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E-Business Supply Chain Collaboration Measurement Scale: A Confirmatory Approach

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Abstract— **This study focuses on the confirmatory factor analysis for testing validity and reliability of E-Business Supply chain collaboration measurement scale in Arabian context. Items of the Scale was developed initially from literature review in supply chain collaboration. The initial form was pilot tested using The study is considered as the first in the Middle East E- business supply chain environment, especially in the Kingdom of Saudi Arabia, which is witnessing rapid growth in the use of electronic commerce between business partners along supply chain. It provided a valid and reliable measurement tool adapted to the Saudi business environment.**

Keywords— *E-Business, Supply Chain Collaboration, EFA, CFA, SEM, KSA.*

1. Introduction

Several studies identified the concept of the supply chain, supply chain management, and the implications of these concepts on entire supply chain. The studies headed on the concept of collaboration in the supply chain [1]–[3]. Many researches defined factors affecting collaboration in supply chain field, for example, [4]has defined supply chain collaboration as: a complete philosophy about how to control the purchase rates and production rates, across multiple layers of the supply chain system. Ref [5]found seven interrelated components of a supply chain collaboration, namely: share information, harmony of goals, and coincided decisions, stimulating compatibility, resource sharing, collaborative communications, and create a common knowledge. As showed in the same study that these components contribute to creating value by lowering costs, reducing the response time, maximum utilization of resources, and improve innovation. According to [2], collaboration in the supply chain is divided into two types, internal collaboration, and intended to which is being at the departmental level within the company (manufacturing, research and development, marketing, sales, management. External collaboration is

between the company and supply chain parties (partners, suppliers, customers, and competitors, research institutions, and networks). Furthermore, Ref [6]argues that both types (internal and external) are on the same level of importance for the company. The company may affected by both, thus, the good performance of the supply chain generally contributes to enhance performance as a whole.

Industrial sector plagued by a numerous amount of challenges in terms of technology and effective operational processes [7]. Furthermore, the change in consumers behavior toward using the e-commerce is became a challenge for these organizations [8]. However, these changes increased in the last decades worldwide and particularly in Arabian context [9]. So, many organization are responding to these changes by adapting e-business as a solution to face these challenges [10]. A number of researchers argree, since we have a high demand on technology the solution will be using and implementing these technologies such as E-business [11]–[15]. However, E- business companies are affected by supply chain collaboration, where their work depends fully and almost on the Internet [13]. E-business companies significantly affected as a result of their need for rapid response to client's requirements, both in terms of providing the product, or the availability of payment methods, shipping and delivery. Smoothness and speed of these operations is a cornerstone upon which the success of the online store [16]. Building efficient supply chains is essential in light of the trend towards e-commerce as the future shape of the trade. in Arabian context, electronic commerce has experienced significant growth in the volume of electronic transactions.

The context of this paper involves the main components that support internal, external supply chain. Moreover, this paper focuses on validating supply chain collaboration measurement that is related to both internal and external

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supply chain collaboration based on the literature review. Several noticeable contributions can be highlighted in this paper. Firstly, this study aimed to develop and validate the supply chain collaboration measurement scale in Arabian context specifically Saudi Arabia e-business companies. Secondly, Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) was deployed to test the factors and identify core values that explain both supply chain collaboration measurement scale in the selected e- business companies in Saudi Arabia.

2.   Literature review

This paper focused on E-business companies for several reasons, Kingdom of Saudi Arabia markets characterized by rapid development, and there is a constant increase in the number of Internet users. A Significant percentage of shoppers doing shopping online, which create great opportunities for e-commerce companies to enter the market. The second reason, KSA is in the top of Arab countries in the use of e-commerce shopping [17]. Additionally, studies often directed to industrial and service sectors, we find that the studies ignore this sector, which contribute significantly to the GDP. For these reasons, the focus of this study was on e-commerce companies to achieve its goals. Many relevant studies have been conducted to measure collaboration between supply chain members, Studies in this area in the Arab countries is considered very rare. The study reviewed the most studies related to the research topic, and it has highlighted all the factors that combine collaboration between supply chain members and accounted to the hypothesized CFA model. The development of measurement scale followed three steps, first, item generation based on literature review to put the initial scale paragraphs, then interviewing the practitioners from the e-business sector for the initial evaluation and assuring readability and credibility. in the same step, the measurement scale was reviewed by academics to assure face and content validity. Second, the items in the scale developed initially from responses to the paragraphs by 87 respondents from selected e-Business companies. This initial form was pilot tested and subjected to exploratory factor analysis. Finally, later the revised scale was sent to 350 e-business companies, the result of data was subjected

to CFA, reliability analysis, and validation of the measurement scale.

