

## The Role of e-Business Solution in Firm Performance: Impact of Supply Chain Collaboration in Manufacturing Sector in Jordan

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### Abstract

**Purpose:** This research seeks to present a theoretical model about the role of e-business in firm performance taking into consideration the impact of the mediators "collaboration with customer and collaboration with competitors".

**Design:** The study was conducted in manufacturing sectors in Jordan. The researcher used the exploratory factor analysis in the first phase of the analysis. A total of 66 questionnaires were distributed and considered for pilot testing. In the second phase, confirmatory factor analysis was conducted to validate the measurement scale. The researcher distributes 178 questionnaires and used to validate the measurement scale. Then the researcher used structural equation modelling to investigate the relationship between the dimensions, and to measure the impact of e-business on firm performance, impact of supply chain collaboration on e-business and firm performance.

**Finding:** Based on final results of this research, e-business doesn't have a significant impact on firm performance, the assumption of the mediating effect of collaboration with customers on e-business and firm performance was refused, in the other side it was accepted for collaboration with competitors mediate the relationship between e-business and firm performance.

**Practical Implication:** The study presents suggestion and recommendation for managers in Jordanian's manufacturing sectors that may be helpful to use e-business effectively to improve the organizational performance by collaboration with customers and competitors. The researchers recommends that the future researches should include other types of collaboration such as retailers, suppliers, etc., also should include other sectors such as services, other industries, telecommunications, etc.

**Originality:** The paper considered as the first in Jordanian e-business supply chain environment, which witnessing accelerated growth in investment in e-business and using of collaborative techniques to support the work of business partners across the supply chains. The study provided a valid and reliable measurement scale adapted to the Jordanian environment and built a framework for effective collaboration within supply chain.

**Keywords:** E-business; Supply chain collaboration; Firm performance

### Introduction

This study investigates the role of e-business solutions and supply chain collaboration in firm performance in manufacturing sector in Jordan. It is seeking to provide a conceptual framework to examine the impact of e-business on firm performance, taking into consideration the mediating role of collaboration with customers and competitors. A valid measurement scale was developed to explore the factors that underlying the study variable using exploratory and confirmatory factor analysis. Then estimate direct and indirect relationship between the study variable, finally, fitting and validating the model regarding the sample data using structural equation modeling (SEM). Few studies that have addressed all dimensions of the study in a one conceptual framework. In addition, few researches that studied this subject in the Arab world, as well as in manufacturing sector in Jordan.

E-business is the transformation of processes to deliver extra customer value through the utilization of technologies [1], philosophies and computing paradigm of the new economy [2]. As Ipatakis, EB is conducting of business online including global communication media (web or other electronic systems) [3]. It is also the transformation of key business processes utilizing web technologies, with the application of information and communication technologies to support all business activities. The organization's performance can be seen from the financial statement revealed by the organization. Thus, a great performing organization reinforced administration for quality exposure. Performance measurement indicates the way of measuring the action's efficiency and effectiveness. Likewise, it is the transference

of the complex reality of performance in organized symbols that can be connected and handed-off under the similar conditions. In the current business administration, performance measurement is considered to be in a more critical role compared to quantification and accounting [4]. Supply chain is group of independent organization associated together through the products and services that independently or mutually add value to deliver them to the end customer, collaboration means working together to achieve common goal from project to project and from business to business [5]. Furthermore, supply chain collaboration is defined as a long-term relationship where participants generally cooperate, share information, and cooperate to plan and modify their business practices to enhance joint performance [6]. Customer collaboration refers to the way an organization utilizes customer feedback to benefit its business, products and services. Examples of commonly used customer collaboration methods include social media, network-based recordings and analytics, video feedback and web-based collaborations through customer relationship management. On the

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other hand, competitor collaboration is a set of one or more agreements between competitors to connect as economic activity. Competitor collaborations usually involved one or more business activities, such as research and development, production, marketing, distribution, sales or purchasing. Information sharing, and different exchange activities might also take place through competitor collaborations [7]. New manufacturing with low economies tend to compete on costs, while established players want to move up the manufacturing value chain to compete on innovation and developing [8]. This study demonstrates that EB can provide more customer value by using internet technology in much organization. Firm performance measurement is a great way for measuring the effectiveness and efficiency of the manufacturing sectors and providing them a high quality with a lower cost supporting that by collaborating with customers to use the customer feedback to benefit it business, product and services, additionally through collaborating with competitors to connect with competitors from one or more business activities such as research and development, distribution and production [8-10].

