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MODEL OF INTERRELATION AMONG E-SERVICE QUALITY FACTORS: CASE STUDY IN ONLINE BUSINESS OF BANGLADESH

Abstract: Nowadays the online business of Bangladesh has become very popular to customers due to its salient features on the global market. To achieve a higher level of customer satisfaction, e-service quality must be improved. Although, some studies have focused on the identification of the e-quality factors in case of developed countries, modeling the interrelationship among factors is not done yet for the online business of developing countries like Bangladesh. This study proposes a structured framework based on the Delphi and grey DEMATEL approach to identify such factors and model the causal relationship among them. A total of 9 e-quality factors were identified through literature review and by conducting a survey of different online shoppers. Then, grey DEMATEL approach was anticipated to examine their interrelationship and to prioritizate them. The results showed the cause and effect factors and their prominence. Among all factors, “reliance” got high priority which was followed by “responsiveness”.

Keywords: E-commerce; E-quality; Delphi; Grey DEMATEL; Quality model

1. Introduction

Online shopping has brought a massive revolution in shopping environment due to its salient features. People are now experiencing a new chapter of shopping where they can browse an endless range of items in different designs, colors, styles and prices. Comparing to online shopping, the store shopping has a limited range of products (Wan et al., 2018). At present, online shopping is possible with just a few clicks of the mouse and home delivery facilities have made this business more lucrative. Online shoppers compare the price of a specific product visiting different sites at the same time by which they can get the perfect product at a reasonable price.

Online stores offer discounts, cash back facility, easy exchange policy, cash on delivery policy, etc. In Bangladesh, few online sites are now offering installment facilities to attract more customers. Due to the complex and busy life, this revolution has made shopping very easy as users can select their products through narrowing search as per their preference like color, fabric, design or price (Kwak et al., 2019).

As a result, in the world wide people are now eagerly accepting online shopping and the number of users is increasing day by day. The retail e-commerce sales worldwide in 2018 was 2.84 trillion US dollars wherein 2017 amounted to 2.3 trillion US dollars. The revenues are projected to rise in 4.88 trillion

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US dollars in 2021 (Statista, 2019). According to the information of Statista 2017, around 1.66 billion global digital buyers purchased goods and/or services in 2017 whereas the number is projected to 2.14 billion in 2021. According to the source (Statista, 2019), China had the highest retail sales online as a percentage of total retail sales 23.1%, followed by UK 19.1%, South Korea 16.0%, Denmark 12.6%, and USA 9.0%. The neighboring country of India has 2.2% and a meager 0.7% for Bangladesh (Statista, 2019). Although the percentage is small, but the pie will get bigger in the upcoming decades.

Undoubtedly, e-commerce business is booming for the last couple of years in Bangladesh due to better access, inclusion of developed web, massive use of smart phones as well as a vibrant youth pool (Hossain, 2000). In Bangladesh, about 33% of 165 million population are mobile internet users, the e-commerce market is by all means considerably potential in up and coming days (Hoque et al., 2015). The total number of *internet subscribers* has reached 93.102 Million at the end of March, 2019 (Islam, 2020). The online business market has made a dramatic jump in 2017; creating an increase 70% from 2016 (Billal et al., 2019). At present, the quantities of online business sites and pages are 2,500 and 150,000 respectively. The quantity of delivery is assessed at 15,000 to 20,000 at the retail level every day. Besides numerous local online sites like Chaldal.com, Shohoz.com, Daraz.com, big investors like IFC and Alibaba have got involved with the Bangladesh E-commerce environment. According to the e-Commerce Association of Bangladesh (e-Cab), there are around 700 e-Commerce sites and around 8,000 e-Commerce pages on Facebook. Facebook is a powerful platform to bring customers into this fairly nascent e-commerce ecosystem. About 10 billion BDT transaction takes place on online sites per year according to e-Cab report (E-cab report, 2017).

As the number of e-commerce sites is increasing and the business has a bright future so it is paramount task of e-retailer to maintain the high service quality level towards customer satisfaction and retention. In fact, service quality in virtual business is a crucial driver for successful operation. E-quality or e-service quality can be defined as the consumers' overall evaluation and judgment of excellence and quality of e-service offerings in the virtual marketplace (Santos, 2003). Increased e-quality can help online companies to achieve a higher level of customer satisfaction and retention (Grönroos et al., 2000). Quality of e-service has many dimensions which should be measured and improved regularly by online companies to sustain in the global market. However, different models have been developed in recent years for measuring the e-quality of online shops and virtual businesses (Napitupulu & Kartavianus, 2014; Blut et al., 2015; Kaura et al., 2015; Al-dweeri et al., 2017). However, building a robust model requires the identification of proper factors and understanding the relationships among them. A recent study has been conducted on exploring the impact of service quality factors of Bangladeshi online business towards customer satisfaction but examining the interrelationship among factors was not considered (Momotaz & Hasan, 2018). Moreover, in case of e-commerce, these e-quality service factors may vary from region to region. As e-commerce is an emerging sector in Bangladesh, interrelationships and significance among e-quality factors for Bangladeshi online companies must be assessed which has not been analyzed yet.

With the number of the online store increasing markedly in recent years, e-quality has become a key factor for the success of e-commerce. Quality of e-service has many dimensions which should be measured and improved regularly by online companies. However, the impacts of these dimensions on e-quality vary according to the context and nature of the online shops (Blut et al., 2015).

Proper identification of dimensions of e-quality and assessment of the relationships among these dimensions are key to success in online business.

The aim of this study is to develop a structured framework to identify the most relevant quality factors of online business in Bangladesh and assess the relationship and significance of these factors. To achieve this objective, E-S-QUAL has been used to identify the e-quality service factors. The causal relationships and significance of these factors have been assessed by integrating a grey method to decision making trial and evaluation laboratory (DEMATEL).

