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How to Evaluate and Improve E-Commerce Implementation and Administration Success State? a New Approach for Managing Success-Relevant Activities

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Abstract

Achieving e-commerce success is influenced by a variety of interrelated activities. Identifying, analyzing and prioritizing these activities enable decision-makers firstly to evaluate the current success state of Electronic Commerce (EC) businesses more accurately and then to develop an efficient improvement plan to allocate limited resources to achieve a higher level of success. In this research, a Fuzzy Cognitive Maps- analytical hierarchy process (FCM-AHP) approach is used to address this issue by (1) determining interrelationships between influential activities, (2) determining how much these activities influence each other and the overall success, and (3) prioritizing activities to develop a sound improvement plan. In this approach, the FCM technique is used to indicate all possible causal interrelationships between activities and consider all feedback loops between them. Then, the AHP technique is used to determine the contribution weights of activities to the overall success. The obtained management matrices that make it possible to categorize influential activities and the results of improvement scenarios help the decision-makers to develop the most efficient improvement plan and gain the maximum benefit from the allocation of limited resources. An empirical study is implemented to serve as an example to indicate how the approach works.

Keywords: Electronic commerce (EC), Fuzzy Cognitive Map (FCM), Analytical Hierarchy Process (AHP), Evaluation model, Improvement plan.

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Introduction

E-commerce has shaken the foundation of different types of businesses around the world and can be defined as the process of buying, selling, or exchanging products, services, and information via computer networks including the internet (Turban et al., 2017). Despite the outwardly prevalent usage of e-commerce in business activities, there is considerable potential for e-commerce growth; for example, in 2018 e-commerce accounted for only 11.9% of the whole retail sales worldwide (Statista). Although there is an untapped potential for e-commerce growth, the failure rate among EC businesses is overwhelmingly high. According to the research conducted by Practical E-commerce in 2014, the failure rate of EC businesses is roughly 80% (Practical e-commerce, 2014-11-07).

If decision-makers of EC businesses aspire to succeed and avoid failure, they need to evaluate their current state and then devise an improvement plan accordingly. To do so, firstly, the influential activities that affect the successful implementation and administration of e-commerce must be identified and categorized. Secondly, an evaluation model must be provided to evaluate the current success state of EC businesses. Finally, decision-makers must consider the current success state, develop an improvement plan and choose a set of activities for improvement based on the categorization and ranking of activities to reach the highest success state possible.

In the context of e-commerce success, a lot of studies have been conducted to illuminate different aspects of this process. Some of these studies tried to identify activities, or motivations that affect the success or adoption of e-commerce (Beldad, De Jong, & Steehouder, 2010; Chaparro-Peláez, Agudo-Peregrina, & Pascual-Miguel, 2016; Choshin & Ghaffari, 2017; Jennex, Amoroso, & Adelakun, 2004; Laosethakul & Boulton, 2007; Sung, 2006). Furthermore, it has been indicated that these influential activities are interrelated, and any improvement in one of them influences other activities (D. Lee, Park, & Ahn, 2001; Tsai, Chou, & Lai, 2010).

Another stream of research is done to develop several evaluation models in order to assess the current state of EC businesses (Delone & Mclean, 2004; Huang, Jiang, & Tang, 2009; Kong & Liu, 2005; Y. S. Wang, 2008) or to evaluate the quality of EC businesses' website from different aspects (Agarwal & Venkatesh, 2002; Baloglu & Pekcan, 2006; Barnes & Vidgen, 2003; Chiou, Lin, & Perng, 2010). Some of these studies prioritize influential activities and factors using different methods based on the contribution of activities to the overall success (Kabir & Hasin, 2011; Valmohammadi & Dashti, 2016). Another branch of studies, after evaluating the website's quality, proposes improvement plans (Tanjung & Dhewanto, 2014; Tsai et al., 2010). Table A (presented in Appendix) gathers the most related works in this domain, highlighting the advantages and limitations of each one.

Following the literature review, none of these studies has taken into account the causal relationship between activities, and their role in the evaluation models and improvement plans.

The importance of considering causal relationships is that it enables decision-makers to measure all direct and indirect influences of an improvement in one activity on the other activities and on the overall success. In other words, taking into account the causal relationship enables decision-makers to evaluate the current success state of EC businesses and the results of different improvement plans more accurately. The outcome of this higher accuracy is focused on developing more practical and fruitful improvement plans.

From a conceptual perspective, this paper has a holistic and systematic perspective on companies that have developed e-commerce. In such companies as a live organism, all components which affect e-commerce success are influential on each other. In this paper, the inter-relationships between the effective components are investigated and a network model is developed. To the best of our knowledge, no previous study has this type of perspective in scrutinizing the concept of e-commerce success.

From a methodological perspective, most previous studies developed qualitative models for investigating e-commerce. This paper introduces a step-by-step instruction that enables decision-makers to quantify and evaluate the result of various improvement plans. As a result, decision-makers can calculate and compare the result of different improvement plans and adopt the most productive one.

From a practical perspective, decision-makers can use the approach to assess the current success state of e-commerce and analyze the effect of different improvement scenarios. As a result, the most productive improvement plan can be developed with regard to the limited available resources.

To formulate causal relationships between activities, the fuzzy cognitive maps (FCM) technique is used. This technique is an extension of a neural network with directed weighted networks and feedback loops which is used to model and analyze the behavior of complex systems (Ahmadi, Forouzideh, Alizadeh, & Papageorgiou, 2015). Then the analytical hierarchy process (AHP) technique is used to determine the contribution weight of each activity to the overall success by using the comparative judgment. By using these two techniques, the evaluation model is developed. In the next step, the results of the DEcision MAking Trial and Evaluation Laboratory (DEMATEL) technique which is two management matrices, as well as the result of improvement scenario (1) are used to prioritize and rank activities and devise the most effective improvement scenario.

This paper has a sound contribution to e-commerce research, by developing a new evaluation model for the success state of the EC business, as well as by exploiting different improvement scenarios and choose the most efficient one. In particular, after developing the evaluation model, activities are prioritized based on two criteria: (1) their causal relationships and interactions with other activities and (2) their contribution to the overall success. This prioritization enables decision-makers to determine where to focus the limited management

effort and devise improvement plans more efficiently.

The remainder of this paper is organized as follows; the literature review of influential activities and their categorization are presented in section 2. The objectives and contribution of the research are explained in section 3. The FCM-AHP approach is explained in section 4. Section 5 indicates the results obtained from the application of the approach to make a decision in the case study, Digikala Company. Finally, Section 6 summarizes the main outcomes of this work and recommendations for future studies.

Background

Functional areas and influential activities

In order to achieve success in the implementation and administration of e-commerce, it is necessary to consider a lot of activities (Beldad et al., 2010; Valmohammadi & Dashti, 2016). In this research, activities have been considered that decision-makers of EC businesses can change. Factors such as computer literacy of customers, or internet connection have been mentioned as influential factors on the success of e-commerce (Laosethakul & Boulton, 2007). However, decision-makers of EC businesses have limited ability to influence this type of factor. As a result, we have excluded this type of activity from this research._In the following, the influential activities and their categorization are described.

Generally, the success of e-commerce is hugely dependent on using security features and providing customers with a private assurance policy to decrease customers' concerns and increase customers' trust (Lawrence & Tar, 2010). Furthermore, devising plans to handle the intrinsic technical complexity of e-commerce implementation is another activity that decision-makers must address (Sila, 2013).

To launch and administer successful e-commerce, it is necessary to provide sufficient financial resources (Gunasekaran, McGaughey, Ngai, & Rai, 2009) and increase awareness regarding the costs, benefits, and essence of e-commerce (Valmohammadi & Dashti, 2016). To highlight the importance of this awareness, Darch & Lucas (Darch & Lucas, 2002) showed that the lack of awareness decreases the speed of e-commerce implementation. Furthermore, devising plans to decrease the cost of implementation and administration of e-commerce is vital to increase the probability of success (Darch & Lucas, 2002).

Another influential activity is increasing the knowledge of staff to handle different tasks of implementation and administration of e-commerce (Kshetri, 2007), where this knowledge decreases organizational resistance to any change that is resulted from e-commerce implementation (Gunasekaran et al., 2009). In other words, successful implementation of e-commerce requires staff's adaptation to the resultant changes. As a result, devoted to decreasing this adverse resistance, EC businesses need to have top management support (H.-C. Chiu, Hsieh, & Kao, 2005) and develop a comprehensive change plan (MacGregor & Vrazalic, 2005).

To administer and implement e-commerce successfully, it is necessary to obtain appropriate and efficient software and infrastructure (Valmohammadi & Dashti, 2016) and choose suitable products and services regarding the essence of e-commerce (Rao, Metts, & Monge, 2003). To do so, it is necessary to evaluate the suppliers of technology in the market and conduct market research to offer suitable products and services on the website. Consequently, a thorough assessment of the environment is important to increase the probability of success.

Every EC business must be able to attract and retain customers to survive. To do so, online stores should offer competitive prices (C. M. Chiu, Wang, Fang, & Huang, 2014), satisfactory shipping fees and an acceptable speed of shipment (Lewis, 2006), a wide range of products and services (Cho & Park, 2001), and a clear return and refund policy (Bonifield, Cole, & Schultz, 2010). The idea of providing customers with a lot of choices can act as a double-edged sword. Whereas the absence of a wide range of choices can harm the trust of customers, a very wide range of choices can confuse customers and decrease the sale (Iyengar & Lepper, 2000). Thus, the decision-makers of an EC business should consider a balance between the range of offered products and the simplicity of purchase for customers.

In addition to considering customers' needs, the administrators of online stores must extend the market share by using marketing techniques (Hanssens & Pauwels, 2016). Thus, online stores need to use various marketing channels (Verhoef, Kannan, & Inman, 2015), do continuous marketing (Currim, Lim, & Zhang, 2016; Levinson, 2007), apply analytical methods and tools to assess the efficiency of marketing plans (Hanssens & Pauwels, 2016) and use CRM methods and tools to improve the retention rate of customers (Stein, Smith, & Lancioni, 2013). The necessity of using different channels for marketing is that customers use different channels and devices during their decision-making and buying process (Yellavali, Holt, & Jandial, 2004). Thus, online stores should develop plans, and allocate sufficient resources to do marketing in different channels.

In addition to the aforementioned activities, there are a set of activities that affect customers' trust. Trust-building activities have been included in this research because a direct relationship exists between the level of trust and the intention of customers to buy from an online store (Gefen & Straub, 2004; Mou, Shin, & Cohen, 2017; W.-T. Wang, Wang, & Liu, 2016). In other words, if decision-makers of EC businesses seek to succeed and attract customers, they should gain customers' trust.

One of the main ways to earn customers' trust is through features that are provided for customers on the website of an EC business. To launch a trust-earning and reliable website, it should be easy to use (Cebi, 2013), has informative and comprehensive information about products, services, and processes that directly affect customers (Sun, Cárdenas, & Harrill, 2016), has a high-quality graphical user interface (Al-Qeisi, Dennis, Alamanos, & Jayawardhena, 2014), has the capability of customization based on user's requests (Krishnaraju, Mathew, &

Sugumaran, 2016), has signs of being connected to a well-known and reputable third party (Ponte, Carvajal-Trujillo, & Escobar-Rodríguez, 2015), provide customers with the possibility to chat online and view customers' review (Ou, Pavlou, & Davison, 2014), has a mobile-responsive interface (Sonika Singh & Swait, 2017), and provide social presence signs (Guillory & Sundar, 2014). The issue of social presence signs comes from the absence of face-to-face communication in e-commerce. Thus, EC businesses' websites should convey the perception and feeling of being connected to another intelligent entity through a text-based encounter in their communications with their customers (Tu & McIsaac, 2002). Another point about this type of activity is the notion of third-party guarantee that comes from the concept of trust creation based on the transference process (Doney, Cannon, & Mullen, 1998). This concept argues that having signs of connectedness and support from a well-known and reputable third party on the website increases the level of trust in the online stores.