## Background

E-business created new alternative ways in finding customers using different internet technologies. Sheung concluded that e-business makes a lot of benefits to a company such as increasing demand and productivity [8]. Ramanathan et al. suggested that the performance of the entire supply chain could be improved through collaboration [9]. On the other hand, Cao and Zhang proposed that the collaboration help the firm boost the productivity and Competitive advantages to deliver a satisfying relationship [10]. Many studies demonstrated the impact of e-business on firm performance. For example, Cerdan and Acosta recommended that the influences on firm's performance were observed for two out of the three EB dimensions: e-communication, e-workflow, e-information [11]. While Bremser and Chung mentioned that the development of e-business results in higher firm performance as a result of lower search and straight on comparison cost, e-business prompts more intense competition, result in higher firm performance and productivity [12]. Rodriguez and Honeycutt mentioned that the Performance with customers is the degree to which the sales professional develops deeper customer relationships by understanding the client's unique needs and providing a solution that meet those needs [13]. While Loecker and Biesebroeck suggested that the potential impact of international competition on firm performance highlight two points. First, it is important to consider effects on productive efficiency and market power in an integrated framework [14,15]. Second, greater international competition enlarges the relevant market and can affect both the set and type of competitors a firm face, as well as the nature of competition. In addition, Devaraj et al. indicated that the effect of the E-business channel investment on firm performance can better be realized with the presence of strong off-line business infrastructure that permits the exploitation of E-business investments [14-17]. Wu and Liang indicated that the E-business must rely on elements of the customer website interaction, it might be hypothesized that the customers might reach some levels of satisfaction with the product or services, after doing that the customers could be obtained, hold or reach profitability [15]. In other words, the customer satisfaction is related to the involvement, responsiveness, and disclosing behaviors of the interaction of the business's level. According to the previous relationships studies, the researcher found that the solutions of e-business technologies contribute significantly to increase the performance of the organizations. The researcher also found that e-business solutions lead to collaboration across the supply

chain, that motivate the researcher to build a general theoretical framework to examine all these relations in one conceptual model. This study is keen to answer the following questions namely, Does e-business solution impact firm performance, and does Supply Chain Collaboration, "Collaboration with Customers (CC) and Collaboration with Competitors (CCO)" mediate the impact of e-business on firm performance in manufacturing Sector in Jordan?. In the light of the previous discussion and the increased impact of e-business on firm performance in Jordan, especially in manufacturing sector, there is a need to investigate these relations. To achieve this, a conceptual framework to examine this impact was developed. Additionally, a measurement scale to explore the factors that underlying the study variable, then estimate the total impact (direct and indirect) relations between the study variable and, finally, fitting the model and validation of the study model were assured.

## Conceptual Development and Hypothesis

According to Igitakis, e-business can be viewed as online business management, including global media (web or other electronic systems). It also reflects the transformation of major business processes using Web technologies, in relation to the application of ICTs to assist and support all business activities. Many argue that interests in e-business are a competitive need and not a source of competitive advantage. Although large amounts of investments have been made in e-business technologies, there is evidence that many have not valued their business [17]. According to Kahkonen, e-business brings many benefits to business such as increased product demand and productivity that automatically increase their business profitability, e-business development that leads the company to success (by working globally) [18]. The company finds more customers that increase sales and thus increase profitability and productivity. Similarly, e-business increases revenue from e-commerce but its main contribution comes from its ability to reduce costs, including fixed and variable costs. Troshani and Rao suggested that the use of e-business and related innovations continue to have a significant impact on the way organizations operate [16]. Petrtyl stated that the implementation of e-business can make organizations more effective [18]. The researcher presented a general framework for e-business and the challenges associated with using it in the European countries and how to make full use of it. Completed through a number of e-business applications, study illustrated the current possibilities of using ICTs to become more competitive. The study focused on drawing future scenarios for the use of e-business in order to achieve higher levels of performance. Azeem et al. stated that e-banking is one of the most important transformations in the banking sector in Pakistan [19]. They measured the impact of e-commerce (business to business, business to customers, customers to customers) on enterprise performance (business processes, performance, and customer satisfaction). The results indicate a positive relationship between e-commerce and e-commerce performance; companies enhance their performance in terms of business processes, performance and customer satisfaction. Based on the above discussion the researcher proposed the direct impact hypothesis of e-business on firm performance as:

$H_{01}$ : There is a direct positive impact of e-business on firm performance.

Chae mentioned that information technology (IT) is a key driver for improved collaboration between SC partners, they also indicated that e-business is one of the forms of using information technology; this study shows that the impact of information technology is not

predetermined by its technological capabilities. Instead, its impact on inter-organizational collaboration which can be seen through the characteristics of the development of the exchange between information technology and existing relationships among partners [20]. This study focused on four dimensions of the relationship between SC partners to investigate the impact of routing relationships based on the effectiveness of information technology. They suggest that collaborative contexts among partners should precede efforts to link IT-based organizations. Troshani and Rao suggested that under the current favorable conditions for collaborative behavior, organizations are discovering that it is difficult to gradually create a competitive advantage by implementing distributed EB solutions [16]. The results show that EB applications can be seen as an enabling tool that promotes organizational competencies, thereby enabling organizations to transfer traditional and new services more effectively and efficiently. The way EB systems are used is also a source of advantage. It has also been discovered that in an industry that requires extensive interaction among organizations within the supply chain, consolidation of EB systems and collaboration with partners and competitors is a source of advantage. Sanders suggested that the use of innovative solutions provided by the EB-SC was objective in modern literature [21]. Organizational collaboration and the establishment of SC management have been enabled through the progress and utilization of EB innovations. This study focused on proposing and testing a model for the relationship between organizational use of EB innovations, organizational collaboration, and performance. Yan indicated that with the rapid progress in e-commerce and the adoption of dual channels, manufacturers and retailers are gradually implementing cross-supply collaboration through profit-sharing techniques to improve channel coordination and standards performance [22]. Chang and Graham explore the integration of electronic SC through the e-commerce application. In addition, they explored the critical success factors of an e-business strategy in affecting SCC [23]. Iyer stated that the use of advanced information technology in inter-firm collaboration has been studied in many current literatures. Although conventional wisdom is aware that IT frameworks encourage SCC. We propose the Hypotheses of direct impacts of e-business on SCC as:

H<sub>02</sub>: There is a direct positive impact of e-business on collaboration with customers.

H<sub>03</sub>: There is a direct positive impact of e-business on collaboration with competitors.

According to Cao and Zhang, collaboration relationships help companies share risks to achieve common goals, access to resources, reduce costs, increase productivity, and profit performance, competitive advantages over time to provide satisfactory relationship. Majava et al. indicated that customer collaboration refers to the way organizations within the supply chain use customer feedback to take advantage of their business, products, and services [6]. There are many examples of commonly used customer collaboration methods, including social media, web-based recordings, analytics, video notes, and web collaboration through CRM. Collaboration between competitors means connect as an economic activity and the resulting economic activity. Competing collaboration usually involves one or more business activities, such as research, development, production, marketing, distribution, sales or purchase. Information exchange and exchange activities can also be carried out through collaboration with competitors. The Kristensen and Kijl study reported that collaboration was considered as the main driver of overall business performance, progress and efficiency [24]. Saban and Mawhinney stated that performance in the supply chain is frequently compared

to the constant introduction of innovations in processes [25]. Their study suggests that the current studies in the field of collaboration within the supply chain view the performance of organizations also requires human collaboration in order to change patterns of thinking. Cao and Zhang revealing the nature of collaboration in the supply chain, verifying its impact on the performance of organizations and the advantage of collaboration in the supply chain. They also concluded that collaboration in the supply chain leads to enhanced utilization of the collaborative advantage and has already a linear impact on the performance of organizations. Vieira indicates that collaboration contributes to enhancing logistics performance related to deliveries and urgent deliveries that occur when demand increases [26]. Shams and Moussawi measured the impact of collaboration with customers in the process of innovation based on knowledge management practices with customers and marketing results in business and business activities [27]. Customer collaboration in the innovation process has been directly positive to customer knowledge management and collaboration with customers in the innovation process and has had a direct positive impact on performance. Based on the above discussion, the researchers propose the hypotheses of direct impacts of SCC on firm performance as follow:

H<sub>04</sub>: There is a direct positive impact of collaboration with customers on firm performance.