In this study, different models and e-quality factors of e-business are reviewed and the most relevant factors have been selected using the Delphi method. Then, grey DEMATEL method has been applied to identify the ranking of prominent factors as well as the causal relationships of these factors have been modeled. The reason of using grey DEMATEL approach is that this method can provide the prominence status and causal relationships among the factors simultaneously.

2. LITERATURE REVIEW

In this section, e-business, e-quality factors of e-business and proposed research methods have been discussed.

2.1. E-business

Development of information and communication technology has changed the traditional form of business (Iansiti & Lakhani, 2017). Even the established brick and mortar companies have found that the use of the internet in business makes all operations and marketing activities more efficient (Madu & Madu, 2002). As a result, the growth of e-business has become very fast and a new industry of dot-com companies has been created. Holsapple and Singh (2000) defined the concept of e-business as the use

of information and technology across the value chains of business as well as supporting the decision making the process. IBM started using its foundation in IT solutions and expertise to market itself as a leader in internet business through the term 'e-business' (Pettit, 2007).

E-business has changed the competition rules for established businesses in an unprecedented way (Amit & Zott, 2001). Therefore, many established businesses have changed their business models to adopt e-platform. Even small and medium-sized enterprises have been prepared to use the internet platform to carry out their business activities (Mazzarol, 2015). However, the adoption of the internet-based platform in business model has a significant impact on other business activities and business decisions (Gordijn & Akkermans, 2001). Consumer behavior is one of the major determinants of formulating e-business strategy. Again, the quality of e-businesses and e-services has a major impact on consumer behavior. Poor quality of e-service creates confusion among the consumers due to their pre-conceived expectations about the product and service. The undefined strategy for e-business success is therefore to ensure the highest quality of e-service.

2.2. E-business in Bangladesh

E-commerce business is booming for the last couple of years in Bangladesh due to better access, inclusion of developed web, massive use of smart phones, low cost of bandwidth, vibrant youth pool etc (Hossain, 2000; Khan et al., 2012). Chaldal.com, Shohoz.com, Daraz.com, Ajker Deal, Pickaboo etc. are some popular online shops among the consumers in Bangladesh. Big investors such as IFC and Alibaba have got involved with the Bangladesh E-commerce environment recently. More investors are showing intense interest to put their resources in online business environment of Bangladesh.

As the number of online shops in Bangladesh is increasing very fast in recent years, the e-

business environment has become more and more competitive (Suhan, 2015). However, most of the online shops have been facing problems to establish their business in full sewing (Dutta & Bose, 2007). Many have failed to guarantee the e-quality of their services. Identifying and developing the business strategy based on the most important e-quality factors are now major challenges to the success of the e-commerce business (Azam, 2007). Technology acceptance model (TAM) model has been proposed to explain Bangladesh's consumer acceptance of e-shopping.

2.3. E-service quality or e-quality

E-service quality or e-quality has become one of the major determinants of e-business success. E-quality has a significant impact on consumers' decision making and satisfaction (Yoo, 2015). E-quality is comprised of many interrelated factors and dimensions. Identifying these factors and evaluating their relative importance have become very imperative in order to improve the overall quality of e-service (Yang et al., 2004). Over the past few decades, many models have been developed to measure the e-quality and the relationships among different e-quality factors. In order to describe the standard quality. Garvin mentioned eight core product dimensions in his quality model (Garvin, 1987). These dimensions are performance, features, reliability, durability, serviceability, perceived quality, conformance and aesthetics. These dimensions, however, have some limitations in defining and measuring the quality of services, as services are intangible, unlike products. Parasuraman et al. followed this idea by identifying five attributes in service quality measurement model (Parasuraman et al., 1988). These five attributes of service quality are tangibles, reliability, responsiveness, assurance and empathy. These attributes, however, cannot explicitly measure the quality of e-services and virtual operations.

Madu and Madu explored the nature of e-services by synthesizing the prior quality models and proposed fifteen dimensions for e-service quality (Madu & Madu 2002). These dimensions for e-service quality include performance, features, structure, aesthetics, reliability, strong capability, serviceability, system integrity, trust, responsiveness, customization, web store policies, reputations, assurance and empathy. In fact, this was the starting point for measuring e-services quality and virtual business operations. Van Riel et al. investigated customers' quality expectations with regard to e-service offerings (Van Riel et al., 2003). They discovered that customer disposition largely depends on two dimensions of quality: reliability and safety.

Zeithaml et al. proposed seven dimensions of website quality as ease of use, privacy, graphic style, reliability, content, accessibility and aesthetics (Zeithaml et al., 2002). These seven dimensions were further redefined and divided into two scales by Parasuraman et al. (Parasuraman et al., 2005). The first scale E-S-QUAL consists of 22 items grouped into four dimensions. These dimensions are efficiency, fulfillment, system availability and privacy. The second scale called E-Res-Qual measures the effectiveness of handling problems and returns. This scale includes 11 items grouped into three dimensions (responsiveness, compensation and contact). O'Neill et al. applied SERVQUAL method to assess the quality of Australia's online library service (O'Neill et al., 2001). A new tool named WEBQUAL was developed by Loiacono et al. to measure the perception of website quality by customers (Loiacono et al., 2002). They identified twelve key dimensions to construct this website quality assessment tool. However, this study has focused on website quality only ignoring the other key operations of e-services. Kim et al. modified the E-S-QUAL scale to evaluate the quality of apparel websites' quality (Kim et al., 2006).

Bayraktaroglu et al. extended the unified theory of acceptance and use of technology model to assess the quality of e-business (Bayraktaroglu et al., 2019). Yang evaluated the e-quality of e-shopping environment and e-satisfaction of customers (Yang, 2008). He integrated E-S-Qual and D&M IS model to assess the website's loyalty using a set of empirical data from 668 e-shoppers. The results of the study revealed that e-shoppers satisfaction is largely influenced by the information quality and service quality offered by e-shops.