In addition to earning customers' trust in an EC businesses' website, the firm that administrates the website should undertake a set of activities to win customers' trust in the firm itself (Beldad et al., 2010). However, at some point, it is confusing to differentiate between the firm behind a website and the website itself. One of these activities is devising plans to increase the offline presence (Herhausen, Binder, Schoegel, & Herrmann, 2015). The effect of offline presence on customers' trust is controversial. Whereas some researchers believe that the offline presence increases customer trust (Chaouali, Yahia, & Souiden, 2016; Kuan & Bock, 2007), other researchers argue that the offline presence affects customers' trust insignificantly (Teo & Liu, 2007). Another activity is devising plans to increase the reputation of online stores among the community of customers (Walsh, Bartikowski, & Beatty, 2014). This aim can be achieved by doing continuous marketing (Levinson, 2007), having signs of being connected to a well-known and reputable third party (Ponte et al., 2015), and a set of other activities.

To conduct the AHP technique and calculate the contribution weight of activities on each other and the overall success, it is necessary to classify influential activities. Regarding the essence of activities, 8 functional areas are developed.

1- Technical area: this area demands technical ability and planning to handle the technical challenges of successful implementation and administration of e-commerce.
2- Financial area: this area covers activities that are related to the financial aspects of e-commerce.
3- Individual area: this area deals with activities that need to be done on an individual scale in an EC business to achieve success.
4- Environmental area: this area includes activities that are related to the environment of an EC business.
5- Customer care: this area deals with the required services that an EC business must provide to respond to its customers' needs and demands.

6- Marketing area: this area includes activities that administrators of online stores must do to acquire and retain customers.
7- Website area: this area covers features that a website must have to earn customers' trust and increase customers' intention to buy.
8- Organization area: this area includes activities that affect customers' trust significantly, but do not fall into the website area.

In the following, Table 1 is presented to indicate functional areas and their related activities.

Table 1. An overview of the activities that influence e-commerce success

Area	No	Influential activities	References
Technical F_1	1	Using security features and providing a privacy assurance policy on the website to increase customers' trust	(Darch & Lucas, 2002; Lawrence & Tar, 2010)
	2	Devising plans to handle the intrinsic technical complexity of e-commerce	(MacGregor & Vrazalic, 2005; Sila, 2013)
Financial F_2	3	Providing adequate financial resources	(Gunasekaran et al., 2009; Lawrence & Tar, 2010)
	4	Devising plans to decrease the cost of e-commerce implementation and administration	(Darch & Lucas, 2002; Lawrence & Tar, 2010; Zaied, 2012)
	5	Increasing awareness regarding the costs, benefits, and essence of e-commerce between administrators and decision-makers	(Lawrence & Tar, 2010; Valmohammadi & Dashti, 2016)
Individual F_3	6	Increasing technical skills and IT knowledge of the staff	(Darch & Lucas, 2002; Kshetri, 2007; Lawrence & Tar, 2010)
	7	Achieving top management support	(Lawrence & Tar, 2010; S.-H. Liao, Cheng, Liao, & Chen, 2003)
	8	Decreasing organizational resistance to change	(Gunasekaran et al., 2009; Lawrence & Tar, 2010; MacGregor & Vrazalic, 2005)
Environmental F_4	9	Finding a reliable supplier of technology	(MacGregor & Vrazalic, 2005; Valmohammadi & Dashti, 2016)
	10	Choosing products and services that are suitable regarding the essence of e-commerce	(MacGregor & Vrazalic, 2005; Rao et al., 2003; Stockdale & Standing, 2004)
Customer Care F_5	11	Providing customers with competitive prices	(C. M. Chiu et al., 2014; Harn, Khatibi, & Ismail, 2006; Nagle & Müller, 2017)
	12	Providing customers with a satisfactory shipping fee and acceptable speed of shipment	(Lantz & Hjort, 2013; Lewis, 2006; Trocchia & Janda, 2003)
	13	Providing customers with a wide range of products and services	(Cho & Park, 2001; Page & Lepkowska-White, 2002)
	14	Defining obvious return and refund policy	(Bonifield et al., 2010; Chang, Cheung, & Tang, 2013; Lantz & Hjort, 2013)
Marketing F_6	15	Using different and various channels of marketing	(Fensel, Toma, García, Stavrakantonakis, & Fensel, 2014; Rangaswamy & Van Bruggen, 2005; Verhoef et al., 2015)
	16	Doing continuous marketing	(Currim et al., 2016; Levinson, 2007)
	17	Using analytical methods and tools in marketing	(Hanssens & Pauwels, 2016;

			Järvinen & Karjaluoto, 2015)
	18	Using CRM methods and tools	(Reichheld & Schefter, 2000; Stein et al., 2013)
Website F_7	19	launching a website that is easy to use	(Bart, Shankar, Sultan, & Urban, 2005; Cebi, 2013; Kim, 2012; S. Lee & Koubek, 2010)
	20	Providing customers with complete, related, and up-to-date information about products, services, and processes that affect customers directly on the website	(H.-C. Chiu et al., 2005; C. Liao, Palvia, & Lin, 2006; Sun et al., 2016)
	21	Designing a graphically attractive website	(Al-Qeisi et al., 2014; Cebi, 2013; Djamasbi, Siegel, & Tullis, 2010; Nathan & Yeow, 2011)
	22	Providing customers with social presence cues on the website	(Gefen & Straub, 2004; Guillory & Sundar, 2014)
	23	Providing customers with Customization capacity on the website	(Kaptein & Parvinen, 2015; Krishnaraju et al., 2016)
	24	Demonstrating the signs of being connected to a reputable and well-known third party on the website	(Chang et al., 2013; Ponte et al., 2015)
	25	Providing customers with the possibility to chat online, and view customers' reviews	(Beldad et al., 2010; Ou et al., 2014)
	26	Designing a Mobile-responsive website	(Mohorovičić, 2013; Sonika Singh & Swait, 2017)
Organization F_8	27	Devising plans to increase the offline presence of the firm	(Chaouali et al., 2016; Herhausen et al., 2015; Jones & Kim, 2010)
	28	Devising plans to increase the firm's reputation among customers community	(Ponte et al., 2015; Walsh et al., 2014)

Objectives and contributions

As mentioned earlier in the introduction section, there is a need to develop an evaluation model that takes into account the causal relationships between influential activities. To make the approach more understandable and provide practical instruction to apply the proposed method, the approach is divided into two steps:

- Evaluate the current success state of the EC business.
- Develop different improvement scenarios and choose the most efficient one.

It is possible to regard the issue of reaching a higher level of success as a problem. In other words, the issue of increasing the probability of success can be regarded as the problem of decision-makers. With this restructuring of the issue in mind, problem-solving is defined as the process of determining the current situation, desired situation, and the path between these two situations (Garrette, Phelps, & Sibony, 2018).

To follow the proposed definition, it is necessary to determine the current state of EC businesses. The proposed evaluation model is founded on the combination of FCM and AHP techniques. Using the FCM technique enables decision-makers to illustrate all of the causal relationships between influential activities. The importance of these causal relationships is that they help decision-makers to measure the result of a change in one activity on other activities and

the overall success of the EC business. Added to these considerations, the successor state of the influential activities is subjective. Consequently, to determine the success state of the activities and formulate the interrelationship between them, the FCM technique is used (Kosko, 1986). Furthermore, calculating the current success state of the EC business also requires the contribution weight of activities that come from the employment of the AHP technique. Determining the current success state equals determining the current situation in the process of problem-solving.

The desired situation is the highest success state possible by the lowest consumption of resources. This concept is defined by a numerical value and is the overall success state of the EC business after implementing the most efficient improvement plan. This is the point where the strength of the proposed FCM-AHP technique is revealed. As will be shown in the case study, the combination of causal relationships and the contribution weight of activities makes it possible for decision-makers to measure the result of improving different activities separately.

In the last step, it is necessary to determine the path between the two situations. In other words, we have to choose the improvement plan that yields the highest improvement by considering the current success state of the EC businesses. As mentioned before, the employment of the FCM-AHP technique enables decision-makers to evaluate the result of different improvement scenarios, and choose the most efficient one. In this approach, 2 criteria are defined to assist decision-makers with choosing the most fruitful activities for improvement:

1. Two management matrices that help decision-makers to categorize activities based on their interaction with other activities.
2. The result of improvement scenario (1) that ranks activities based on their contribution to the overall success.

Decision-Making Trial and Evaluation Lab (DEMATEL) is used to develop criterion 1, and to prioritize activities according to their interaction with other activities. In fact, DEMATEL helps find the most important causal activities where there are very complex interrelationships between activities. Using DEMATEL enables decision-makers to categorize influential activities in a management matrix with four management zones. This matrix helps choose activities for improvement, and allocate limited resources effectively to gain the maximum benefits. These two criteria assist decision-makers in choosing activities for improvement more evidence-driven and reach a higher level of success more efficiently.

Conducting improvement scenario (1) that is introduced as the second criteria are recommended to the decision-makers of all EC businesses. This improvement scenario is conducted to rank activities based on their influence on the overall success of an EC business. To implement this improvement scenario, each activity is improved by one level and its effect on the overall success is measured. The result of this improvement scenario enables decision-makers to identify activities that have the highest effect on the success of an EC business. As a result,

decision-makers will be able to develop the most effective improvement scenario that results in the highest improvement to the overall success of an EC business.

To conclude, one of the main contributions of this paper is taking into account the causal relationship between the influential activities to develop an evaluation model that measures the currents state of an EC business and the result of different improvement scenarios more accurately. Generally, this approach provides a practical and data-driven framework for decision-makers and practitioners who aspire to improve the success state and performance of an EC business.In the following, the proposed evaluation model and improvement plan are described thoroughly.

An e-commerce success management approach

Table. 2. Shows the proposed FCM-AHP approach for e-commerce success management with the required data and used approach. Evaluation model development that is implemented by using experts' opinions is the first phase of the approach. This success evaluation model includes the causal relationship between activities and their contribution weights to the overall success of EC business. The second phase is model analysis in which the EC business develops an action plan for improving the overall success after assessing the current success state. In the following section, five steps of the approach are explained.

Table 2. Key phases and steps in the FCM-AHP method

Phase	step	Method	Output
Evaluation model development	Step 1: Formulate the relationship between activities that were identified in the literature review	Using the FCM technique	The success evaluation model
	Step 2: calculate the success contribution weight of activities	Using the AHP technique	
Model analysis	Step 3: evaluate the current success state of activities	Using a set of six linguistic terms to represent the six-state of success	1. The overall success of the EC business
	Step 4: evaluate the overall success of the EC business	Using FCM inference process	2. An action plan for allocating limited management efforts and improving the overall success
	Step 5: Analyze the result of the e-commerce success evaluation	Using the DEMATEL technique and the management matrix	

Step 1: Formulate the relationship between activities

As has been discussed in the literature review, there are 28 activities that affect the success of EC. The experts and managers of the EC business assign the causal relationship between activities by discussing questions like the following:

“Which activity B, C, D, etc. will be influenced by any change in activity A?” (Stach, Kurgan, Pedrycz, & Reformat, 2005).