The purpose of theoretical review was to ascertain the content validity, were many studies reviewed to develop the initial paragraphs for each dimension (factor) and then presented to academics, experts and practitioners in the same field. According to [18], [19], the paragraphs of the scale must cover the content of each construct, comprehensive review were made to develop and proposed initial paragraph, the scale contain 39 items distributed on six dimensions of collaboration. The development of internal collaboration scale was based on the study of [14], the scale used indicated relating integrated infrastructure that allows participation in data and information resources, also includes setting goals and strategic plans through collaboration between the various functional levels. As well as [20], who pointed out that the internal processes are managed through a multi-functional work teams, integration and interdependence of functions, and participation in the information, ideas, and resources within the organization, sharing of knowledge within the organization to contribute to the development of products and services, and the use of joint planning in order to anticipate and solve the operational problems. A study [21] included paragraphs regarding the exchange of information in terms of work reports and official documents, or information working methods, expertise and tacit knowledge, as well as the development of performance measurement techniques between organizational units. External supply chain collaboration paragraphs were adopted from the study of [5], [16]The study included the paragraphs relating to collaboration with suppliers in terms of participation in all of the information that will enhance operations with suppliers, which included work on common goals and planning for promotional events, and exchanging of accurate and complete information in a timely manner. Two above studies were also adopted for the development of the paragraphs relating to supportive services providers as a second external member in supply chain.

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The studies focused on the rules and policies that are necessary to coordinate activities with service providers, purposes that lead collaboration with them so as to achieve support for products and services and the institution's operations, the scale included also contains paragraphs concerning collaboration with service providers, distributors and dealers in many aspects, both in terms of planning, promotion and forecasting demand, inventory management, problem-solving, and risk tolerance. [22] argue that the collaboration with consumers reflects positively on the performance of the organization as contributing to facilitate marketing of the new product process, and reducing the risks associated with the introduction of new products to the market. [3] indicated the presence of the impact on the performance of new product development and innovation performance. Previous studies were adopted to develop the measurement scale for collaboration with customers.

Collaboration with customers include paragraphs related to building both formal and informal communication channels with consumers, sharing knowledge with consumers in order to develop products and services, collaboration in order to find potential customers, and finally collaboration with consumers in designing of promotional campaigns. For collaboration with competitors, the scale incorporated paragraphs related to collaboration with competitors in many aspects, such as in research and development, sharing the cost, exchanging of information, benchmarking to keep updated with the latest developments in the field of technology and market trends for the purpose of accelerating the development processes. Collaboration with competitors also include information exchanging about electronic auctions, and information about the product and cost. Scale paragraphs were adopted from [3], [23]. Finally, [3], [24] suggest collaboration with research institutions and universities, where they studied this type of collaboration in terms of developing processes, systems and improving the products, also using of an integrated knowledge base in order to share knowledge to achieve collaborations. The study used these aspects in order to develop collaboration with research

institutions and universities measurement scale paragraphs.

3. Methodology

A total of 39 items were generated form literature (see Appendix A). Potential paragraphs for each factor of the scale has been set, revised with practitioners from different sectors conducting business online in order to assess the readability and credibility of the scale. Structured interviews with practitioners and managers in some companies were conducted to ensure clarity and relevance of each paragraph for each factor, they were asked for ordering of paragraphs according to priority of measuring that factor, then classified by harmony of each paragraph with factor. based on their observations we removed some duplicated and unclear paragraphs, modified some of them, and adding some paragraphs when necessary. This process was repeated three times to ensure conformity with the surrounding environment. then, the scale was sent to seven academics at the University of AL-Qassim in the Department of Management Information Systems and production methods, Department of Business Administration, who reviewed each paragraph of the scale to ensure good formulation, based on their recommendations, we removed, modified, or added paragraphs for each factor. The scale settled on thirtynine paragraph. The questionnaire was developed to measure the variables (internal and external collaboration). we used 5-Likert scale measurement to assess the answers for both internal and external collaboration variables , the answers are ranged as follows: (5=Strongly Agree to 1= Strongly Disagree). A scale of 39 items have distributed on 6 component factors, namely (Internal Supply Chain Collaboration= 9 items, Collaboration with Suppliers 7 items, Collaboration with Customers= 5 items, Support Services Providers= 10 items, Collaboration with Competitors= 5 items, and finally Collaboration with Research Institutions and Universities= 3 items).