Shachaf and Oltman evaluated three of the key dimensions of e-service quality namely responsiveness, reliability and courtesy among different customer groups (Shachaf and Oltman, 2007). This study found no significant differences in these dimensions between different groups. Kim et al. proposed an e-quality measurement framework for virtual companies (Kim et al., 2005). This framework focused primarily on information and considered 3 dimensions: quality of information, form of information and time of information. Blut et al. analyzed e-service quality with respect to three contextual factors: country culture, regulatory environment, and industry context (Blut et al., 2015). This study found website design, fulfillment, customer service, and security as key dimensions to evaluate the quality of e-services. Yoo et al. found that interactivity of electronic word of mouth and e-quality have a significant impact on decision support satisfaction (Yoo et al., 2015). This study considered reciprocity, responsiveness, non-verbal information, speed of response, content quality, time quality and e-loyalty as e-quality measurement dimensions.

According to Akinci et al., responsiveness and compensation dimensions have a significant and positive effect on customer loyalty (Akinci et al., 2010). They used E-Res-QUAL tool to assess the e-service quality offered by 13 banks in Turkey. Petnji et al. observed that the dimensional structure of E-S-QUAL is unstable depending on the application area and type of business (Petnji

et al., 2012). However, dimensions of efficiency, system availability and privacy have appeared in many service quality models. According to Wen et al., managers of e-businesses must first understand how consumers perceived and evaluated e-customer service (Wen et al., 2015). They found a strong relationship between e-loyalty and e-quality among the consumers of e-services. Lopes et al. studied the psychometric properties of e-TailQ and E-S-Qual scale to measure the quality of the website (Lopes et al., 2019). They found e-TailQ more effective for measuring satisfaction, loyalty, positive word of mouth and repurchase intention. Momtaz and Hasan conducted a study aiming at identifying the service quality factors for the online shopping service of Bangladesh and then, assessing the impact of service quality factors on customer satisfaction (Momtaz and Hasan, 2018).

2.4. Grey DEMATEL

The decision-making trial and evaluation laboratory (DEMATEL) method was initially developed between 1972 and 1976 by the Battelle Memorial Institute of Geneva's Science and Human Affairs Program to study and solve the complex and intertwined problem group (Tzeng et al., 2007). This method has been applied for exploring the relationship between quality factors of different sectors. Wei et al. evaluated the quality of web advertising and its effect on consumers using structural equation modeling and DEMATEL technique (Wei et al., 2010). Hsu and Lee identified the critical factors of blog quality and evaluate the causal effect relationship among the factors using DEMATEL method (Hsu & Lee, 2014). This study revealed the critical factors that the bloggers and developers should focus on. Kumar et al. constructed an influential network relation map of consumer decision making applying DEMATEL technique in the e-marketplace (Kumar et al., 2016). Cebi evaluated the quality of shopping websites in

Turkey applying the integrated fuzzy theory and DEMATEL approach (Cebi, 2013). Fuzzy set theory was used to cope with the linguistic evaluation of the different design parameters of the website. Fuzzy theory are used when there is little data and the environment is fuzzy (Heil et al., 2019). Ecer (2014) developed a hybrid AHP and COPRAS-G model to evaluate the quality of banks' websites.

Tsai et al. investigated the effectiveness and quality of Taiwanese airlines' websites using DEMATEL technique (Tsai et al., 2011). DEMATEL has been used to evaluate the relationship among different criteria of the websites' quality. Shieh et al. identified key quality factors for hospital and evaluated their importance by using DEMATEL method. They developed causal relations among the key factors (Shieh et al., 2010). Rekik et al. showed that many multi-criteria decision-making methods like the analytic hierarchy process (AHP), VIŠeKriterijumska Optimizacija I Kompromisno Rešenje (VIKOR), DEMATEL have been widely used for improving the quality of websites in e-business sectors (Rekik et al., 2016).

Grey based DEMATEL has also widely been used in different sectors. Service quality assessment model using grey fuzzy DEMATEL method was developed by Tseng (Tseng, 2009). Bai and Sarkis applied grey DEMATEL method to evaluate the critical success factors of business process management (Bai & Sarkis, 2013). Ozcan and Tuysuz evaluated the performance of retail stores using modified grey DEMATEL approach (Ozcan & Tuysuz, 2016).

2.5. Research gap

Previous studies have focused on the identification of dimensions for measuring e-quality but assessing the interrelationships and significance among them has not been analyzed yet especially in developing countries like Bangladesh. For this reason, this study has some questions:

1. Which are the key service quality factors of e-commerce that influence customer satisfaction in the context of Bangladesh?
2. How can e-retailers evaluate the cause and effect relationship between selected factors?
3. What should be the strategy for successful implementation of these factors in the existing one?

The objectives of this study are:

1. To identify the relevant dimensions of e-quality for online shops in Bangladesh.
2. To understand the cause and effect relationships between a selection of these factors.
3. To recommend some theoretical and managerial implications.

To fulfill these objectives, the study has presented a two phased methodology. 1) One is to apply Delphi method to identify e-quality attributes through the existing literature review and expert's feedback. 2) Then, Grey-based DEMATEL approach is utilized to investigate the causal relationships among selected factors.

3. METHODOLOGY

Multi-criteria decision-making methods have been applied for many decision making and quality factor assessments in many sectors (Tsaur et al., 2002; Tzeng et al., 2007; Harputlugil et al., 2011). In this study, grey-based DEMATEL method has been proposed to assess the e-quality factors for online shops and e-businesses. Figure 1 describes the structure of the proposed methodology more briefly and clearly.