Using an if-then rule enables us to determine the weight (strength) of each causal relationship. The form of this rule is as follows:

If activity A_i faces a change in its value, then this will cause a change by a {very small, small, medium, large, or very large amount} in activity A_j.

The influence of activity A_i on activity A_j can be one of 13 linguistic terms given in Table 3. The negative membership in Table 3 indicates that an increase or improvement in activity A_i causes a decrease or deterioration in activity A_j.

Since several experts are asked to create their own final matrix of activities, a consensus between different experts' opinions is needed to be reached. The augmented FCM method (Salmeron, 2009) enable us to reach this agreement. This approach is used when experts' opinions have equal weights. In this approach, an average between corresponding cells in the final matrices of activities received from experts is calculated and the final connection matrix (W) is created. This matrix is used to draw the graph form of the FCM model.

Table 3. Linguistic terms used for assessing the causal relationship between activities

Linguistic term	Crisp value
μ_{cn}= Completely negative	-1
μ_{nvs} = Negative very strong	-0.9
μ_{ns} = Negative strong	-0.7
μ_{nm} = Negative medium	-0.5
μ_{cw} = Negative weak	-0.3
μ_{nvw} = Negative very weak	-0.1
μ_{z} = Zero	0
μ_{pvw} = Positively very weak	0.1
μ_{pw} = Positively weak	0.3
μ_{pm} = Positively medium	0.5
μ_{ps} = Positively strong	0.7
μ_{pvs} = Positively very strong	0.9
μ_{cp} = Completely positive	1

Step 2. Measure the contribution weight of the activities to the overall success

To calculate the contribution weights of activity, it is possible to use either absolute judgment or comparative judgment (Saaty, 2006; Yeh & Chang, 2009). Comparative judgment is the process of comparing activities against each other and determining their relative importance in this way (Shidpour, Shahrokhi, & Bernard, 2013). On the other hand, contribution weights in absolute judgment are obtained by giving each activity its own single weight regardless of other activities. In the context of e-commerce success, there are no scales to evaluate the influence of activities on the overall success; furthermore, the result of comparative judgment is more reliable because in many cases there is no scale to weighing the decision criteria (Saaty, 2006). Considering the aforementioned points, comparative judgment is accomplished.

Experts, by using the linguistic terms given in Table 4 and the following question, compare

the importance of all activities against each other to measure the contribution weight of activities to the overall success.

"How important is activity A compared to activity B in determining the overall success?"

As discussed in the literature review, there are eight functional areas of activities. To evaluate how each activity contributes to the overall success three following steps should be followed (Yeh & Chang, 2009):

1. Activities within each functional area should be compared against each other to determine their contribution weights in each functional area. This calculation determines the local contribution of each activity.
2. Functional areas should be compared against each other to determine how each area contributes to the overall success. This calculation determines the local contribution of each functional area.
3. The two sets of local weights of activities and areas should be used to calculate the global contribution weight of activities

To assess the local and global contribution weights of activities $A_1, A_2 \ldots A_n$ within functional area F_k is given below:

1. Because there is only one comparison matrix, the Normalization method makes it possible to obtain the local weight of each activity and each functional area.

$$LW_{A_i} = \frac{A_{ij}}{\sum_{j=1}^{n} A_{ij}} \qquad i,\ j = 1, 2 \ldots \text{n} \tag{1}$$

After calculating the normalized value of each cell, we calculate the average amount of each row to determine the local weight of activities and functional areas.

2. the global weights of each activity Ai are calculated as follows:

$$GW_{A_i} = \frac{LW_{A_i} \times LW_{F_k}}{\left(\prod_{i=1}^{N_k} LW_{A_i}\right)^{\frac{1}{N_K}}} \tag{2}$$

Where F_k the functional area k ($k = 1,2,...,m$), LW_{F_k} is the local weights of each functional area F_k in association with other *m-1* functional areas, $LW_{A_i} (i = 1,2,..., N_k)$ is the local weight of each activity in its corresponding functional area F_k with N_k associated activities.

Table 4. Set of Linguistic terms used for pairwise comparisons between the activities

Linguistic term	Crisp value
Just equal (JE)	1
Weakly more important (WI)	3
Strongly more important (SI)	5
Very strongly more important (VSI)	7
Absolutely more important (AI)	9

Step 3. Evaluate the success of the activities

As shown in Table 5 a set of linguistic terms is used to represent the six success states of e-commerce activities. Because experts' evaluations are full of imprecise and subjective notions, it is intuitively much easier to reflect experts' opinions using linguistic terms instead of crisp numbers (Yeh & Chang, 2009).

Table 5. Activities' success state

Linguistic term	Value
Not successful (NS)	0
Very weakly successful (VWS)	0.2
Weakly successful (WS)	0.4
Moderately successful (MS)	0.6
Strongly successful (SS)	0.8
Very strongly successful (VSS)	1

Step 4: Evaluate the overall e-commerce success

Having an initial success state of activities and the results of the FCM inference process (Salmeron, 2012) enable decision-makers to assess the overall success state of the EC business. In the FCM model, by using the FCM inference shown as following Eq (3) all activities reach a new value that is the result of the continuous influence of activities on each other (Froelich, Papageorgiou, Samarinas, & Skriapas, 2012). The new value is calculated by aggregating the initial success state of each activity with the summation of influences received from other activities. Assessing the new (final) value of each activity is calculated by

$$V_{A_i}^{(t)} = V_{A_i}^{(t=0)} + f\left(\sum_{j=1}^{n} V_{A_j}^{(t-1)} \times w_{A_j A_i}\right) \tag{3}$$

In this formula, the value of each activity (A_i) in t-th iteration is $V_{A_i}^{(t)}$ and the weight of the causal relationship between each pair of A_j and A_i is shown by $w_{A_j A_i}$; furthermore, f is the hyperbolic tangent equation as shown in Eq. (4)

$$f(x) = \frac{e^{cx} - e^{-cx}}{e^{cx} + e^{-cx}} \tag{4}$$

$$x = \sum_{j=1}^{n} V_{A_j}^{(t-1)} \times w_{A_j A_i}$$

Where c>0 is the slope of the function which is constant.

The final success state of an EC business is calculated by multiplying the final success values of activities by their corresponding global weight. The complete equation is indicated below:

$$FR = \frac{\sum_{i=1}^{n} V_{A_i} \times GW_{A_i}}{\sum_{i=1}^{n} GW_{A_i}} \tag{5}$$

This approachV_{A_i} comes from the result of FCM inference shown in Eq (3) and the global weight of each activity GW_{A_i} comes from the result of step 2.

Step 5. The evaluation model analysis

The results of applying the DEMATEL method to the evaluation's model connection matrix (*W*) enable decision-makers to prioritize activities based on their influential ability and their interaction with other activities. In other words, the result of this analysis enables decision-makers to classify activities into four management zones represented in Fig. 1. This matrix enables decision-makers to choose the activities for improvement that yields the most substantial benefits from the investment of EC businesses' limited resources. (Ahmadi, Yeh, Papageorgiou, & Martin, 2015; Politis & Siskos, 2004; Yeh & Xu, 2013).

As mentioned before, the final connection matrix W is the input of the DEMATEL method that helps decision-makers determine the extent of each activity influences the others. The final connection matrix is denoted as $W = \lfloor w_{ij} \rfloor_{n \times n}$. The steps of the DEMATEL method is shown below.

1. The normalized final connection matrix $X = \lfloor x_{ij} \rfloor_{n \times n}$ is calculated and

$0 \le x_{ij} \le 1$

$$X = s \cdot W \tag{6}$$

$$s = \frac{1}{Max_{1 \le i \le n} \sum_{j=1}^{n} w_{ij}} \qquad i, j = 1,2,...,n \tag{7}$$

2. The matrix T that shows the direct and indirect relationships between activities is calculated as follows.

$$T = X(I - X)^{-1} \tag{8}$$

Where I is the $n \times n$ identity matrix?

3. Two values that are *"R"* and *"J"* can be extracted from the *T* matrix. The rows sums is a column named *"R"* and the column sums is a row named *"J"*. The *"R_i"* (row sums) is used to determine how much the activity *i* influence other activities. On the other hand, the "*j_i"* (column sums) is used to determine how much influence activity *i* receives from other activities.

4. Calculate *(R_i+J_i)* and *(R_i-J_i)* for each individual activity *i*. These values help decision-makers to assess the role of activities in the FCM model. The *(R_i+J_i)* shows the interaction degree of

each activity with the other activities in the evaluation model. The index (R_i-J_i) enables us to compare the dispatching influence by activity i to influences received from other activities. A high positive value of (R_i-J_i) means that the activity is highly influenced by dispatching and play an important role in improving the success state of other activities.

Using the results of (R_i+J_i) and (R_i-J_i) enables decision-makers to classify activities under four groups:

1. Activities with a high level of (R_i-J_i) and a high level (R_i+J_i). These activities have a high priority while any change or improvement in this group of activities has a significant effect on other activities; furthermore, considering their high-level interaction in the network, any failure in reaching sufficient level of success related to this group of activities could result in failure in other activities.
2. Activities with a high level of (R_i-J_i) and a low level of (R_i+J_i). Considering the high level of influencing of these activities on the other activities, they require specific attention. Investment in this class of activities will bring significant improvement to other activities.
3. Activities with a low level of (R_i-J_i) and a high level of (R_i+J_i). These activities have a lower priority comparing with the two former groups. Since they only have interaction in the network model and are influence receivers, they need a regular attention
4. Activities with a low level of (R_i-J_i) and a low level of (R_i+J_i). Considering the low interaction of these activities with other activities and the fact that they are just influence receivers, these activities require low attention.

Apart from the aforementioned grouping method, there is another method that can be used to categorize activities from another aspect. We can draw another management matrix, Fig.1, using two criteria that are the geometric mean (Yeh & Xu, 2013) of the influence (direct and indirect) of each activity on the others (vertical axis), and the mean of contribution weight of each activity (explained previously as GW_{A_i} on the overall success (horizontal axis). The vertical measure enables decision-makers to understand the extent of influence of any change in each activity on the success state of other activities. On the other hand, the horizontal measure shows the influence of this change on the overall success of the EC business.

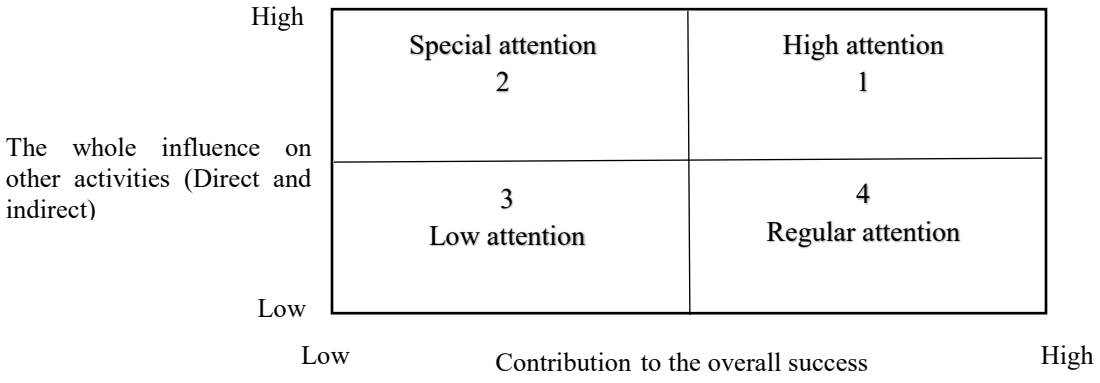


Fig. 1. Management zones of the influential activities

To improve the success state of the EC business, it is recommended to pay special attention to the activities that are in the high attention zone (1) because of the influence that these activities have on the others and the overall success. Allocating sufficient resources to these activities is a sound plan. The success state of these activities should be under the constant supervision of decision-makers.