Sampling process has been conducted two times. Two deferent samples were used to develop and validate the measurement scale. Sample 1 was used for pilot testing

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and exploratory factor analysis, and sample 2 was used for confirming factors that resulted from EFA. First sample consisted of 50 e-business companies, and we have obtained 87 responses. The initial sample were used for EFA. Last version of scale was used for survey. The survey included all the companies that use e-commerce as a tool for selling products and services during the period of 4-2015 and 10-2016. The society is statistically undetermined, and data were collected using the developed survey which has been tested by a group of managers and academics to verify the readability and clarity, then validated using EFA. The survey was sent to a sample by e-mail, some of them were interviewed directly. Required information is characterized by the strategic nature, the questionnaires has been sent to executives and managers, and the owners of the institutions because they are considered the best source of information. Lists of companies was obtained through chambers of commerce or access to such companies through websites. A sample of (350) of e-commerce companies were selected during varying periods from different regions in the KSA, including Qassim, Riyadh, Jeddah, Dammam, AlMadinah Almunwarah, and Jazan. We distributed 350 questionnaires and retrieved (123) and the response rate was (35.1%). The response rate was low since the study focused on a small group of managers and owners who are counted few in companies. Date are coded using SPSS and checked for missing values, then analyzed using AMOS.16. During data screening for outliers, (7) responses were deleted due to Mahalanobis distance values more than the χ^2 value ($\chi^2=42.31$; n=12, p<0.001), a final of (116) response were devoted to analysis. Further statistical analysis are then conducted such as reliability and validity using confirmatory factor analysis for construct and discriminant validity for multicollinearity treatment, composite reliability, and average variance extracted, testing the fit for the hypothesized CFA model and the revised model.

4. Discussion and data analysis

EFA was used to structure the scale of supply chain collaboration which consists of 39 items. Promax rotation

with Kaiser Normalization and Principal Component Analysis were applied. Kaiser-Meyer-Olkin (KMO) coefficient has reached 0.780 indicated the suitability of data for factor analysis using principal components [25]. The observed significance level of Bartlett's Test of Sphericity was (0.000) concluded that the strength of relationships among variables is strong (George and Mallery, 2001). EFA extracted 9 factors with eigenvalues above 1.00 and explained altogether 78% of variance of results. Scree plot indicated that rotation was needed for 5 factors as it display them in a sharp descent. Some of factors were represented by one item with loading higher than 0.50, other items were deleted because their factor loading were lower than 0.5 [26]. Factor analysis with Promax rotation was used again for 19 items. in Summary, the retained items were 19 and resulted on five independent factors loading greater than 0.50. Table.1 shows factors loading and structure of items. Five factors derived from EFA accounted for 74.962% of total variance. These factors were arranged according to common characteristics of the items loading on the same factor. The total variance value is appropriate, according to (Reckase, 1979), proportion of explained variance by initial factor in valid scale should be at least 20%, thus, these results of variance considered satisfactory and indicated internal consistency of the scale. Eigenvalue of factors are (4.587, 2.466, 1.365, 1.166, 1.134) respectively. Table.2 shows the factors, total variance extracted, and eigenvalues.

Based on the above EFA, the items constituting supply chain collaboration were grouped under five factors. Factor 1 contains four items related to internal supply chain collaboration and focus on integrated infrastructure that allows participation in the databases, information, and resources. The second item focusing on collaboration in the goal-setting and strategic planning process across organizational units. Item three related to sharing knowledge to support the development of products / services / processes within the company. The last item is Involved staff sharing work reports and official documents. Mean score was 3.90, SD= 0.676, (SE=0.06), that means the respondents showed positive agreement

toward internal supply chain collaboration. The second factor is collaboration with customers which consisted of four items also. Mean score was 3.90, SD= 0.691, (SE=0.06) which indicate a positive agreement toward this factor. The items related to using formal and informal communication to connect with customers, sharing information about the development of products and services with customers, collaborating with customers in designing promotional campaigns, and providing communication channels for customers to voice their opinions about products and services.