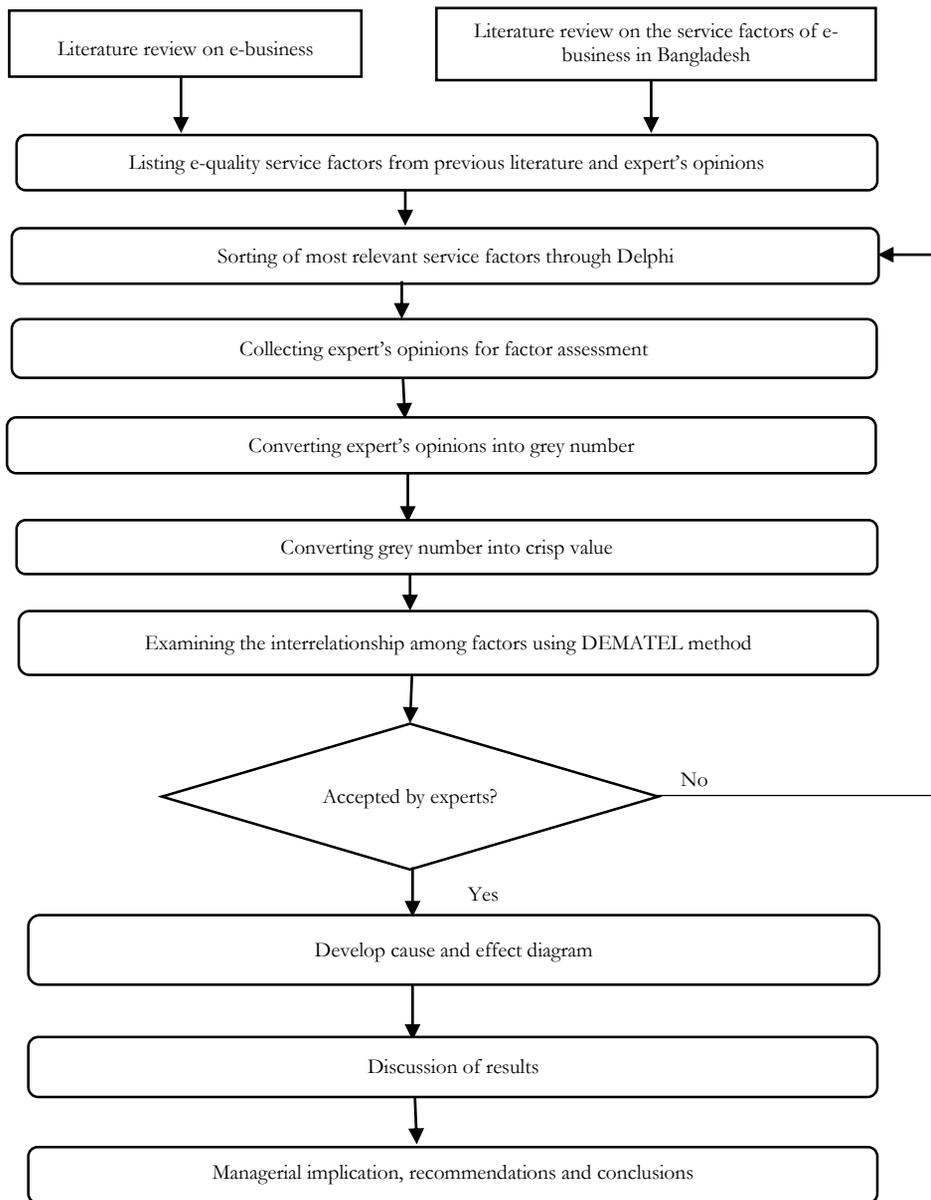


Figure 1. Structure of the proposed methodology

3.1. Delphi method

The Delphi method is a rational research method in which a series of structured questionnaires collect data from a group of evaluators. It is a very dynamic method of data evaluation in which experts / evaluators

share their practical experiences in order to achieve a convergence of opinions. In the Delphi method, there is no hard and fast rule about the number of experts necessary for data collection and analysis. In other words, different numbers of experts for evaluating criteria may be used within the Delphi

method; no universal number exists (Bouzon et al., 2016). For instance, Okoli and Pawlowski (2004) suggested 10 to 18 experts for ensuring the best results whereas Murry and Hammons (1995) advised 10 to 30 experts' opinions. This study used a total of 45 online shoppers thereby satisfying the requirements. The experts had sufficient knowledge about online sites.

3.2. Grey method

The mathematical grey theory can generate possible results with a small amount of data. This theory was first proposed by Julong (Julong, 1982). Grey numbers can be converted into crisp numbers in the following three steps (Xia et al., 2015):

A grey number is defined as $\otimes x = [\underline{\otimes} x_{ij}, \overline{\otimes} x_{ij}]$, where $\underline{\otimes} x_{ij}$ is the lower limit and $\overline{\otimes} x_{ij}$ is the upper limit of $\otimes x$.

Step 1: Normalization of the grey numbers

$$\underline{\otimes} \bar{x}_{ij} = (\underline{\otimes} x_{ij} - \min \underline{\otimes} x_{ij}) / \Delta_{min}^{max} \quad (1)$$

$$\overline{\otimes} \bar{x}_{ij} = (\overline{\otimes} x_{ij} - \min \overline{\otimes} x_{ij}) / \Delta_{min}^{max} \quad (2)$$

Where, $\Delta_{min}^{max} = \max \overline{\otimes} x_{ij} - \min \underline{\otimes} x_{ij}$

Step 2: Standardization of total crisp values

$$Y_{ij} = ((\underline{\otimes} \bar{x}_{ij}(1 - \underline{\otimes} \bar{x}_{ij}) + (\overline{\otimes} \bar{x}_{ij} \times \overline{\otimes} \bar{x}_{ij})) / (1 - \underline{\otimes} \bar{x}_{ij} + \overline{\otimes} \bar{x}_{ij})) \quad (3)$$

Step 3: Computation of the final crisp values

$$Z_{ij} = \min \overline{\otimes} \bar{x}_{ij} + Y_{ij} \Delta_{min}^{max} \quad (4)$$

3.3 Grey DEMATEL

DEMATEL (Decision Making Trial and Evaluation Laboratory) is a simple method to evaluate the relationship among various alternatives based on the pairwise comparison. This method was first proposed by Fontela and Gabus (Fontela & Gabus, 1974). The DEMATEL has widely been used in analyzing the complex structural model of

causality between complex factors. Integration of grey system with DEMATEL enables the decision makers to evaluate the complex factors which are usually expressed with linguistic variables. Table 1 shows the grey linguistic scale for direct relation criteria.