In zone (2) activities are characterized by their high influence in the network model and low contribution level. Because of influences in the model, decision-makers must pay special attention to the success state of these activities and ensure that sufficient resources are allocated to them. Allocating more resources to these activities can be one of the long-term plans of decision-makers.

Decision-makers should provide regular or periodic checks on the success state of the activities that belong to the regular attention zone (4). Furthermore, it is recommended that decision-makers pay minimal attention to the activities that fall into the low attention zone (3) only after allocating adequate attention to the other activities.

Empirical study

To provide step-by-step practical guidance on the proposed FCM-AHP method, we will apply it to Digikala, an EC business in Iran that has the biggest share of the e-commerce market. There are ten experts providing input information.

Step 1: Formulate the relationship between activities

In the first stage, we use the proposed FCM technique in Section 4.1 to formulate the interrelationship between activities. Experts and managers of Digikala assess the existence (columns 1, 2, and 3 in Table 1 Appendix) and weight (column 4 in Table 1 Appendix) of the interrelationship between activities by running some workshops and meetings.

Using the if-then rule explained in Section 4.1 and 13 linguistic terms given in Table 3 make it possible to obtain the weight (strength) of causal relationships between activities that are shown in column 3 of Table 1 of Appendix. As can be seen in Table 1 Appendix, a negative relationship is used in some cells to represent the reverse relationship that exists between activities. A reverse relationship means that any improvement in the first activity will affect the second activity adversely. In the next stage, the augmented weights are calculated shown in column 4 of Table 1 Appendix. Furthermore, these values fill the cells of the final connection matrix shown in Table 2 Appendix. This matrix indicates row activities influence column activities. Fig. 2 represents the final connection matrix visually. The direction of arrows indicates the direction of influence. To make the diagram less crowded and more readable, we have used the notation Ri, j ; for example, the arrow $RA17, A2$ (down right on Fig.2) feeds into activity A_2 (top right on Fig. 2).

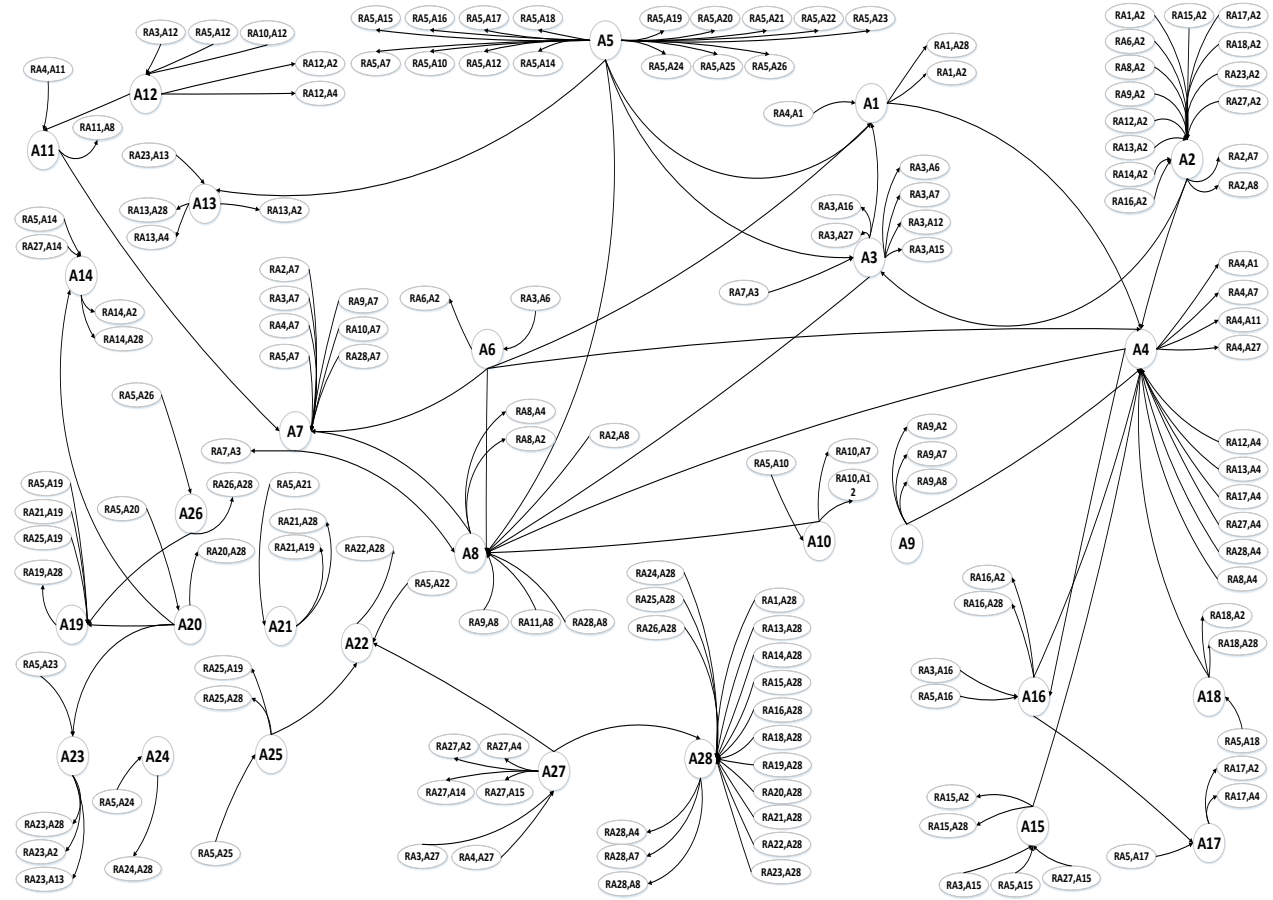


Fig. 2. The causal relationship between the influential activities

Step 2: Assess the contribution weight of activities to the overall success

To calculate the contribution weight of activities, the hierarchical structure of activities and their corresponding, as shown in Table 1, is used. In each functional area, all pairs of activities are compared to obtain LW_{Ai} , then all pairs of functional areas are compared to obtain LW_{Fk} and finally by using Eq. (2) the global contribution weight of activities GW_{Ai} is calculated.

Fig. 3(a)-(i) are drawn to show the result of pairwise comparison within each area and among 8 functional areas.

(a) irwise comparison in F_1

	A_1	A_2	LW_A	GW_A
A_1	JE	WI	0.75	0.147
A_2	1/WI	JE	0.25	0.049

(b) Pairwise comparison in F_2

	A_3	A_4	A_5	LW_A	GW_A
A_3	JE	1/WI	1/VSI	0.08	0.113
A_4	WI	JE	1/VSI	0.167	0.236
A_5	VSI	VSI	JE	0.751	1.062

(C) Pairwise comparison in F_3

	A_6	A_7	A_8	LW_A	GW_A
A_6	JE	WI	SI	0.633	0.437
A_7	1/WI	JE	WI	0.259	0.179
A_8	1/SI	1/WI	JE	0.106	0.073

(d) Pairwise comparison in F_4

	A_9	A_{10}	LW_A	GW_A
A_9	JE	1/WI	0.25	0.031
A_{10}	WI	JE	0.75	0.093

(e) Pairwise comparison in F_5

	A_{11}	A_{12}	A_{13}	A_{14}	LW_A	GW_A
A_{11}	JE	WI	WI	WI	0.485	0.225
A_{12}	1/WI	JE	JE	WI	0.223	0.103
A_{13}	1/WI	JE	JE	JE	0.161	0.074
A_{14}	1/WI	1/WI	JE	JE	0.129	0.059

(f) Pairwise comparison in F_6

	A_{15}	A_{16}	A_{17}	A_{18}	LW_A	GW_A
A_{15}	JE	1/WI	WI	WI	0.282	0.089
A_{16}	WI	JE	WI	WI	0.474	0.151
A_{17}	1/WI	1/WI	JE	JE	0.121	0.038
A_{18}	1/WI	1/WI	JE	JE	0.121	0.038

(g) Pairwise comparison in F_7

	A_{19}	A_{20}	A_{21}	A_{22}	A_{23}	A_{24}	A_{25}	A_{26}	LW_A	GW_A
A_{19}	JE	JE	WI	WI	SI	WI	WI	SI	0.269	0.368
A_{20}	JE	JE	JE	WI	WI	JE	WI	SI	0.192	0.263
A_{21}	1/WI	JE	JE	WI	WI	JE	JE	JE	0.126	0.173
A_{22}	1/WI	1/WI	1/WI	JE	JE	1/WI	JE	JE	0.06	0.082
A_{23}	1/SI	1/WI	1/WI	JE	JE	1/WI	JE	JE	0.055	0.076
A_{24}	1/WI	JE	JE	WI	WI	JE	WI	WI	0.157	0.216
A_{25}	1/WI	1/WI	JE	JE	JE	1/WI	JE	WI	0.082	0.112
A_{26}	1/SI	1/SI	JE	JE	JE	1/WI	1/WI	JE	0.055	0.076

(h) Pairwise comparison in F_8

	A_{27}	A_{27}	LW_A	GW_A
A_{27}	JE	1/SI	0.166	0.027
A_{27}	SI	JE	0.833	0.138

(i) Pairwise comparison between 8 functional areas

	F_1	F_2	F_3	F_4	F_5	F_6	F_7	F_8	LW_A
F_1	JE	1/WI	1/WI	WI	JE	WI	1/SI	1/WI	0.085
F_2	WI	JE	WI	SI	WI	SI	WI	SI	0.305
F_3	WI	1/WI	JE	WI	WI	SI	JE	WI	0.179
F_4	1/WI	1/SI	1/WI	JE	JE	JE	1/WI	JE	0.054
F_5	JE	1/WI	1/WI	JE	JE	WI	JE	WI	0.101
F_6	1/WI	1/SI	1/SI	JE	1/WI	JE	JE	WI	0.067
F_7	SI	1/WI	JE	WI	JE	JE	JE	WI	0.145
F_8	WI	1/SI	1/WI	JE	1/WI	1/WI	1/WI	JE	0.062

Fig. 3. Results of pairwise comparisons

Step 3 and 4: Evaluate the success state of activities and the overall e-commerce success

The linguistic terms explained in Table 5 enable decision-makers to evaluate the current success state of Digikala. Column 2 of Table 6 shows the initial success state of the 28 activities.

In the next step, we calculate the influence of activities on each other using the FCM inference calculation Eq. (3). Then, the overall success state of Digikala, by using Eq. (5) and the contribution weights calculated in Step 2 and the final values of activities is calculated.

The current overall success value of Digikala is 0.6799. If Digikala's decision-makers want to transform this value to a linguistic term, the success state is between moderately successful (MS) and strongly successful (SS). As a result, it can be inferred that Digikala is generally successful and its administrators have paid adequate attention to different aspects of this EC business.

Table 6. The initial and final success state of activities, and the overall success state of Digikala

Activities	Initial success state	The final value of success state	Activities	Initial success state	The final value of success state
A_1	SS	0.8129	A_{15}	SS	0.8101
A_2	MS	0.5841	A_{16}	MS	0.6108
A_3	MS	0.6146	A_{17}	MS	0.6088
A_4	WS	0.4103	A_{18}	SS	0.807
A_5	SS	0.8	A_{19}	MS	0.6181
A_6	MS	0.6018	A_{20}	SS	0.803
A_7	SS	0.8408	A_{21}	MS	0.6024
A_8	SS	0.8408	A_{22}	MS	0.6094
A_9	WS	0.4	A_{23}	WS	0.4075
A_{10}	WS	0.4072	A_{24}	VWS	0.2024
A_{11}	SS	0.8084	A_{25}	MS	0.6029
A_{12}	SS	0.8078	A_{26}	MS	0.6027
A_{13}	VSS	1	A_{27}	WS	0.4037
A_{14}	VSS	1	A_{28}	SS	0.8522
The overall success: 0.6799					

Success state abbreviations come from Table 5.