Table 1. Factors structure and items for supply chain collaboration

Items	Component				
	Factor. 1	Factor. 2	Factor. 3	Factor. 4	Factor. 5
Factor. 1 Internal Supply Chain Collaboration					
ISCC1	0.904				
ISCC2	0.821				
ISCC5*	0.792				
ISCC8*	0.664				
Factor. 2 Collaboration with Customers					
CUS3		0.854			
CUS5		0.788			
CUS1		0.659			
CUS2*		0.593			
Factor. 3 Support Services Providers					
SER8			0.813		
SER4			0.810		
SER3			0.707		
SER1			0.620		
SER10*			0.551		
Factor. 4 Collaboration with Research Institutions and Universities					
RE2				0.940	
RE1				0.843	
RE3				0.813	
Factor. 5 Collaboration with Competitors					
COMPT3					0.821
COMPT2					0.821
COMPT4*					0.768

Note: (*) indicates items eliminated in CFA

Table 2. Eigenvalues, and Variance of Factors

Factors	Eigenvalues	Variance
Factor. 1 Internal Supply Chain Collaboration	4.587	32.763
Factor. 2 Collaboration with Customers	2.466	17.615
Factor. 3 Support Services Providers	1.365	9.749
Factor. 4 Collaboration with Research Institutions and Universities	1.166	8.330
Factor. 5 Collaboration with Competitors	1.129	6.504

Factor. 3 consisted of five items. Mean score was 3.90, SD= 0.732, (SE=0.06) for support service providers. The items include (collaboration with partners to deliver products and service on time, keen with service providers to provide the company's products at the right time and place, IT Infrastructure that allows sharing information and knowledge between the company it's service providers, policies and rules to coordinate collaboration activities with support services providers, and collaboration with service providers in planning for providing a variety of customized products and services). Collaboration with Research Institutions and Universities (factor. 4) consisted of three items which focus on (collaboration with academic institutions and independent researchers to improve products/services, collaborative ventures with universities to support research and development of processes and systems, and using an integrated knowledge base in order to share knowledge with universities and research centers), Mean score was 3.90, SD= 0.823, (SE=0.06). The fifth factor is Collaboration with Competitors, Mean score was 3.90, SD= 0.860, (SE=0.06). three items establishing factor. 5 namely (sharing information about electronic auction and tendering with competitors, and Exchanging information with competitors in order to learn about the latest developments and market trends, and sharing production

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costs information with competitors). The consistency between multiple measurement of variables has been assessed in order to show overall measurement reliability. Cronbach alpha for the entire scale was calculated and yielded values of 0.70. As suggested by [27], the questionnaire considered reliable and proved reliability since alpha coefficient (α) for all variables were (Internal collaboration=0.832, Collaboration with Customers =0.811, Support Services Providers =0.770 , Collaboration with Research Institutions and Universities =0.764, Collaboration with Competitors=.855), the overall Cronbach alpha coefficient for measurement scale of 19 items was =0.861 . Mean and standard deviation was also calculated to show the degree of agreement on items values among respondents. The results indicates no high standards deviation for all items. Factor correlation matrix has been examined to assure Discriminant validity. Table.3 shows that Correlations between factors not exceed 0.7. indicating that factors are distinct and uncorrelated as a correlation greater than 0.7 indicates a majority of shared variance [28].

Table 3. Factor Correlation Matrix

Factor	1	2	3	4	5
1	1	0.491	-0.051	0.287	0.267
2	0.491	1	0.183	0.287	0.184
3	-0.051	0.183	1	0.048	0.236
4	0.287	0.287	0.048	1	0.189
5	0.267	0.184	0.236	0.189	1

The scale resulted from EFA was subjected to survey and distributed to selected sample. A total of 116 response were devoted to confirmatory factor analysis.