Table 1. Grey linguistic scale

Linguistic	Grey numbers
No influence (N)	[0,0]
Very low influence (VL)	[0.00,0.25]
Low influence (L)	[0.25,0.50]
High influence (H)	[0.50,0.75]
Very high influence (VH)	[0.75,1.00]

Grey system converts these linguistic variables into crisp numbers. These crisp numbers are then used in DEMATEL to evaluate the relationship among the factors. The steps of grey DEMATEL are presented as follows:

Step 1: Development of direct influence matrix A by integrating the inputs from experts.

Step 2: Development of direct impact matrix Z using equations (1) to (4).

Step 3: Construction of standardized matrix X using the following equation:

$$X_{ij} = \frac{Z_{ij}}{S} \quad (5)$$

Where $S = \max\{\max \sum_{j=1}^n Z_{ij}, \max \sum_{i=1}^n Z_{ij}\}$

Step 4: Total relation matrix T construction using the following equation

$$T = X(I - X)^{-1} \quad (6)$$

Where I indicates the identity matrix.

Step 5: Then the degree of influential impact (D) and the degree of influenced impact (R) are calculated as follows:

$$D = \sum_{j=1}^n t_{ij} \quad (7)$$

$$R = \sum_{i=1}^n t_{ij} \quad (8)$$

Step 6: In this step, (D+R) and (D-R) are calculated. (D+R) indicates the prominence vector and (D-R) indicates the relation vector.

Step 7: Finally the causal diagram is developed using the prominence vector and relation vector.

4. AN EXAMPLARY APPLICATION

The objective of this study was to identify and evaluate the relationship among the e-quality factors of the online shop in Bangladesh. This section describes the implementation of the proposed methodology in sequential order.

4.1 Data collection using Delphi method

The number of online shops is increasing very fast in Bangladesh. Many experts and researchers have been researching how these online shops can improve the quality of service. To identify and determining causal relations among the e-quality service factors of online business, a survey was conducted by online users from Bangladesh. Initially, the questionnaire (see Appendix A) was sent to 70 users by email to sort out the factors. These respondents were chosen based on frequency of online shopping, experience, gender etc. In this study, feedback was collected from 45 respondents; 30 were from female users and remaining were male users. The profile of the selected online sites along with the respondents for data collection in this study is represented in Table 2.

Table 2. Profile of case online sites and respondents

Name of the online sites	Respondents	Gender	Number of users surveyed	Frequency of online shopping (per year)
'A' online grocery	Housewife	Female	04	10
	Employee	Male	03	15
	Academic	Female	03	20
'B' lifestyle shopping	Employee	Female	03	30
	Academic	Male	02	15
	Employee	Female	02	20
'C' ticketing	Employee	Female	02	20
	Adult	Male	03	05
	Housewife	Female	03	18
'D' pureplay e-commerce	Employee	Female	03	15
	Employee	Male	05	25
	Adult	Female	03	20
'E' local artisan products	Housewife	Female	04	30
	Academic	Male	02	25
	Employee	Female	03	22

After reviewing the existing literature and group discussion with these users, nine e-quality factors were selected in the context of Bangladesh. These factors are: *website infrastructure (F₁)*, *information sharing (F₂)*,

delivery method (F₃), *responsiveness (F₄)*, *customization (F₅)*, *customer service (F₆)*, *reliance (F₇)*, *payment security (F₈)* and *return facility (F₉)*. Table 3 describes these e-quality factors.

Table 3. E-quality factors and their brief explanation

Code	Factors	Brief explanation
F1	Website infrastructure	The website acts as the main media of communicating the product or service information to the customer for online shops. Effective advertisement and communication depends on the good quality website
F2	Information sharing	As customer choose their product in a virtual environment, comprehensive information is required to express the details of products and services.
F3	Delivery method	The customer expects an easy delivery method without any hustle from the online shops. Quick and hustle free delivery method can take the e-service quality to an extraordinary level.
F4	Responsiveness	As communication between the customer and online shop occurs in an indirect manner, prompt responses from the shop make them trustworthy to the customer.
F5	Customization	Customization in online shopping refers to personalized shopping experience which still remains largely unfulfilled. Most of the online shops lack this feature in their services.
F6	Customer service	Customer service plays an important role in the success of every business. Effective customer service enhances the trust among the customers.
F7	Reliance	Reliance in e-service refers to the trust and conformance of products and services. Customers expect the products and services as per specifications that are given on the website.
F8	Payment security	E-business must ensure enough security and trust in the payment method. It can take the quality level of service into another level
F9	Return facility	Sometimes misunderstanding occurs to the customer in case of online purchasing. Product return facility with some conditions can make the consumer feel safe and secured in online shopping.

4.2. Assessment of e-quality service factors by grey DEMATEL

In this phase, 9 e-quality factors were assessed using grey DEMATEL method. The pair-wise comparisons among e-quality factors were prepared by using the 5 points grey linguistic scale. These scales contain the following scale item factor influence relationships: No influence (N), Very low (VL), Low (L), Moderate (M), High (H), and Very high (VH) influence. Then, the linguistic variables were converted into grey numbers and direct influence matrix was made by taking the average of these grey values given by online users. The direct influence matrix is presented in Table B1 in Appendix B. In the next step, the impact matrix of factors was calculated from average direct influence matrix using equation (1) to (4). Each element in the direct influence matrix was a grey number. Each grey number

was converted into a crisp number and impact matrix was formed shown in Table B2 in Appendix B.

The standardized matrix was formed from the impact matrix using equation (5). The standardized matrix is represented in Table B3 in Appendix B. Now, the total relation matrix was obtained from the standardized matrix using equation (6). This matrix is shown in Table B4 in Appendix B.