Step 5: The evaluation model analysis

Activities planning and managing

Success evaluation model can be used to extract practical insight for decision-makers to develop improvement plans more efficiently. As mentioned earlier in section 4.5, we can categorize activities into two matrices, and based on four criteria: GW_A, R_i, R_i-J_i and R_i+J_i. These criteria assist decision-makers in choosing activities for improvement that yields the most favorable results.

The final connection matrix, shown in Table 2 Appendix, and the DEMATEL technique are used to categorize activities. Table 7 is drawn to indicate the result of this analysis.

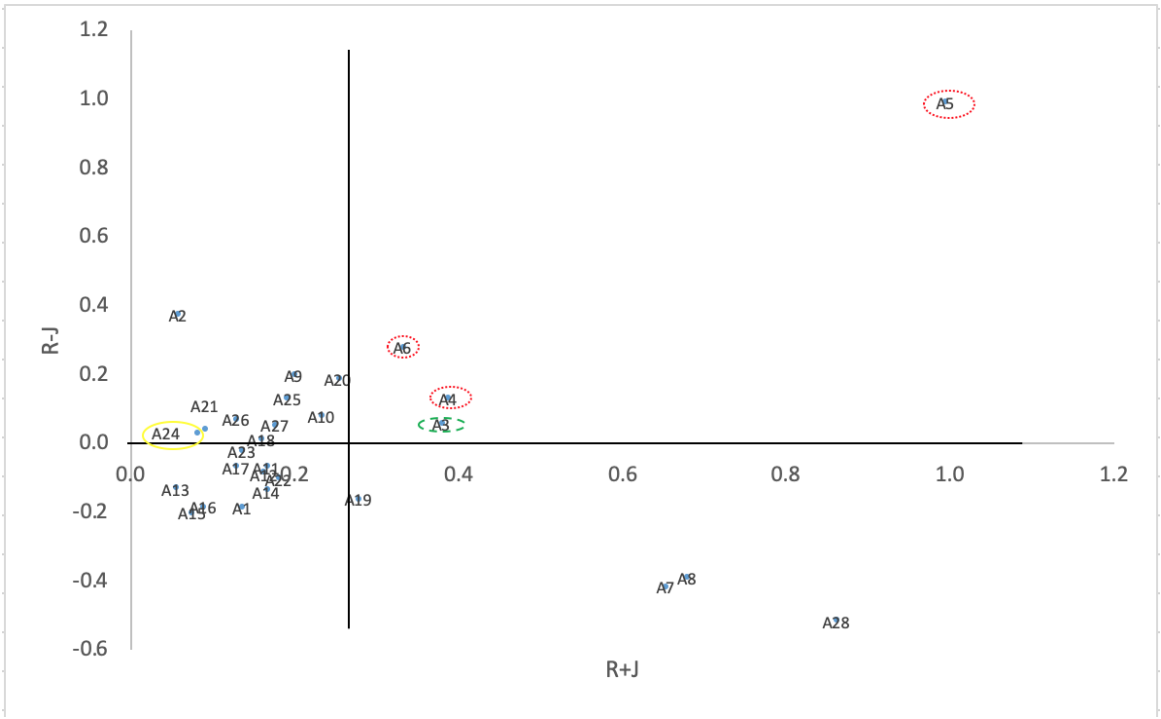
These four criteria enable decision-makers to form two plots shown in Fig. 4(a) and (b). Fig 4(a) visualize the categorization of activities into four management zones using 2 criteria: R_i-J_i and R_i+J_i. In Fig. 4(b), the criterion GW_A, and activities' overall influence on other activities (R_i,) are used to categorize the activities.

It is possible to combine the results that are shown in Fig. 4(a) and Fig. 4(b) to provide a better analysis. As Fig. 4(a) indicates, the four activities of A_3, A_4, A_5, and A_6 all have a high influencing degree and a high level of interaction in the network model while three of these activities including A_4, A_5, and A_6 are also located in the high attention zone with high contribution weight and high influence on other activities. These activities can improve the overall success state of Digikala considerably and demand constant supervision of decision-makers.

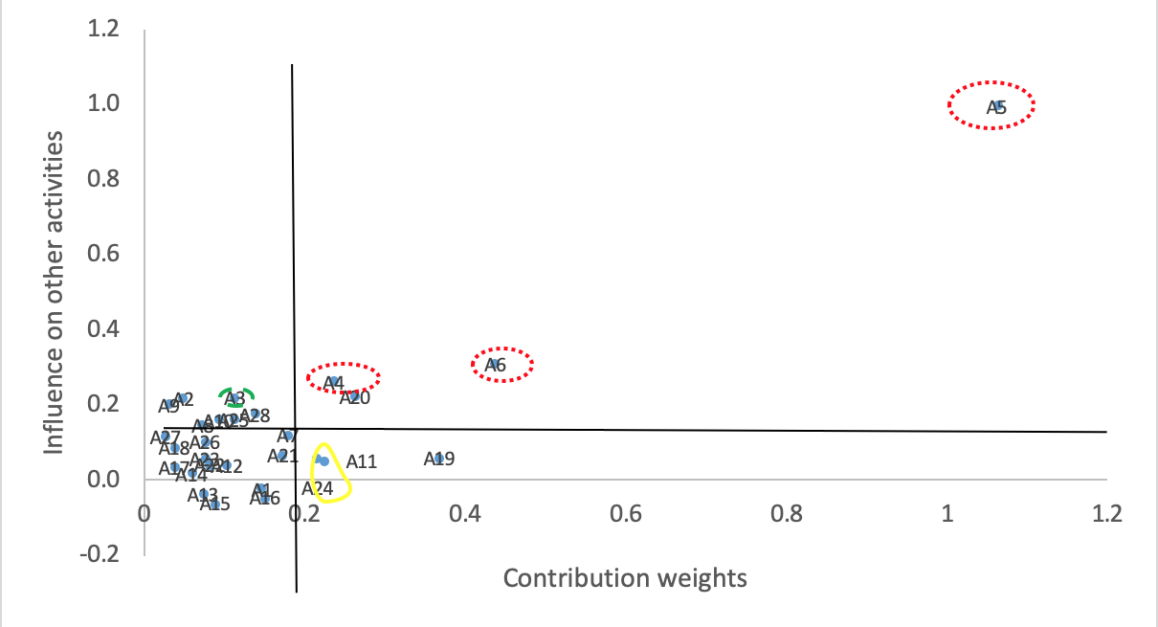
As can be seen in Fig. 4, while the activity of providing adequate financial resources (A_3) has a high influence on the other activity and also it has a high level of interaction with other activities it is located in the special attention zone. This activity has a low direct contribution to the overall success state of Digikala, however, it has a high positive influence on other activities; therefore, decision-makers should pay special attention to this activity.

Table 7: The result of DEMATEL analysis

Activity	R_i	J_i	R_i+J_i	R_i-J_i	Activity	R_i	J_i	R_i+J_i	R_i-J_i
A_1	-0.025	0.161	0.136	-0.186	A_{15}	-0.062	0.138	0.076	-0.2
A_2	0.217	-0.158	0.059	0.374	A_{16}	-0.047	0.136	0.089	-0.183
A_3	0.218	0.161	0.379	0.057	A_{17}	0.032	0.097	0.129	-0.065
A_4	0.26	0.128	0.388	0.133	A_{18}	0.086	0.074	0.159	0.012
A_5	0.994	0	0.994	0.994	A_{19}	0.059	0.22	0.279	-0.161
A_6	0.307	0.025	0.332	0.282	A_{20}	0.222	0.032	0.253	0.19
A_7	0.119	0.534	0.653	-0.415	A_{21}	0.065	0.025	0.091	0.04
A_8	0.144	0.534	0.678	-0.389	A_{22}	0.04	0.141	0.181	-0.101
A_9	0.2	0	0.2	0.2	A_{23}	0.057	0.079	0.136	-0.022
A_{10}	0.158	0.076	0.233	-0.082	A_{24}	0.057	0.025	0.082	0.032
A_{11}	0.05	0.116	0.166	-0.065	A_{25}	0.161	0.03	0.191	0.131
A_{12}	0.039	0.124	0.163	-0.086	A_{26}	0.101	0.029	0.129	0.072
A_{13}	-0.037	0.092	0.055	-0.129	A_{27}	0.116	0.06	0.176	0.055
A_{14}	0.015	0.151	0.166	-0.136	A_{28}	0.173	0.688	0.861	-0.515



(a) Categorization of the activities based on ($R_i + J_i$) and ($R_i - J_i$)



(b) Categorization of the activities based on their contribution weight and influence on the other activities

Activity in the high attention zone in Fig. 4(b)

Activity in the especial attention zone in fig. 4(b)

Activity in the regular attention zone in Fig. 4(b)

Fig. 4. Management matrices of 28 influential activities

Improvement planning scenario analysis

After evaluating the current success state of Digikala, decision-makers should find the best improvement plan to improve the overall success state of Digikala. As mentioned before, the main advantage of taking into account the causal relationship in developing the evaluation model is to assess the success state of an EC business with considerable precision after conducting different improvement scenarios.

To the most efficient activities for improvement, a set of improvement scenarios is developed as follows:

1. Apply one level up improvement in a single activity and evaluate its effect on the overall success. The results of this improvement scenario determine the activity with the highest influence in the model.
2. Apply one level up improvement in activities of a single functional area and then measure this plan's effect. The improvement scenario distinguishes the best functional area to be improved.
3. Improve one activity with the highest contribution to the overall success within each functional area.

4. Improve a set of activities with an initial success state lower than the mean and ranking better than the average of activities.

After conducting these improvement scenarios and assessing their results on the success state of Digikala, the probability to find the most efficient improvement plan will increase.

In the first set of scenarios, all activities are improved one level up. It means if the current success state of activity is moderately successful (MS), then decision-makers improve it to strongly successful (SS). Table 8 is drawn to indicate the result of these 28 improvement scenarios on the overall success of Digikala. The column of "Value of overall success" in Table 8 expresses the result of each of these 28 improvement scenarios and the last column of this table indicates activities' improvement rank. As shown, activity A_5 yields the highest overall success (0.7253) compared to improvements in other activities. As a result, if the decision-makers plan to improve the overall success state of Digikala by allocating resources to only one activity, the result of this analysis can be used. However, this conclusion should be considered with caution. It is necessary to consider required resources to improve activity by one level and compare the outcomes with the outcomes and required resources of improving other activities to determine the best activity to improve.