H<sub>05</sub>: There is a direct positive impact of collaboration with competitors on firm performance.

Troshani and Rao suggest that integrating e-business and collaboration with partners and competitors is a source of advantage. Sanders argue that the use of innovative solutions provided by the EB-SC may impact performance. Therefore, organizational collaboration and information exchange is used to enhance the organizational performance and overall performance of the supply chain. They found that the use of EB innovations affects performance directly and indirectly by pushing two measures of collaboration. It was also found that inter-firm collaboration has a direct impact on the organizational performance and overall performance of the supply chain. The impact of collaboration between organizations on performance has been found to be indirect only through the impact of collaboration within the organization. These findings reveal the complexity of organizational collaboration, emphasize the importance of organizations to enhance internal collaboration, and invest in information technologies that facilitate collaboration across the supply chain. Kim and Lee envisions frameworks for collaboration in the supply chain and strategic collaboration as key types of inter-firm collaboration [28-30]. They studied multiple roles of collaboration simultaneously as well as frameworks and strategic collaboration, and how they directly and indirectly affect the company's response and market performance. The results suggest that the interrelationships between IT efficiency, inter-firm collaboration, and the response of the SC have important impact on market performance. Iyer shows that the use of advanced information technology in inter-firm collaboration has been studied in many current literatures. They confirm that the positive collaboration between organizations, e-commerce and the analytical capacity of information technology leads to increased performance. The researchers propose the hypotheses of mediation impact of SCC as follow:

H<sub>06</sub>: Collaboration with Customers mediates positively the impact of E-business on Firm Performance.

H<sub>07</sub>: Collaboration with Competitors mediates positively the impact of E-business on Firm Performance.

## Method

### Scale development

The scale development followed two steps. In the first step, exploratory factor analysis was deployed to develop initial measurement scale. Next step, Confirmatory Factor Analysis was carried out to confirm the results. Cronbach alpha coefficient, composite reliability, and Average Variance Extracted (AVE) were calculated to measure reliability for each construct in the modified measurement scale. Validity tests were conducted to meet certain empirical properties and standardizing the measurement scale.

### Exploratory factor analyses (EFA)

A total of 40 items were generated from literature. The initial paragraph of e-business was based on Sanders Bakotic, Ramanathan. The studies of Cao and Zhang, Vachon and Klassen, Ryzhkova and Pesamaa, Chen were adopted for developing the item for collaboration with customers and competitors [10,31-41]. Finally, the researcher adapted the studies of Devaraj, Troshani and Rao for developing the items to measure firm performance [14,16]. During the initial development of the measurement scale, exploratory factor analyses of all items included in the study are used, with a principal-components analysis method to evaluate the latent dimensionality and to discover the structural factors of the scale. A sample of (66) respondents were considered for pilot testing and EFA. Factor loading for each item which exceed 0.4 with an Eigenvalue of 1.00 or more were retained. Hair demonstrated that the acknowledged factor loading for the sample of 100 respondents is 0.75 [30]. The researcher decided to retain all items that loaded more than 0.40, because the researcher trying to incorporate more items due to exploratory nature of the investigation. Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett's Test of Sphericity used

to assess adequacy of data. When the value of KMO is larger than 0.5 and the KMO is significant, it considered appropriate according to Kim et al. [31]. The first step in conducting EFA was assumption of factorability. Hair indicated that when significant correlation between items are more than 30% of the correlation matrix its mean that the researcher is able to proceed to EFA. Correlation matrix shown that 105 of 234 correlations (44%) are significant at level (0.01). Maximum likelihood ML extraction technique with Varimax rotation was utilized to extract the factors, the estimation of eigenvalues was conducted, and the factors that exist in data can be acquired. Estimation of eigenvalues must surpass '1' to consider it as one factor.