The CFA model for supply chain collaboration hypothesizes that the responses to the items in the questionnaire can be explained by 5 factors as discussed above. Another assumption suggest that each item has non-Zero loading on its factor and Zero loading on all other factor. All five factors are correlated, and error terms associated with item measurements are uncorrelated. Confirmatory factor analysis was selected for assessing convergent and discriminant validity of the instrument. CFA are used because it is appropriate statistical test to

identify number of factors required to explain the inter-correlation among the measurement variables [29], and to identify which the observed variables are more likely to be reliable indicators of a particular factor. Matrix of factor correlation which considered as an explicit part for the correlation between factors also calculated. The researchers are able to decide priori whether the factors would correlate or not [30]. Moreover, impose which factor pairs that are correlated and which observed variables are affected by which common factors. CFA also shows the observed variables that are affected by a unique factor and which pairs of unique factors are correlated [31]. CFA considered as a tool to confirm the proposed factors of internal, external supply chain. To purify the measurement model, two step approach was used to identify and determine whether items should be eliminated from the measurement model considering number of criteria such as weak loading, cross loading, multiple loading, communalities, error residuals and theoretical determination [32]–[34]. Then Cronbach alpha coefficient and alpha- if- items deleted were calculated once again to determine construct reliability.

Confirmatory factor analysis for the initial model was conducted using AMOS.16. The initial CFA included 19 items that were resulted from exploratory factor analysis. Model fitness was assessed, to produce over identified model, the regression path in each measurement components was fixed at 1. We use item's error variance estimate to evaluate the items, additionally, evidence of items needing to cross-load on more than one component factor as indicated by large modification indices. The extent to which item give rise to significant residual covariance, parsimony purpose, regression coefficient of each item, reliability of the item and the reliability of the whole construct. Adding to the logic and consistency of data with the theoretical framework was considered when evaluating each item. Table.4 shows the fit indices for initial CFA model. The model were subjected to re-specification, and the second CFA model was performed based on re-specified model.

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Table 4. Fit indices for initial model (internal, external supply chain collaboration)

First MODEL	CMIN (X^2)	DF	P	CMIN((X^2))/DF	RMR	GFI	AGFI	CFI	NFI	TLI	RMSEA	PCLOSE
	278.590	142	0.000	1.962	0.077	0.799	0.730	0.856	0.751	0.827	0.091	0.000

Based on [26], [35], modeling strategy could be three distinct and different types namely: Confirmatory modeling strategy, competing models strategy and model development strategy. The confirmatory approach specifies a single model composed of a set of relationships and apply SEM to assess the model adequacy. In other words, to find support whether the model fits the data. competing models focusing on several models and finding best model that could represent the data. Finally, model development strategy that have been adopted for this paper, the paper focused on building framework for basic model based on theoretical judgement that will be empirically tested using SEM. Then model modified based on suggestions given by the modeling software used. The re-specification was also theoretically supported. Initial estimates based on 19 items for collaboration model showed the need for purification. As the initial model fit indices indicated poor fit and need for re-specification to fit better with the sample data. The criteria used for elimination of items was adopted based on poor square multiple correlations as well as low regression weights, large error covariance between items, items that have less effects in the constructs, items that load onto other factors, high error variances. Some items with low squared multiple correlation and relatively low regression weight were retained, removing these items would cause other items to lose their overall affects in the component factor, and the reliability value for the factor will become weaken. Following the elimination process, measurement scale included 14 items and 5 items were eliminated namely (ISCC5, ISCC8, CUS2, SER10, COMPT4), Appendix A show items retained and eliminated. Model fit indices for purified model are shown in table.5 and indicated good fit with sample data, as the analysis resulting in the following statistical values : X^2/df = 1.589, Comparative fit index CFI are 0.94. These statistics indicated good fit with sample data for the overall

measurement model [36]. Table.5 summarizes fit indices after testing modified model.

Table 5. Fit indices for CFA modified model

Modified model	CMIN	DF	P	CMIN/DF	RMR	GFI	AGFI	CFI	NFI	TLI	RMSEA	PCLOSE
	106.460	67	0.033	1.589	0.056	0.912	0.891	0.938	0.853	0.915	0.072	0.088

Figure. 1 shows the modified measurement model. The modified model indicates that items retained load well onto five component factors. The regression weights ranging from 0.57 to 0.94. Table.6 shows the Results of descriptive statistics, multivariate normality and confirmatory factor analysis for the modified model, critical ratio were above 1.96 indicating significant regression weights. Factor loading which greater than 0.50 were retained based on [27]. Modified model in figure.1 indicates that all 14 items converge into collaboration constructs. The items are portioning into five factors namely (Internal Supply Chain Collaboration, Collaboration with Customers, Collaboration with Support Services Providers, Collaboration with Research Institutions and Universities, and Collaboration with Competitors). Each of items is loaded only one of these scale factors without any cross-loading. The results of multivariate normality shows the distribution of the variables were not far from the normality (see table.6), because the absolute values of kurtosis not larger than 3 or 4 [37], and the absolute values of skewness were less than 3 [38].