Table 8. Results of 28 one level up improvement scenarios

Scenario	Activity	Improvement scenario	Value of overall success	Rank [a]
1	A_1	SS to VSS	0.6857	11
2	A_2	MS to SS	0.6821	22
3	A_3	MS to SS	0.6848	12
4	A_4	WS to MS	0.6901	5
5	A_5	SS to VSS	0.7253	1
6	A_6	MS to SS	0.6986	2
7	A_7	SS to VSS	0.686	10
8	A_8	SS to VSS	0.6824	21
9	A_9	WS to MS	0.6813	25
10	A_{10}	WS to MS	0.6839	16
11	A_{11}	SS to VSS	0.689	7
12	A_{12}	SS to VSS	0.6841	15
13	A_{13}	VSS		
14	A_{14}	VSS		
15	A_{15}	SS to VSS	0.6834	17
16	A_{16}	MS to SS	0.6862	9
17	A_{17}	MS to SS	0.6816	23
18	A_{18}	SS to VSS	0.6815	24
19	A_{19}	MS to SS	0.6955	3
20	A_{20}	SS to VSS	0.691	4
21	A_{21}	MS to SS	0.6873	8
22	A_{22}	MS to SS	0.6834	18
23	A_{23}	WS to MS	0.6831	20
24	A_{24}	VWS to WS	0.6891	6
25	A_{25}	MS to SS	0.6848	13
26	A_{26}	MS to SS	0.6833	19
27	A_{27}	WS to MS	0.6811	26
28	A_{28}	SS to VSS	0.6843	14

In the second set of improvement scenarios, the eight functional areas are used. In this set of scenarios, each time, all the activities in one functional area were improved by one level up. Table 9 indicates the result of these 8 improvement scenarios.

As can be seen, in the first scenario, activities A_1 and A_2 are improved one level from their initial success state shown in Table 8. The overall success after conducting this improvement scenario is 0.6879.

The result of this analysis determines the functional areas where the decision-makers should concentrate their improvement efforts. Table 9 suggests that the Website area F_7 (0.7328) and Financial area F_2 (0.7404) are two functional areas that have the greatest effect on the improvement of other activities and the overall success of Digikala.

Table 9. Functional area improvement scenarios

Improving functional area	**Activities within each functional area**	**Improvement scenario description**	**Value of overall success**
F_1: Technical	A_1	SS to VSS	0.6879
	A_2	MS to SS	
F_2: Financial	A_3	MS to SS	0.7404
	A_4	WS to MS	
	A_5	SS to VSS	
F_3: Individual	A_6	MS to SS	0.7070
	A_7	SS to VSS	
	A_8	SS to VSS	
F_4: Environmental	A_9	WS to MS	0.6854
	A_{10}	WS to MS	
F_5: Customer care	A_{11}	SS to VSS	0.6932
	A_{12}	SS to VSS	
	A_{13}	VSS	
	A_{14}	VSS	
F_6: Marketing	A_{15}	SS to VSS	0.6931
	A_{16}	MS to SS	
	A_{17}	MS to SS	
	A_{18}	SS to VSS	
F_7: Website-based trust	A_{19}	MS to SS	0.7328
	A_{20}	SS to VSS	
	A_{21}	MS to SS	
	A_{22}	MS to SS	
	A_{23}	WS to MS	
	A_{24}	VWS to WS	
	A_{25}	MS to SS	
	A_{26}	MS to SS	
F_8: Organization-based trust	A_{27}	WS to MS	0.6855
	A_{28}	SS to VSS	

The third improvement scenario is improving activities with the highest rank within each functional area.

In the last improvement scenario, Digikala's decision-makers have tried to take into account the required resources in the process of choosing activities for improvement. To do so, activities with the highest ranking and lowest initial success state are chosen. There is an underlying assumption for choosing these activities. The assumption is that the lower the initial success state of activity, the fewer resources will be needed to improve that activity by one level. As can be seen in Fig. 5., activities fall into the area where the ranking is high and the initial success state is low are chosen. More specifically, activities including A_3, A_4, A_6, A_{16}, A_{19}, A_{21}, A_{24}, and A_{25} are chosen. Furthermore, as mentioned earlier, management matrices are developed to help decision-makers choose activities for improvement more informed. Among the chosen activities for this improvement scenario, A_3, A_4, A_6, and A_{24} belong to the group of activities that have a significant influence on the overall success of Digikala and need constant supervision of decision-makers.

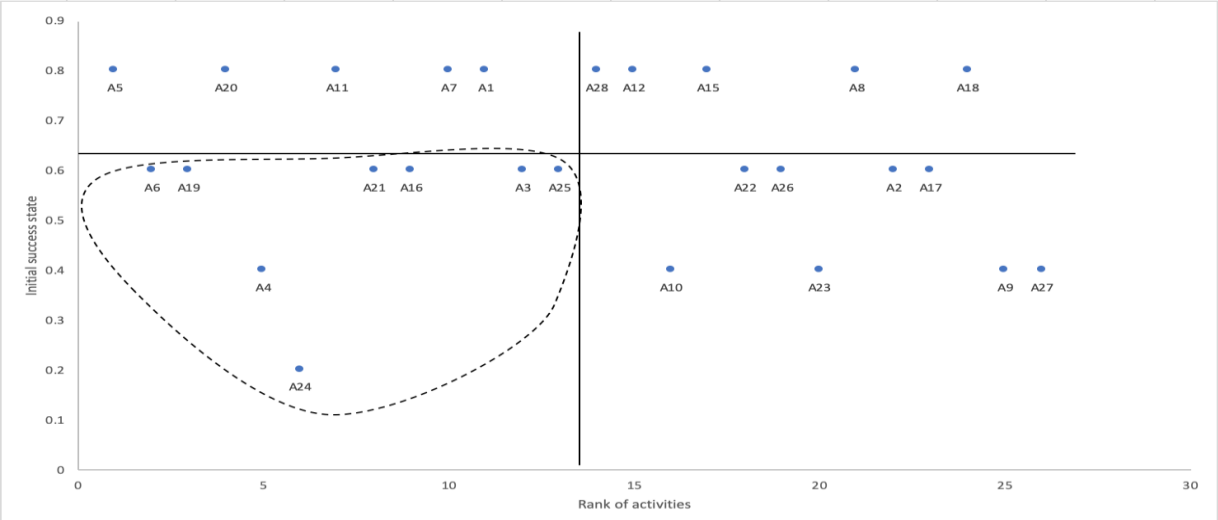


Fig. 5. Categorization of activities for improvement scenario 4

Table 10 is drawn to compare the result of the last two improvement scenarios:

1. Improve 8 activities with the highest rank where each of them is chosen from each functional area

2. Improve set of top 8 activities that have high ranks and low initial success state In all of the improvement scenarios, the rank of activities comes from column 4 of Table 8.

It can be asserted that it is better for Digikala's decision-makers to follow the improvement scenario (3) compared to the improvement scenario (4). However, it is possible that the required resources for implementing improvement scenario (3) are much higher than the required resource for implementing improvement scenario (4). In other words, this analysis fails to take into account a very decisive point that is resources and efforts that must be allocated to these

improvement scenarios. For example, further analyses are needed to determine whether improving the success state of two activities that are in the same functional area demands more resources rather than improving the success state of two activities that are in two different functional areas. Making a decision based on the result of improvement scenarios without considering the resources that must be allocated is impractical and unreasonable. As a result, if decision-makers want to choose between four improvement scenarios, they must take into account the required resources and results carefully.

Table 10. The result of improvement scenarios (3) and (4)

Functional area	**Activities within each functional area**		**Improving top activities within each functional area**		**Improving activities with high rank and low initial success state**	
			Chosen activity within each functional area	**Improvement scenario description**	**Chosen activity based on Fig. 5**	**Improvement scenario description**
F_1: Technical	A_1	11	✔	SS to VSS		No change
	A_2	22		No change		No change
F_2: Financial	A_3	12		No change	✔	MS to VSS
	A_4	5		No change	✔	WS to MS
	A_5	1	✔	SS to VSS		No change
F_3: Individual	A_6	2	✔	MS to SS	✔	MS to SS
	A_7	10		No change		No change
	A_8	21		No change		No change
F_4: Environmental	A_9	25		No change		No change
	A_{10}	16	✔	WS to MS		No change
F_5: Customer care	A_{11}	7	✔	SS to VSS		No change
	A_{12}	15		No change		No change
	A_{13}			No change		No change
	A_{14}			No change		No change
F_6: Marketing	A_{15}	17		No change		No change
	A_{16}	9	✔	MS to SS	✔	MS to SS
	A_{17}	23		No change		No change
	A_{18}	24		No change		No change
F_7: Website-based trust	A_{19}	3	✔	MS to SS	✔	MS to SS
	A_{20}	4		No change		No change
	A_{21}	8		No change	✔	MS to SS
	A_{22}	18		No change		No change
	A_{23}	20		No change		No change
	A_{24}	6		No change	✔	VWS to WS
	A_{25}	13		No change	✔	MS to SS
	A_{26}	19		No change		No change
F_8: Organization-based trust	A_{27}	26		No change		No change
	A_{28}	14	✔	SS to VSS		No change
Overall success				0.7892		0.7571

Conclusion

Decision-makers of EC businesses that aim to reach a higher success state in the administration and implementation of e-commerce must identify influential activities that lead to e-commerce success, use a model to evaluate the current success state, and devise an improvement plan accordingly. In this paper, we have identified influential activities, and have proposed a structured FCM-AHP approach to manage influential activities to reach a higher success state. This approach makes methodological and conceptual contributions to the field of e-commerce success. This approach proposes three advancements:

1. The approach makes it possible to use causal relationships between influential activities to develop a more accurate evaluation model.

2. The approach enables researchers to determine the extent of contribution of each activity to the overall success of EC businesses.

3. The approach provides two criteria for choosing activities for improvement that help decision-makers to develop improvement scenarios more informed.

These features facilitate the analyzing process of e-commerce success. Using the causal relationships between influential activities clears the direct and indirect effect of any change or improvement in one or a set of activity(s) on the other activities and the overall success. As a result, assessing the effect of different improvement scenarios becomes possible. Another advantage of the approach is that it can be tailored to the special situation of every EC business. More specifically, the evaluation model that is the bedrock of improvement scenarios is generated based on the specific situation of each EC business. This feature provides decision-makers with the possibility to devise improvement plans based on the special success state of an EC business.

To illuminate different stages of the approach, we have applied the success management approach to Digikala and tried to indicate how the overall success of an EC business can be analyzed and then be improved. We have tried to indicate that this approach helps decision-makers to (1) evaluate the success state of an EC business more accurately by taking into account the causal relationships between activities, and (2) analyze effects of different improvement scenarios on the overall success and improve activities that yield the highest improvement possible. These are the approach's practical applications that make the proposed approach beneficial for an EC business to effectively manage its influential activities during the implementation and administration of e-commerce.

Finally, this research has some limitations that are (a) the difficult process of evaluating the success state of activities because of their qualitative nature, (b) the fact that the robustness and accuracy of developed evaluation model are mainly founded on the knowledge of experts, and the point that as the number of nodes increases the complexity of model will increase, and (c) the

inability of the model to take into account the available resources of an EC business at the time of choosing the most effective improvement plan are the main limitations of this research. Future studies on this research area could be done for solving these problems by (a) devising new and more efficient approaches to evaluate the success state of the activities without omitting causal relationships, (b) decreasing the dependency of the model on the experts' knowledge by using historical data and automatic methods of FCM construction, and (c) developing an approach to taking into account available resources of EC businesses at the time of developing the most effective improvement plan. Finally, as Collins & Hansen (Collins & Hansen, 2011) mentioned, it is not judicious to think that the key to the success of a business is just finding a set of influential activities. In fact, developing a model to evaluate the current success state accurately and developing the most cost-effective improvement plan are other components of this process. To conclude, we have tried to propose an approach that will increase the probability of success in the implementation and administration of e-commerce, and help decision-makers to devise improvement plans and allocate limited resources more efficiently.

Conflict of interest

The authors declare no potential conflict of interest regarding the publication of this work. In addition, the ethical issues including plagiarism, informed consent, misconduct, data fabrication and, or falsification, double publication and, or submission, and redundancy have been completely witnessed by the authors.