The degree of influential impact (*D*) and the degree of influenced impact (*R*) were calculated from the total relation matrix using Equation (7) and (8). Finally, the prominence vector and relation vector were obtained. The prominence vector indicates the significance of each factor. Prominence vector and relation vector along with the ranking were represented in Table 4 and Table 5 respectively. To develop the cause and effect diagram, relation vector was used. All the

risks having positive relation values ($D - R$) were grouped into cause group and risks with negative relation values were grouped into effect group.

Table 4. Prominence vector and ranking of factors

Rank	Factors	The prominence vector (D+R)
1	F7	17.877
2	F4	19.157
3	F9	19.304
4	F3	19.718
5	F2	14.943
6	F1	15.457
7	F8	20.107
8	F6	17.034
9	F5	19.626

Table 5. Relation vector of factors

Factors	The relation vector, (D-R)	Group
F1	1.438	Cause group
F2	0.567	Cause group
F3	-0.752	Effect group
F4	-0.602	Effect group
F5	-0.197	Effect group
F6	-1.346	Effect group
F7	0.188	Cause group
F8	1.088	Cause group
F9	-0.384	Effect group

Here, this research has found that website infrastructure (F₁), information sharing (F₂), reliance (F₇) and payment security (F₈) are in the cause group. On the other hand, the delivery method (F₃), responsiveness (F₄), customization (F₅), customer service (F₆) and return facility (F₉) have fallen into effect group. Figure 2 shows the level of each factor group.

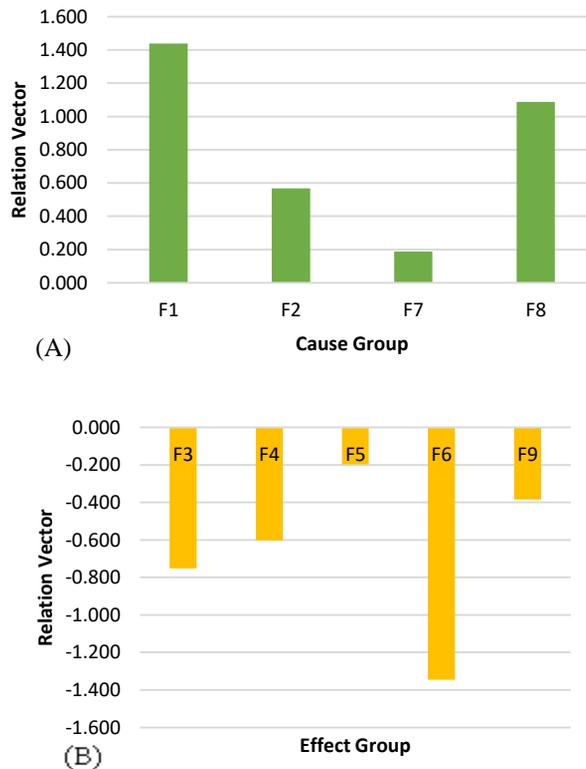


Figure 2. The relation vector of cause group (A) and effect group (B)

Finally, a cause and effect diagram has been constructed. Figure 3 represents the cause and

effect diagram of e-quality factors.

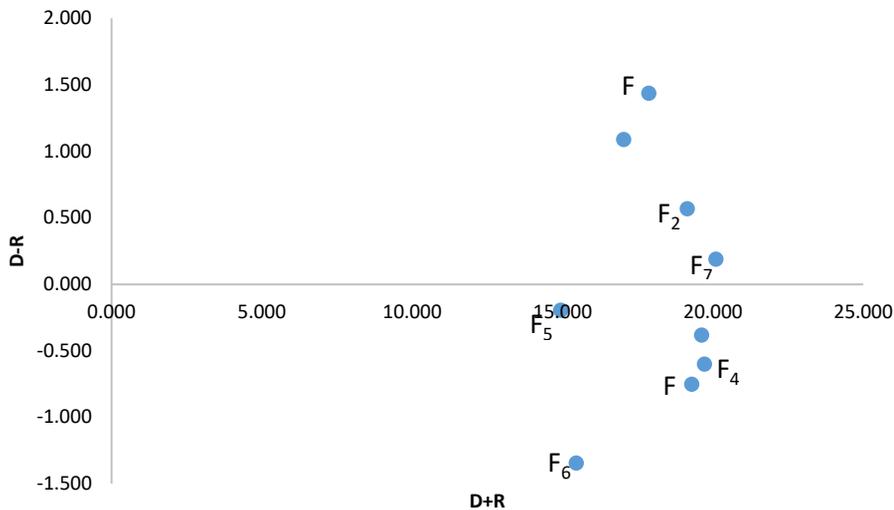


Figure 3. Cause and effect diagram of e-quality factors

5. DISCUSSION

In this section, the details of the research findings have been discussed. These findings can help e-business companies and virtual business services understand the factors for improving the quality of e-services in Bangladesh's online shops. This research reveals that reliance (F₇) is the most prominent e-quality factor for e-business success in Bangladesh. The study conducted by Ismanto also showed that reliance is the significant factor for online business success in Indonesia (Ismanto et al., 2019). In Bangladesh, online shopping is a recent but fastest growing trend. Many online shops have established their brand by increasing trust among the customers. As online shopping is a new experience to consumers, they always worry about the reliability and conformance of the product and service from the online shops.

Therefore, trust has become the most significant factor in improving the quality of e-services. Apart from this factor, responsiveness (F₄) and return facility (F₉)

also play a vital role in e-service quality in Bangladesh. This finding is similar to the finding of the research conducted by Choshin and Ghaffari (Choshin & Ghaffari, 2017). In this current research, these two factors were ranked second and third respectively. As online shops differ from traditional brick and mortar stores, the customer expects prompt responses from the online shops. Besides, customers hardly want to wait for long to get the product or service. Moreover, products or services sometimes differ from their appearance on the website. Sometimes customers make misperception about the product and order. Therefore, online shops should focus on adding the facility for returning the product with some conditions.