To meet certain empirical properties and standardizing the measurement scale , reliability and validity test have been conducted. Cronbach alpha coefficient, composite reliability, and Average Variance Extracted (AVE) had been calculated to measure reliability for each factor in the modified model. Calculation of composite reliability and AVE were conducted using ref.[39] suggest that composite reliability should be greater than 0.7 and AVE is greater than 0.5. As can be shown in table.6, the composite reliability and AVE values exceeded the minimum acceptable values, indicating that measures

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were reliable and no errors and introducing consistent results.

Table 6. Results of descriptive statistics, multivariate normality and CFA

Item#	Cronbach alpha	Mean	SD	Skewness	Kurtosis	Standardized path coefficient	SE	CR	P	SMC	Composite Reliability	Average Variance Extracted (AVE)
Internal Supply Chain Collaboration	0.851										0.736	0.597
ISCC2		3.97	0.903	-0.998	1.394	0.934				0.872		
ISCC1		4.07	0.882	-1.433	2.719	0.567	0.159	3.283	0.001	0.321		
Collaboration with Customers	0.813										0.756	0.509
CUS3		3.66	0.932	-0.775	0.990	0.737				0.543		
CUS5		3.90	0.879	-0.880	1.005	0.661	0.141	4.26	0.000	0.437		
CUS1		3.57	0.970	-0.498	0.079	0.740	0.184	5.887	0.000	0.548		
Support Services Providers	0.892										0.827	0.548
SER1		3.82	0.947	-0.989	1.105	0.589			0.000	0.347		
SER4		3.95	0.968	-1.111	1.305	0.806	0.221	6.321	0.000	0.650		
SER3		3.91	0.897	-0.880	0.146	0.834	0.250	6.431	0.000	0.696		
SER8		3.78	0.921	-0.902	0.871	0.707	0.200	5.830	0.000	0.500		
Collaboration with Research Institutions and Universities	0.844										0.849	0.658
RE3		3.97	0.946	-1.186	1.673	0.654				0.428		
RE1		4.05	0.940	-1.048	0.915	0.811	0.166	7.408	0.000	0.658		
RE2		3.95	0.959	-0.967	0.864	0.942	0.201	7.254	0.000	0.887		
Collaboration with Competitors	0.823										0.760	0.613
COMPT2		3.72	0.968	-1.068	0.634	0.778				0.605		
COMPT3		3.86	0.977	-0.901	0.564	0.788	0.127	7.269	0.000	0.621		

Note: SE= Standard Error, CR= Critical Ratio, SMC= Squared Multiple Correlation

SE and CR for First item in each factor are not shown because the regression weight of the first variable of each factor is fixed at 1.

The other empirical property for measurement model is validity. We used CFA to determine construct validity. Construct validity means how will is the construct explained the variables under construct. In other words, whenever the correlation of items within the same construct is relatively high it is said to have the construct validity. Also, factor loading, high regression weights and square multiplied correlations of the items are significantly correlated to specified construct would also contribute to construct validity [26]. Convergent validity on the other hand indicates the degree to which items measure the underlying construct. CFA verified that each item loads onto one single component factor without any cross-loading onto other factor. We used critical ratio (CR) to evaluate the statistical significance, the individual item's standardized coefficient should be significant and greater than twice its standard error [32]. The parameters which have critical ratio greater than 1.96 can be significant. Table.6 shows that coefficient for all items are greater than standard error, and the coefficient for all items are large and significant, and the values of critical ration are greater than 1.96. Based on this analysis, we

conclude that convergent validity for the constructs of measurement models was supported. Finally, discriminant validity indicates the extent to which the latent variables are different [40]. Each individual item measure one latent construct and not measure deferent latent construct at the same time [41], so, AVE of the two constructs must exceed the square of their correlation. Table. 7 shows Average variance extracted, squared correlation for every pairs of factors. AVE for each latent variable was larger than squared correlation for the same pair. Indicating that each construct was a distinct construct and is different from other construct [42].