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Appendix

Table 1. Causal Relationship between activities

If	Then	Relation	Weights *(W)*
The EC business uses security features to decrease customers' concerns and increase customers' trust,	The administration and implementation of e-commerce will be more complex.	A_1 influences A_2	-0.3
	Costs related to the administration and implementation of e-commerce will increase.	A_1 influences A_4	-0.28
	Customers will feel that the EC business is reputable.	A_1 influences A_{28}	0.28
The implementation and administration of e-commerce are	It is more probable that the allocated financial resources would be sufficient.	A_2 influences A_3	0.5
	Costs related to the administration and implementation of e-commerce will decrease.	A_2 influences A_4	0.7
	Top management support for the implementation and administration of	A_2 influences	0.66

If	Then	Relation	Weights *(W)*
not complicated regarding the type of market chosen by the company,	e-commerce will increase.	A_7	
	Organizational resistance to the necessary changes for the implementation and administration of e-commerce will decrease.	A_2 influences A_8	0.72
The EC business allocates sufficient financial resources to the implementation and administration of e-commerce,	The EC business will use security features to increase customers' trust and decrease customers' risk.	A_3 influences A_1	0.3
	The EC business will have the possibility and resources to equip staff with technical skills and IT knowledge.	A_3 influences A_6	0.3
	Top management support for the implementation and administration of e-commerce will increase.	A_3 influences A_7	0.26
	Organizational resistance to the necessary changes for the implementation and administration of e-commerce will decrease.	A_3 influences A_8	0.5
	The EC business will provide customers with fast shipment and reasonable shipping fees of ordered goods and services.	A_3 influences A_{12}	0.28
	The EC business will have the possibility and resources to use many channels to market and communicate with customers.	A_3 influences A_{15}	0.3
	The EC business will have adequate financial resources to do continuous marketing campaigns and plans.	A_3 influences A_{16}	0.3
	The EC business will have adequate financial resources to increase its offline presence.	A_3 influences A_{27}	0.36
The costs related to the implementation and administration of e-commerce are low,	The EC business ability and disposable financial resources to use security features to increase customers' trust and decrease customers' risk will increase.	A_4 influences A_1	0.24
	Top management support for the implementation and administration of e-commerce will increase.	A_4 influences A_7	0.7
	Organizational resistance to the necessary changes for the implementation and administration of e-commerce will decrease.	A_4 influences A_8	0.7
	The EC business will be able to offer competitive prices.	A_4 influences A_{11}	0.68
	The EC business will have adequate financial resources to do continuous marketing will increase.	A_4 influences A_{16}	0.42
	The EC business will have adequate financial resources to increase its presence in the physical market.	A_4 influences A_{27}	0.36
The people who are involved in the implementation and administration of e-commerce in an EC business are aware of the costs, benefits, essence, and the nature of e-commerce,	It is more likely that the EC business will use security features to increase customers' trust and decrease customers' risk.	A_5 influences A_1	0.88
	It is more likely that the EC business will allocate adequate financial resources to the implementation and administration of e-commerce.	A_5 influences A_3	0.72
	Top management support for the implementation and administration of e-commerce will increase.	A_5 influences A_7	0.88
	Organizational resistance to the necessary changes for the implementation and administration of e-commerce will decrease.	A_5 influences A_8	0.9
	The EC business will offer products and services that are more suitable for e-commerce, with respect to the nature of e-commerce.	A_5 influences A_{10}	0.9
	The EC business will be able to provide customers with fast shipment and reasonable shipping fees of ordered goods and services.	A_5 influences A_{12}	0.3
	The EC business will offer a wide range of products and services.	A_5 influences A_{13}	0.48
	The EC business will provide customers with specific and obvious return and refund policies.	A_5 influences A_{14}	0.68
	The EC business will use many channels to market and communicate	A_5 influences	0.72

If	Then	Relation	Weights *(W)*
	with customers.	A_{15}	
	The EC business will do continuous marketing campaigns and plans.	A_5 influences A_{16}	0.9
	It is more likely that the EC business will use analytical methods and tools in marketing to improve the efficiency and effectiveness of its marketing plans.	A_5 influences A_{17}	0.9
	It is more likely that the EC business will use CRM methods and tools.	A_5 influences A_{18}	0.88
	The EC business will launch a website that is easy to use for customers.	A_5 influences A_{19}	0.48
	The EC business will try to provide accurate, relevant, and complete information about goods and services for customers.	A_5 influences A_{20}	0.38
	The EC business will try to launch a website that is attractive in terms of graphical characteristics.	A_5 influences A_{21}	0.3
	The EC business will try to launch a website that conveys the feeling of being connected to a human through a system to customers.	A_5 influences A_{22}	0.3
	The EC business will try to launch a website that has customization capacity.	A_5 influences A_{23}	0.24
	The EC business will try to show that they are connected to a well-known and reputable EC business on its website.	A_5 influences A_{24}	0.3
	The EC business will try to launch a website that is equipped with live chat and customers' reviews.	A_5 influences A_{25}	0.36
	The EC business will try to launch a website that is responsive to different digital devices.	A_5 influences A_{26}	0.34
The staff are equipped with the required technical skill and IT knowledge,	The EC business will have the technical ability to use security features to increase customers' trust and decrease customers' risk.	A_6 influences A_1	0.5
	The administration and implementation of e-commerce will be less complex.	A_6 influences A_2	0.7
	Costs related to the administration and implementation of e-commerce will decrease.	A_6 influences A_4	0.7
	Top management's support for the implementation and administration of e-commerce will increase.	A_6 influences A_7	0.88
	Organizational resistance to the necessary changes for the implementation and administration of e-commerce will decrease.	A_6 influences A_8	0.88
The top management strongly supports the implementation and administration of e-commerce,	It is more likely that adequate financial resources are allocated to the implementation and administration of e-commerce.	A_7 influences A_3	0.7
	Organizational resistance to the necessary changes for the implementation and administration of e-commerce will decrease.	A_7 influences A_8	0.72
The personnel are inclined to adapt themselves to the necessary and required changes	The administration and implementation of e-commerce will be less complex.	A_8 influences A_2	0.54
	Costs related to the administration and implementation of e-commerce will decrease.	A_8 influences A_4	0.48

If	Then	Relation	Weights *(W)*
of e-commerce implementation,	Top management support for the implementation and administration of e-commerce will increase.	A_8 influences A_7	0.7
The EC business can find reliable and trustworthy suppliers of technology,	The administration and implementation of e-commerce will be less complex.	A_9 influences A_2	0.7
	Costs related to the administration and implementation of e-commerce will decrease.	A_9 influences A_4	0.5
	Top management support for the implementation and administration of e-commerce will increase.	A_9 influences A_7	0.7
	Organizational resistance to the necessary changes for the implementation and administration of e-commerce will decrease.	A_9 influences A_8	0.48
The offered products and services by the EC business are suitable to the nature and essence of e-commerce,	Top management support for the implementation and administration of e-commerce will increase.	A_{10} influences A_7	0.5
	Organizational resistance to the necessary changes for the implementation and administration of e-commerce will decrease.	A_{10} influences A_8	0.48
	The EC business will be able to provide customers with fast shipment and reasonable shipping fees of ordered goods and services.	A_{10} influences A_{12}	0.9
The EC business offers customers competitive prices for goods and services,	Top management support for the implementation and administration of e-commerce will increase.	A_{11} influences A_7	0.3
	Organizational resistance to the necessary changes for the implementation and administration of e-commerce will decrease.	A_{11} influences A_8	0.3
The EC business provides customers with fast shipment and reasonable shipping fees of ordered goods and services,	The administration and implementation of e-commerce will be more complex.	A_{12} influences A_2	-0.3
	Costs related to the administration and implementation of e-commerce will increase.	A_{12} influences A_4	-0.28
	The price offered to the customers will be more competitive.	A_{12} influences A_{11}	0.7
The EC business offers a wide range of products and services to customers,	The administration and implementation of e-commerce will be more complex.	A_{13} influences A_2	-0.5
	Costs related to the administration and implementation of e-commerce will increase.	A_{13} influences A_4	-0.28
	Customers will feel that the EC business is reputable.	A_{13} influences A_{28}	0.34
The EC business has an obvious return and refund policy and accepts returned goods and services,	The administration and implementation of e-commerce will be more complex.	A_{14} influences A_2	-0.3

If	Then	Relation	Weights *(W)*
	Customers will feel that the EC business is reputable.	A_{14} influences A_{28}	0.48
The EC business uses various channels to communicate with potential customers and market its products and services,	The administration and implementation of e-commerce will be more complex.	A_{15} influences A_2	-0.5
	Costs related to the administration and implementation of e-commerce will increase.	A_{15} influences A_4	-0.52
	Customers will feel that the EC business is reputable.	A_{15} influences A_{28}	0.28
The EC business does continuous marketing,	The administration and implementation of e-commerce will be more complex.	A_{16} influences A_2	-0.48
	Costs related to the administration and implementation of e-commerce will increase.	A_{16} influences A_4	-0.7
	The EC business will be able to use analytical tools and methods because of the volume of data produced.	A_{16} influences A_{17}	0.26
	Customers will feel that the EC business is reputable.	A_{16} influences A_{28}	0.36
The EC business uses analytical methods and tools to assess the results of marketing actions,	The administration and implementation of e-commerce will be more complex.	A_{17} influences A_2	-0.3
	Costs related to the administration and implementation of e-commerce will decrease because the EC business can eliminate inefficient approaches and channels.	A_{17} influences A_4	0.68
The EC business uses CRM tools and methods,	The administration and implementation of e-commerce will be more complex.	A_{18} influences A_2	-0.3
	Costs related to the administration and implementation of e-commerce will decrease because of the increase in retention rate.	A_{18} influences A_4	0.7
	Customers will feel that the EC business is reputable.	A_{18} influences A_{28}	0.62

If	Then	Relation	Weights (W)
The EC business launches a website that is easy to use,	Customers will feel that the EC business is reputable.	A_{19} influences A_{28}	0.7
The information that is available on the website about goods, services, and different processes is accurate, relevant, and complete,	The EC business will provide customers with specific and obvious return and refund policies.	A_{20} influences A_{14}	0.56
	Working with the website will be easier.	A_{20} influences A_{19}	0.68
	Customers will be able to customize goods, services, or transaction environments.	A_{20} influences A_{23}	0.7
	Customers will feel that the EC business is reputable.	A_{20} influences A_{28}	0.7
The website has an attractive graphical appearance,	Working with the website will be easier.	A_{21} influences A_{19}	0.28
	Customers will feel that the EC business is reputable.	A_{21} influences A_{28}	0.5
The customers feel that they are not communicating with a system, but they are communicating with a human through a system,	Customers will feel that the EC business is reputable.	A_{22} influences A_{28}	0.48
The website has features to customize services, products, or transaction environment,	The administration and implementation of e-commerce will be more complex.	A_{23} influences A_{2}	-0.24
	The EC business will offer a wide range of products and services.	A_{23} influences A_{13}	0.62
	Customers will feel that the EC business is reputable.	A_{23} influences A_{28}	0.3
The website has signs that indicate the presence of a reputable third party,	Customers will feel that the EC business is reputable.	A_{24} influences A_{28}	0.68
The website has features of online chat and showing reviews of other customers,	Working with the website will be easier.	A_{25} influences A_{19}	0.5
	Customers will feel that they are not communicating with a system, but they are communicating with a human through a system.	A_{25} influences A_{22}	0.7
	Customers will feel that the EC business is reputable.	A_{25} influences A_{28}	0.72
The website is responsive to different digital devices,	The usage of the website will be easier.	A_{26} influences A_{19}	0.68
	Customers will feel that the EC business is reputable.	A_{26} influences A_{28}	0.52
The EC business plans to increase its physical presence,	The administration and implementation of e-commerce will be more complex.	A_{27} influences A_{2}	-0.6
	Costs related to the administration and implementation of e-commerce will increase.	A_{27} influences A_{4}	-0.78
	The process of accepting and returning flawed goods and refunding will be easier.	A_{27} influences A_{14}	0.56
	This physical presence affords the opportunity for the EC business to increase the number of communication channels with the customers.	A_{27} influences A_{15}	0.62
	Customers will feel that they are not communicating with a system, but they are communicating with a human through a system.	A_{27} influences A_{22}	0.68
	Customers will feel that the EC business is reputable.	A_{27} influences A_{28}	0.9
The EC business is reputable among customers,	Costs related to the administration and implementation of e-commerce will decrease because the EC business does not have to implement a lot of trust-building actions.	A_{28} influences A_{4}	0.6
	Top management support of implementation and administration of e-commerce will increase.	A_{28} influences A_{7}	0.78
	Organizational resistance to the necessary changes for the implementation and administration of e-commerce will decrease.	A_{28} influences A_{8}	0.68