The researcher performed EFA numerous time to investigate which variables (Items) are attributable to each factor. Variables that loaded less than 0.40 were eliminated; items which loaded on two factors or more, and items that have cross-loading were also removed. Numerous amendments had been performed and moved the items to their appropriate factors. Examining the rotated pattern matrix of factor, the non- significant loading, cross loading items were removed and the structure of variables were devoted to re-specification. The analysis revealed that there were items loaded on two or more factors, for example (CC4) loaded in factor 1 (collaborative with competitors). 21 items were deleted due to cross loading. After the elimination of non- significant loading, low item loading and the cross loading, EFA was conducted for the final structure and indicated that 19 items were retained as they loaded significantly on their factors. VARIMAX-rotated analysis was applied to obtain a clean set of factors loading and avoiding non-cross loading of items to other factors and to maximize the loading of each item on one factor. According Hair, factor loading indicate the degree of association of each item with each factor. Table 1 shows the rotated factor matrix after deletion of items that loaded in many factors. Eigenvalues, total variances explained for modified scale is presented in Table 2, the total of four eigenvalues is (14.499)

	Item	Factor 1	Factor 2	Factor 3	Factor 4
<b>Collaboration with Competitors</b>					
1	The company has knowledge exchange with its competitors	0.9			
2	The company cooperates with competitors in the technology field	0.89			
3	The company has face to face communication with its competitors	0.871			
4	The company exchanges information continuously and accurately with its competitors	0.862			
5	The company joins forces with other specific competitors to develop new products or new technologies	0.845			
6	We conduct research and development with competitors for beneficial cooperation as long as there are no professional secrets	0.832			
7	We exchange information with competitors to achieve common standards, to be informed about whatever is new in the market and technology tendencies	0.818			
8	The company cooperates with competitors in the development processes of the new product	0.75			
9	The Company receives information about the competitor's abilities within the SC	0.474			
<b>Firm Performance</b>					
10	The performance of the company in the total product cost		0.876		
11	The company's performance in the speed of entering new products to the market		0.745		
12	The company's performance in sales growth		0.644		
13	The company's performance in improving quick delivery		0.615		
<b>E-Business</b>					
14	The company uses EB technology according to the field that the company works with			0.872	
15	The company uses EB proportionally with the competition requirements			0.822	
16	The company uses EB technology according to the needs of its key customers			0.685	
<b>Collaboration with Customer</b>					
17	We consider the customers of the company as an extension to it				0.63
18	We consider the relationship with our customers as a long-term alliance				0.613
19	We respond quickly to our customer's need				0.466
All developed items using five-point Likert scale (1: Strongly disagree and 5: Strongly agree)					

Table 1: Varimax- Rotated matrix.

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	7.883	41.491	41.491	7.582	39.903	39.903	6.25	32.893	32.893
2	4.248	22.357	63.848	3.822	20.116	60.019	2.751	14.479	47.372
3	1.219	6.414	70.261	1.004	5.286	65.305	2.496	13.136	60.508
4	1.149	6.046	76.307	0.815	4.291	69.596	1.727	9.088	69.596

Table 2: Total variance explained.

which explain the total amount of variance extracted by factors which has reached to (69.596). The measurement scale of 40 items was reduced to 19 items loaded on 4 factors and 21 items were removed. KMO measure of sample adequacy and Bartlett’s test of sphericity were assessed. The results indicated that KMO were (0.846) and is above the acceptable limit 0.5. Significant chi square indicated that correlations among items were sufficiently high for EFA. Chi-square ( $\chi^2$ )=147.458,  $p < 0.000$  indicated that the correlations among items were adequately sufficient for conducting EFA. The goodness of fit test for overall EFA model revealed that chi-square=147.458, and  $df=101$ , chi-square/ $df=1.46$  which indicated a good model fit for sample data.