Table. 7. Discriminant validity test outcomes (Squared Correlation, AVE)

Construct	Internal Supply Chain Collaboration	Collaboration with Customers	Support Services Providers	Collaboration with Research Institutions and Universities	Collaboration with Competitors
Internal Supply Chain Collaboration	0.600				
Collaboration with Customers	0.180	0.510			
Support Services Providers	0.130	0.360	0.550		
Collaboration with Research Institutions and Universities	0.000	0.040	0.000	0.660	
Collaboration with Competitors	0.140	0.180	0.210	0.000	0.610

5.   Conclusion

The modified measurement model in figure. 1 showed the result of five factor CFA model of supply chain collaboration. Fit indices indicate good fit with sample data as it yielded p- value= 0.088, normed chi-square= 1.589, Comparative fit index CFI are 0.94, and RMSEA= 0.072. All fit indices are more than adequate to conclude that the re-specified CFA model for supply chain

collaboration is correct. It indicates that the model fit the data, and the loading was ranged from 0.57 to 0.94. Convergent validity for the supply chain collaboration was also supported as the re-specified model indicates that all 14 items converge into collaboration constructs and portioning into five factors namely (Internal Supply Chain Collaboration, Collaboration with Customers, Collaboration with Support Services Providers, Collaboration with Research Institutions and Universities, and Collaboration with Competitors).
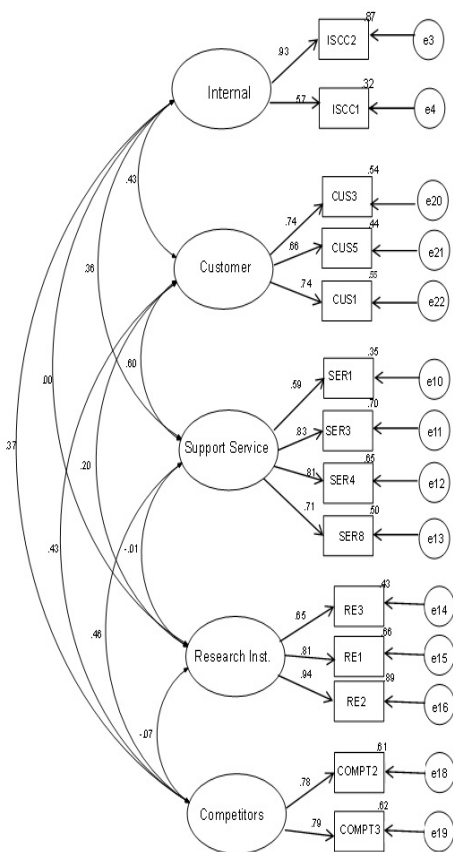

Figure. 1 CFA for Modified model for Supply Chain Collaboration

Also, Each individual item measure one latent construct and not measure deferent latent construct at the same time. Finally, the composite reliability and AVE values exceeded the minimum acceptable values, indicating that measures were reliable and introducing consistent results. From the above results, we can simply conclude that the e-business companies in Saudi Arabia should focus on these core values in order to bring the benefits of supply chain collaboration. The purpose of the study was to validate the values for supply chain collaboration that is related to both

internal and external supply chain collaboration as suggested by [2], [5]. The study offered evidence to five dimensions of CFA model that can be used in Saudi Arabia e-business market, the study also hints that these factors are important in driving e-business companies toward enhancing their collaboration practice. The results of this study are relevant to theories and practice, for example, [6] stated that both types (internal and external) are on the same level of importance for the company. Based on the above, Building efficient supply chains in e-business is essential in light of the trend towards e-commerce as the future shape of the trade. Results of the study did not provide evidence of the importance of collaboration with suppliers as one significant components of the supply chain collaboration scale. This may be attributed to the fact that e-commerce companies in Saudi Arabia did not reach sufficient maturity in electronic dealings. Since collaboration with suppliers requires a high degree of coordination, especially in the development of new products, and create value for the end consumer as suggested by [3], [43]. While e-commerce activity is restricted in Saudi Arabia to bring goods and services from suppliers and delivery only, without participation in the product development process or creating value, the focus of collaboration between e-commerce companies in Saudi Arabia activities is directed to customers and providers of support services and even competitors in order to providing a high quality services to customers. However, there were limitations that should be cautioned in conducting this research. The study only used one sector in Saudi Arabia. Thus, generalization could not be done and future research could expand this to other sectors in Saudi Arabia and region to make it generalizable. Future research could also use structural equation modeling (SEM) procedure. In a short, the survey items is beneficial in measuring the supply chain collaboration for e-business performance based on framework for achieving success. That is why collaboration components are very important as this would bring the organization to achieve the competitive advantage.