In addition, easy and quick delivery method (F₃) plays a vital role in enhancing satisfaction among the customers which leads to high quality. According to Ibam, quick delivery plays a vital role in the success of e-commerce in Nigeria (Ibam et al., 2018). Good quality of information sharing (F₂) about the product and service effects the purchasing behavior of customers from

online shops. However, this factor was ranked fifth in this study.

On the contrary, customization (F₅) has got the lowest prominence value in this research. Although it may also be a big issue in some cases of e-service in the Bangladeshi context. Customization can add another strategic dimension for online shops which may attract the customers toward online shopping more. The findings of this research reveal that the ranking of e-quality factors on the basis of prominence vector can be summarized as follows:

$$F_7 > F_4 > F_9 > F_3 > F_2 > F_1 > F_8 > F_6 > F_5$$

The cause and effect diagram has revealed that website infrastructure (F₁), information sharing (F₂), reliance (F₇) and payment security (F₈) affects other e-quality factors. Without proper product information and website, an e-business may not be able to provide good customer service. Website is the first touch point with the customer in the purchasing process. Therefore, the website has more impact on other e-quality factors. On the other hand, customer service (F₆) is most affected e-quality factor by other factors.

6. MANAGERIAL AND PRACTICAL IMPLICATIONS

The prominent contributions of this research is to develop a structured framework that helps identification of the quality drivers influencing the customers' satisfaction towards e-shopping in Bangladesh and finally prioritization them. This drivers can paly a vital role to enhance the overall performance as well as to cope up with the global market. Through sorting out the improving factors of e-service, the decision makers of e-marketers can refine their existing marketing strategies to attract and retain customers. This study can be a guideline to e-marketers to identify key service quality factors and develop policies for mitigating their limitations. The managerial implications of this research are summarised below:

- *Developing strategic policy for service quality of e-commerce:* To increase the market share as well as gain loyalty from customers, it is essential to formulate strategic policy for incorporating the factors in the existing business. This paper can assist e-marketers to concentrate more on these service quality dimensions and to adopt with their current practice of service.
- *Arranging different training programs:* Customer satisfaction is the key driver for any successful business. To sustain in the competitive market, different training programs must be arranged that will increase the skills of IT personel. This study will help managers to raise fund as well as to arrange training programs for implementaion of identified drivers.
- *Developing organizational vision and managerial policy to develop technology:* E-business totally depends on proper technology. Managers of e-marketers have to formulate their visions and proper policy regarding this issue. Loyalty to customers is very important in this business and this factor has got the high prioritization weight. This paper will help managers to formulate company vision and managerial policy for implementation of the proposed framework.

7. CONCLUSION

In this era of internet, many businesses have been transformed into the internet-based platform and e-businesses are growing very fast around the world. The adoption of this trend is present in Bangladesh. It is one of the fastest emerging economic sectors in Bangladesh. At present, a significant number of online shops are doing business very promptly here. People are eager to adopt

online shopping as it saves their busy time. They can buy their necessary products staying at home which is the salient feature of this business. However, the success of these e-commerce businesses depends on improving the quality of service to customers. So, to promote business, e-marketers must focus on the identification of the service quality attributes affecting customer satisfaction and retention. This research has aims to address the following questions:

1. Which are the key service quality factors of e-commerce that influence customer satisfaction in the context of Bangladesh?
2. What is the relationship among these attributes?
3. What should be the strategy for successful implementation of these factors in existing one?

And to address the above mentioned questions, the current research has demonstrated a structured framework to examine the factors of e-quality in the context of online business in Bangladesh and to evaluate their significance. Here, a Delphi based grey DEMATEL framework has been anticipated. A total of nine e-quality factors of customer satisfaction were identified through the existing literature review and expert's feedback through Delphi analysis. Then, Grey-based DEMATEL approach was utilized to investigate the causal relationships among them and finally, a cause and effect diagram was presented.

The e-quality factors were ranked as follows: Reliance>Responsiveness> Return facility > Delivery method> Information sharing> Website infrastructure> Payment security > Customer service> Customization. The factor "Reliance" has got the high priority among nine which was followed by "Responsiveness". To improve the service, decision makers of e-marketers should give more attention on these attributes and try to adopt in the current practice. The results revealed that among nine drivers, four (website infrastructure, information sharing, reliance and payment security) could be

classified as "causal" and five factors (delivery method, responsiveness, customization, customer service and return facility) as "influenced". From the cause and effect diagram, it was found that "website infrastructure" has the most impact on other e-quality factors whereas "customer service" is mostly affected by other factors. To improve the service, decision makers of e-marketers should give more attention on these attributes and try to adopt in the current practice. Moreover, the Govt. should formulate strategic plans to overcome the problems faced by people during online shopping which ultimately will improve the service quality.

7.1. Limitations of the research

The work has some limitations which can be described as follows:

1. In this study, only 9 drivers were considered for modeling the interrelationships among them.
2. Delphi based DEMATEL approach was used to rank the factors which is dependent on human judgements.
3. Feedbacks were collected from 45 online users. This might not reveal the real picture of the business.
4. The proposed methodology was applied in a case online business which may not be applicable to other company.

The limitations can provide a new way for future research.

7.2. Direction of future research

In future, more service factors of e-quality can be considered. Besides, e-quality factors using international data can also be examined.

The impact and interaction among these factors can be assessed using other MCDM techniques like VIKOR, PROMETHEE.

They may be assessed in the fuzzy environment using fuzzy AHP, fuzzy VIKOR and fuzzy DEMATEL approach.

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Appendix A

Questionnaire

1. Background information of the respondents:

- a) Name:
- b) Gender:
- c) Years of online shopping experience:
- d) Satisfaction level of online shopping (Please, check the box):

Very poor
 Poor
 Average
 Good
 Very good

List of e-service quality factors:

Name of factors	Code
Website infrastructure	F ₁
Information sharing	F ₂
Delivery method	F ₃
Responsiveness	F ₄
Customization	F ₅
Customer service	F ₆
Reliance	F ₇
Payment security	F ₈
Return facility	F ₉

Please provide your opinion based on the following scale: No influence (N), Very low influence (VL), Low influence (L), Moderate influence (M), High influence (H), and Very high influence (VH).

