whether to use sharing economy in the B2C e-commerce system or not. To present this model, the utility function of the B2C system management element has been rewritten, focusing on using the resources of others to respond the customer requests. Besides, with the aim of resource sharing, an architecture for sharing economy and describing the relationship between the descriptive indicators of the sharing economy is introduced. Based on these two concepts, the utility

function of e-commerce system management has been proposed based on the concept of sharing economy. This function enables the business to use the concept of sharing economy for the B2C e-commerce system and to make decisions based on analysis of each of the parameters of sharing economy affecting e-commerce.

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