Author	Addressed issue	Advantage	Limitations
(Kaushik, Khare, Boardman, & Cano, 2020)	Identify and prioritize success factors in the context of Indian online fashion retailers	This study adopts a holistic view of e-commerce success. They identify success-related factors by a comprehensive study of literature and experts' opinions and prioritize them in order of importance and significance using an approach that is a combination of AHP and VIKOR. By the assertion of authors, the main contribution of this study is ranking all success-related factors in a way that no previous study has done so.	The study lacks an evaluation model to assess the effect of improvement in one factor on the overall success or performance of e-commerce.
(Kabir, Ahsan, & Hasin, 2012)	Online retail performance among five alternatives	This study identifies success-related factors using a structured questionnaire and review of the literature and prioritizes these activities using the AHP method. Furthermore, they rank and benchmark the performance of e-commerce among its competitors employing the TOPSIS method.	The study lacks an evaluation model to assess the effect of improvement in one factor on the overall success or performance of e-commerce.
(W.-Y. Chiu, Tzeng, & Li, 2013)	Improve the business of online stores	They introduce a combination of DEMATEL, DANP, and VIKOR to improve the e-commerce situation. This study focuses on the effects of certain influential relationships among dimensions and criteria in e-commerce. The main advantage of the study is that, unlike the traditional e-commerce approach that is to rank the factors and improve the highest rank, the current study not only selects the best but also analyzes which gaps in the dimension and criteria should be improved first.	The study lacks an evaluation model to assess the effect of improvement in one factor on the overall success or performance of e-commerce.
(Kalelkar, Kumbhare, Mehta, & Kar, 2014)	Understand the dynamics of influential factors in top online shops of India	They identify the dynamics of the factors that are decisive for e-commerce customers. This study includes an approach to evaluate a website based on SERVQUAL dimensions and using the AHP technique. The output of this method is a quantitative value for the evaluation of a website. The study, also, provides a ranking for SERVQUAL dimensions based on Indian online retailers' users.	The study lacks an evaluation model to assess the effect of improvement in one factor on the overall success or performance of e-commerce. Furthermore, the research suffers from the absence of any proposed improvement scenarios or plans.
(Dey, Jana, Gourisaria, Mohanty, & Chatterjee, 2015)	Evaluation model of online retail development	The list of success-related factors is identified using questionnaires filled by experts. The weight of these factors is determined using AHP and Fuzzy TOPSIS is employed to get the final rank of websites. The output of this hybrid method is the ranking of websites in order of their service quality. Furthermore, they introduce the order of importance of success-related factors in the Indian e-commerce market.	The research suffers from the absence of any proposed improvement scenarios or plans.

(Kang, Jang, & Park, 2016)	A case study on B2C e-commerce is verified by sensitivity analysis	This research contains a fuzzy hierarchical TOPSIS based on E-S-QUAL (the extended version of SERVQUAL) to evaluate an e-commerce website. They employ hierarchical TOPSIS to effectively reflect the hierarchical structure and apply E-S-QUAL to assess e-commerce website service quality effectively. According to the authors' claim, the result of comparison with other studies verifies the robustness of the approach. Furthermore, it is asserted that this research is the first study that integrates fuzzy hierarchical TOPSIS and E-S-Qual for evaluating B2C e-commerce.	The research suffers from the absence of any proposed improvement scenarios or plans.
(Masudin & Saputro, 2016)	Two websites are compared from a usability point of view	They try to develop an e-commerce evaluation model from a usability perspective. They identify success-related factors by the study of literature and then the evaluation model is developed using a combination of FAHP and hierarchical fuzzy TOPSIS. To address the fuzzy environment of evaluating the B2C website, FAHP is adopted. The research also dissects and evaluate Amazon.com using the proposed method.	The research suffers from the absence of any proposed improvement scenarios or plans.
(Valmohammadi & Dashti, 2016)	Barriers to implementation of e-commerce	This research deploys the interaction among barriers to the successful implementation of e-commerce to calculate the ranking of these barriers using the combination of ISM and FANP. In other words, they indicate the barriers and interactions between them. This contribution results in better recognition and understanding of e-commerce complex systems. They also introduce the ranking of barriers to the success of e-commerce in Iran.	The study lacks an evaluation model to assess the effect of improvement in one factor on the overall success or performance of e-commerce. Furthermore, the research suffers from the absence of any proposed improvement scenarios or plans.
(Kahraman, Onar, & Öztayşi, 2018)	Selection of B2C marketplace and modelling	The study contains a hesitant fuzzy multi-attribute model for the comparison of various B2C online stores. The developed model is based on the hesitant fuzzy linguistic AHP method. They employ hesitant fuzzy sets to address the vagueness of describing the condition of a situation. In other words, this method brings higher flexibility to the assessment process.	The research suffers from the absence of any proposed improvement scenarios or plans.
(Shaina Singh, Singh, & Seth, 2017)	Critical success factors in e-commerce are ranked	The study comprehensively investigates factors that affect the success of e-commerce in India and provides a ranking applying the TOPSIS method.	The study lacks an evaluation model to assess the effect of improvement in one factor on the overall success or performance of e-commerce.

(Gupta & Dubey, 2018)	The adaptability of Indian e-commerce websites	They developed a model to evaluate and rank e-commerce websites from an adaptability perspective applying the AHP technique. They also validate the results using the entropy method.	The research suffers from the absence of any proposed improvement scenarios or plans.
(Chiou et al., 2010)	Provide an overview of studies conducted on developing website evaluation models	In the search for developing a website evaluation model, they review 83 articles and classify them into IS, marketing, and combined approach. Furthermore, they develop a five-stage evaluation method. One of the differentiating features of the proposed evaluation model is that the state of a website is evaluated with regard to the strategies set by decision-makers. This consideration represents itself in the assigned weight of factors.	The research suffers from the absence of any proposed improvement scenarios or plans.
(Kabir & Hasin, 2011)	Mobile commerce success	This study contains factors that affect the success of mobile commerce and customer-oriented prioritization of these activities using FAHP.	The research suffers from the absence of any proposed improvement scenarios or plans.
(Tsai et al., 2010)	Improve website performance	They develop an evaluation model that is a combination of DEMATEL, ANP, and VIKOR to evaluate and rank national park websites in Taiwan. One of the main advantages of this research is taking into account the interdependence between evaluation criteria and convert the criteria's cause and effect relations into a visual structural map. Furthermore, a Weight-Variance Analysis (WVA) is proposed to identify the weakest area demanding urgent attention of decision-makers.	The proposed evaluation model does not assess and quantify the effect of improvement in one factor on the overall performance or success of a website. Furthermore, the investigated factors are limited to the realm of website and don't cover other areas of e-commerce such as human resources.
(Delone & Mclean, 2004)	Provide an evaluation model for EC	They adapt the Information System Success model to develop an e-commerce evaluation model. This research is one of the first studies conducted in the e-commerce success context and introduces different aspects of e-commerce. This study lays the foundation for subsequent studies in the e-commerce success realm.	The proposed evaluation model lacks quantitative outputs and the identified aspects are relatively vague. Furthermore, the research suffers from the absence of any proposed improvement scenarios or plans.
(Kong & Liu, 2005)	An attempt to define an evaluation model	They provide a list of success-related activities and the possibility to convert the performance of e-commerce into quantitative value applying the AHP method.	The research suffers from the absence of any proposed improvement scenarios or plans.

Table 2. Final matrix of activities (W)

	A_1	A_2	A_3	A_4	A_5	A_6	A_7	A_8	A_9	A_{10}	A_{11}	A_{12}	A_{13}	A_{14}	A_{15}	A_{16}	A_{17}	A_{18}	A_{19}	A_{20}	A_{21}	A_{22}	A_{23}	A_{24}	A_{25}	A_{26}	A_{27}	A_{28}
A_1	0	-0.3	0	-0.28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.28
A_2	0	0	0.5	0.7	0	0	0.66	0.72	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_3	0.3	0	0	0	0	0.3	0.26	0.5	0	0	0	0.28	0	0	0.3	0.3	0	0	0	0	0	0	0	0	0	0	0.36	0
A_4	0.24	0	0	0	0	0	0.7	0.7	0	0	0.68	0	0	0	0	0.42	0	0	0	0	0	0	0	0	0	0	0.36	0
A_5	0.88	0	0.72	0	0	0	0.88	0.9	0	0.9	0	0.3	0.48	0.68	0.72	0.9	0.9	0.88	0.48	0.38	0.3	0.3	0.24	0.3	0.36	0.34	0	0
A_6	0.5	0.7	0	0.7	0	0	0.88	0.88	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_7	0	0	0.7	0	0	0	0	0.72	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_8	0	0.54	0	0.48	0	0	0.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_9	0	0.7	0	0.5	0	0	0.7	0.48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_{10}	0	0	0	0	0	0	0.5	0.48	0	0	0	0.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_{11}	0	0	0	0	0	0	0.3	0.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_{12}	0	-0.3	0	-0.28	0	0	0	0	0	0	0.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.34
A_{13}	0	-0.5	0	-0.28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.34
A_{14}	0	-0.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.48
A_{15}	0	-0.5	0	-0.52	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.28
A_{16}	0	-0.48	0	-0.7	0	0	0	0	0	0	0	0	0	0	0	0	0.26	0	0	0	0	0	0	0	0	0	0	0.36
A_{17}	0	-0.3	0	0.68	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A_{18}	0	-0.3	0	0.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.62
A_{19}	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.7
A	0	0	0	0	0	0	0	0	0	0	0	0	0	0.	0	0	0	0	0.	0	0	0	0.	0	0	0	0	0.

A_{20}													56					68				7					7
A_{21}	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.28	0	0	0	0	0	0	0	0	0.5
A_{22}	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.48
A_{23}	0	-0.24	0	0	0	0	0	0	0	0	0	0	0.62	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.3
A_{24}	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.68
A_{25}	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.5	0	0	0.7	0	0	0	0	0	0.72
A_{26}	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.68	0	0	0	0	0	0	0	0	0.52
A_{27}	0	-0.6	0	-0.78	0	0	0	0	0	0	0	0	0	0.56	0.62	0	0	0	0	0	0	0.68	0	0	0	0	0	0.9
A_{28}	0	0	0	0.6	0	0	0.78	0.68	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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