Acknowledgements

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Appendix A

Measurement Scales for E- business Supply Chain Collaboration

	Item#	Paragraph		References
Factor. 1	**Internal Supply Chain Collaboration**			
1	ISCC1	The company has integrated infrastructure allows participation in the databases, information, and resources	**	
2	ISCC2	We collaborate in the goal-setting and strategic planning process across organizational units	**	
3	ISCC3	Our organizational culture creating a common vision towards teamwork and sharing resources		
4	ISCC4	Operations in the company are executed through a multi-functional work teams		(Sanders,2007; Basnet, 2013; Rita et al, 2005)
5	ISCC5	We share knowledge to support the development of products / services / processes within the company	*	
6	ISCC6	We anticipate and solve operational problems through joint planning across organizational units.		
7	ISCC7	We participate the development of performance measures for organizational units		
8	ISCC8	Involved staff sharing work reports and official documents	*	
9	ISCC9	Employees within organizational units share experiences, information, and tacit knowledge about woking methods		
Factor. 2	**Collaboration with Suppliers**			
10	SUP1	Common goals between the company and it's suppliers are identified through formal agreements		
11	SUP2	The company shares accurate and complete information about the enhancing programs and operations with suppliers in a timely manner		
12	SUP3	Our company collaborates with suppliers in developing plans to manage the inventory levels according to the market supply and demand		(Thomson et al, 2009; Cao and Zhang, 2011)
13	SUP4	We are working with suppliers to address market risks and fluctuations		
14	SUP5	We collaborate with suppliers in providing many products and services.		
15	SUP6	We collaborate with suppliers in planning for promotional campaigns		
16	SUP7	We use an integrated knowledge base in order to share knowledge with suppliers		
Factor. 3	**Collaboration with Customers**			
17	CUS1	The company uses formal and informal communication to connect with customers	**	
18	CUS2	The company provides communication channels for customers to voice their opinions about products and services	*	Brettel and Cleven, 2011; René et al, 2014)
19	CUS3	The company shares information about the development of products and services with customers	**	
20	CUS4	We get information about potential costomers through the company's current customers		
21	CUS5	We collaborate with customers in designing promotional campaigns	**	

Factor. 4	Support Services Providers			
22	SER1	The Company follows policies and rules to coordinate collaboration activities with support services providers	**	
23	SER2	The company collaborates with the service providers in developing collaboration solution		
24	SER3	IT Infrastructure allows sharing information and knowledge between the company it's service providers	**	
25	SER4	The company and it's service providers is keen to provide the company's products at the right time and place	**	(Thomson et al, 2009; Cao and Zhang, 2011)
26	SER5	We collaborate with service providers in planning for promotional marketing processes		
27	SER6	We work with service providers to predict products demand		
28	SER7	We Share market risk tolerance with our service providers		
29	SER8	We collaborate with partners to deliver products and service on time	**	
30	SER9	We collaborate with service providers in planning for providing a variety of products and services		
31	SER10	We collaborate with service providers in planning for providing a variety of customized products and services	*	
Factor. 5	Collaboration with Competitors			
32	COMPT1	The company shares costs of research and development with competitors		
33	COMPT2	We Exchange information with competitors in order to learn about the latest developments and market trends	**	Brettel and Cleven, 2011; chan et al, 2005)
34	COMPT3	We share information about electronic auction and tendering with competitors	**	
35	COMPT4	We Share production costs information with competitors	*	
36	COMPT5	We Share product information with competitors for the purpose of development		
Factor. 6	Collaboration with Research Institutions and Universities			
37	RE1	We have collaborative ventures with universities to support research and development of processes and systems	**	Brettel and Cleven, 2011; Zhu, 2011)
38	RE2	The company collaborates with academic institutions and independent researchers to improve its products / services	**	
39	RE3	We use an integrated knowledge base in order to share knowledge with universities and research centers	**	

** Items retained after CFA

* Item Retained after EFA and eliminated in CFA