	F ₁	F ₂	F ₃	F ₄	F ₅	F ₆	F ₇	F ₈	F ₉
F ₁	-								
F ₂		-							
F ₃			-						
F ₄				-					
F ₅					-				
F ₆						-			
F ₇							-		
F ₈								-	
F ₉									-

Appendix B

Table B1. The direct influence matrix (average)

	F ₁	F ₂	F ₃	F ₄	F ₅	F ₆	F ₇	F ₈	F ₉
F ₁	[0,0]	[0.7,0.95]	[0.6,0.85]	[0.6,0.85]	[0.1,0.3]	[0.5,0.75]	[0.65,0.9]	[0.6,0.85]	[0.4,0.65]
F ₂	[0.6,0.85]	[0,0]	[0.75,0.1]	[0.55,0.8]	[0.2,0.45]	[0.35,0.6]	[0.7,0.95]	[0.55,0.8]	[0.65,0.9]
F ₃	[0.2,0.45]	[0.5,0.75]	[0,0]	[0.65,0.9]	[0.35,0.6]	[0.45,0.7]	[0.75,1]	[0.2,0.45]	[0.7,0.95]
F ₄	[0.55,0.8]	[0.6,0.85]	[0.7,0.95]	[0,0]	[0.45,0.7]	[0.55,0.8]	[0.6,0.85]	[0.15,0.4]	[0.65,0.9]
F ₅	[0.3,0.55]	[0.2,0.45]	[0.55,0.8]	[0.25,0.5]	[0,0]	[0.1,0.3]	[0.65,0.9]	[0.2,0.45]	[0.6,0.85]
F ₆	[0.15,0.4]	[0.15,0.4]	[0.45,0.7]	[0.4,0.65]	[0.15,0.4]	[0,0]	[0.55,0.8]	[0.3,0.55]	[0.5,0.75]
F ₇	[0.45,0.7]	[0.65,0.9]	[0.7,0.95]	[0.6,0.85]	[0.65,0.9]	[0.55,0.8]	[0,0]	[0.6,0.85]	[0.55,0.8]
F ₈	[0.45,0.7]	[0.55,0.8]	[0.5,0.75]	[0.35,0.6]	[0.35,0.6]	[0.15,0.4]	[0.7,0.95]	[0,0]	[0.6,0.85]
F ₉	[0.4,0.65]	[0.4,0.55]	[0.55,0.8]	[0.65,0.9]	[0.6,0.85]	[0.55,0.8]	[0.6,0.85]	[0.45,0.7]	[0,0]

Table B2. Impact matrix of factors

	F ₁	F ₂	F ₃	F ₄	F ₅	F ₆	F ₇	F ₈	F ₉
F ₁	0.00	0.90	0.77	0.78	0.15	0.68	0.83	0.79	0.54
F ₂	0.79	0.00	0.95	0.72	0.30	0.49	0.89	0.73	0.84
F ₃	0.30	0.66	0.00	0.85	0.48	0.62	0.95	0.30	0.90
F ₄	0.73	0.78	0.89	0.00	0.60	0.74	0.77	0.24	0.84
F ₅	0.43	0.29	0.71	0.36	0.00	0.16	0.83	0.30	0.78
F ₆	0.24	0.23	0.59	0.54	0.24	0.00	0.71	0.43	0.66
F ₇	0.61	0.84	0.89	0.78	0.85	0.74	0.00	0.79	0.72
F ₈	0.61	0.72	0.65	0.48	0.48	0.25	0.89	0.00	0.78
F ₉	0.55	0.54	0.71	0.85	0.78	0.74	0.77	0.61	0.00

Table B3. Standardized matrix of factors

	F ₁	F ₂	F ₃	F ₄	F ₅	F ₆	F ₇	F ₈	F ₉
F ₁	0.000	0.165	0.125	0.146	0.028	0.125	0.125	0.145	0.089
F ₂	0.138	0.000	0.154	0.134	0.053	0.086	0.134	0.128	0.139
F ₃	0.059	0.130	0.000	0.159	0.095	0.123	0.143	0.059	0.149
F ₄	0.131	0.140	0.144	0.000	0.107	0.132	0.116	0.043	0.139
F ₅	0.101	0.058	0.115	0.067	0.000	0.036	0.125	0.072	0.129
F ₆	0.056	0.046	0.096	0.101	0.062	0.000	0.107	0.103	0.109
F ₇	0.098	0.135	0.144	0.146	0.137	0.119	0.000	0.127	0.116
F ₈	0.126	0.145	0.106	0.090	0.099	0.051	0.134	0.000	0.129
F ₉	0.099	0.097	0.115	0.159	0.141	0.133	0.116	0.110	0.000

Table B4. The total relation matrix

	F ₁	F ₂	F ₃	F ₄	F ₅	F ₆	F ₇	F ₈	F ₉
F ₁	0.888	1.150	1.194	1.226	0.846	1.020	1.185	0.988	1.161
F ₂	1.027	1.029	1.239	1.241	0.887	1.009	1.215	0.992	1.224
F ₃	0.908	1.075	1.040	1.192	0.875	0.983	1.155	0.880	1.167
F ₄	0.991	1.113	1.197	1.087	0.903	1.017	1.166	0.895	1.189
F ₅	0.767	0.823	0.929	0.903	0.627	0.731	0.931	0.724	0.938
F ₆	0.700	0.778	0.876	0.892	0.659	0.663	0.880	0.719	0.886
F ₇	1.020	1.171	1.262	1.278	0.979	1.057	1.128	1.013	1.238
F ₈	0.946	1.071	1.112	1.113	0.856	0.901	1.126	0.809	1.126
F ₉	0.972	1.084	1.179	1.227	0.939	1.020	1.173	0.952	1.075