### Confirmatory Factor Analyses (EFA)

The resulted measurement scale in Table 1 was used for surveying the selected sample from manufacturing sector from diver’s geographic locations in Jordan. Data were used to validate the measurement model according to sample that has relevant experience in the field of EB and collaboration. Participants in the survey should meet several criteria. For example, they must be incorporated in EB practices and engaged for several years. They have access to use different resources of online processes and able to utilize distinctive online procedures. Secondly, the distribution of manufacturing sectors in Jordan was considered, multiple and diverse respondents can be obtained from the same manufacturing company. According to Hair, a sample size of 150 or more is typically necessary to achieve meaningful parameter estimates. Number of latent constructs and items is also considered when the model has five or less latent constructs and each latent construct has more than three items, 100 samples would be enough as recommended by Hair. Total number of (350) questionnaires were sent to selected sample. The initial response rate was 54% (189) respondents indicating low response rate. The reason behind the low response rate since this study focused on a small group of employees of managers and owners of manufacturing sectors. Byrd and Turner indicated that despite the low response rate, the responses from the managers and owners can provide insight. The number of questionnaires were not fully answered (more than 11% of items have blank responses) are 9. Those were considered of low interest and have been eliminated. Other procedures were followed to treat the other missing data less than 20% in each item such as average imputation of value of responses from the other participant [32]. To enhance normality of data, the assessment of the Mahalanobis distance for identifying the potential outliers in data sample was carried out. AMOS version 20 was employed to compute the distance for observations in dataset from the center of all data distribution. The data set of 180 were checked and screened for outliers, 2 observations are deleted from data set due to Mahalanobis distance values more than the  $\chi^2$  value ( $\chi^2=102.44$ ;  $n=38$ ,  $p < 0.001$ ), the final data set remain to be analyzed is (178). The distribution of managers and owners in each manufacturing sector is presented in Table 3.

In developing the overall measurement scale, the researcher considered how all individual constructs converged together. To affirm that, Unidimensional measures according to Hair were considered in

Industry	n	%
Miscellaneous manufacturing equipment	4	2.2
Electrical\Electronic	7	3.9
Chemical	9	5.1
Fabricated metal	10	5.6
Rubber and plastic equipment manufacturing	13	7.3
Computer\electronic	10	5.6
Machinery manufacturing	17	9.6
Transport equipment manufacturing	17	9.6
Apparel manufacturing	20	11.2
Food manufacturing	18	10.1
Furniture and related product manufacturing	14	7.9
Beverage manufacturing	14	7.9
Wood product manufacturing	13	7.3
Paper manufacturing	6	3.4
Others	6	3.4

Table 3: Distribution of managers and owners in selected industry.

which variables can be explained by only one construct. Contrary from EFA, individual variable is hypothesized to relate to only one construct, and this imply that there aren’t any cross- loading (all cross-loading are assumed to be zero). The CFA model for EB, CC, CCO and FP hypothesizes that the responses to the items in the questionnaire can be explained by 4 factors as mentioned above. Each item has non-zero loading on its factor and zero loading on other factor. All four factors are correlated, and error terms associated with item measurements are uncorrelated. CFA was selected for assessing convergent and discriminate validity of the instrument. To purify the measurement model, two step approaches 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 [33]. In specifying the constructs, the researcher set a scale for latent construct because it’s not observed and has no metric scale (no range of values), therefore, the researcher fix one of the factor loading on each construct to specific value (the researcher used 1.00). Figure 1 shows the specified measurement model.

The researcher performed CFA for all four latent constructs and ensured Unidimensionality before assessing validity and reliability. Items with low factor loading don’t fit the measurement model and should be removed from the model. According to Hair factor loading for each item should exceed 0.6. The deletion process has started with regarding to lowest factor loading. After the deletion, the researcher run the new measurement model repeatedly until achieving unidimensionality, noting that it require also positive factor loading. Evaluating the fitness of the model was conducted after each run of CFA model to reflect how the model fits the data. Several fitness indices used, there are a lot of argument about which fitness indices to use, according to Hair and Holmes-Smith, the researcher should at least consider one fitness indices from each category of model fit (Absolute fit, Incremental fit, and Parsimonious fit). Most of literatures are

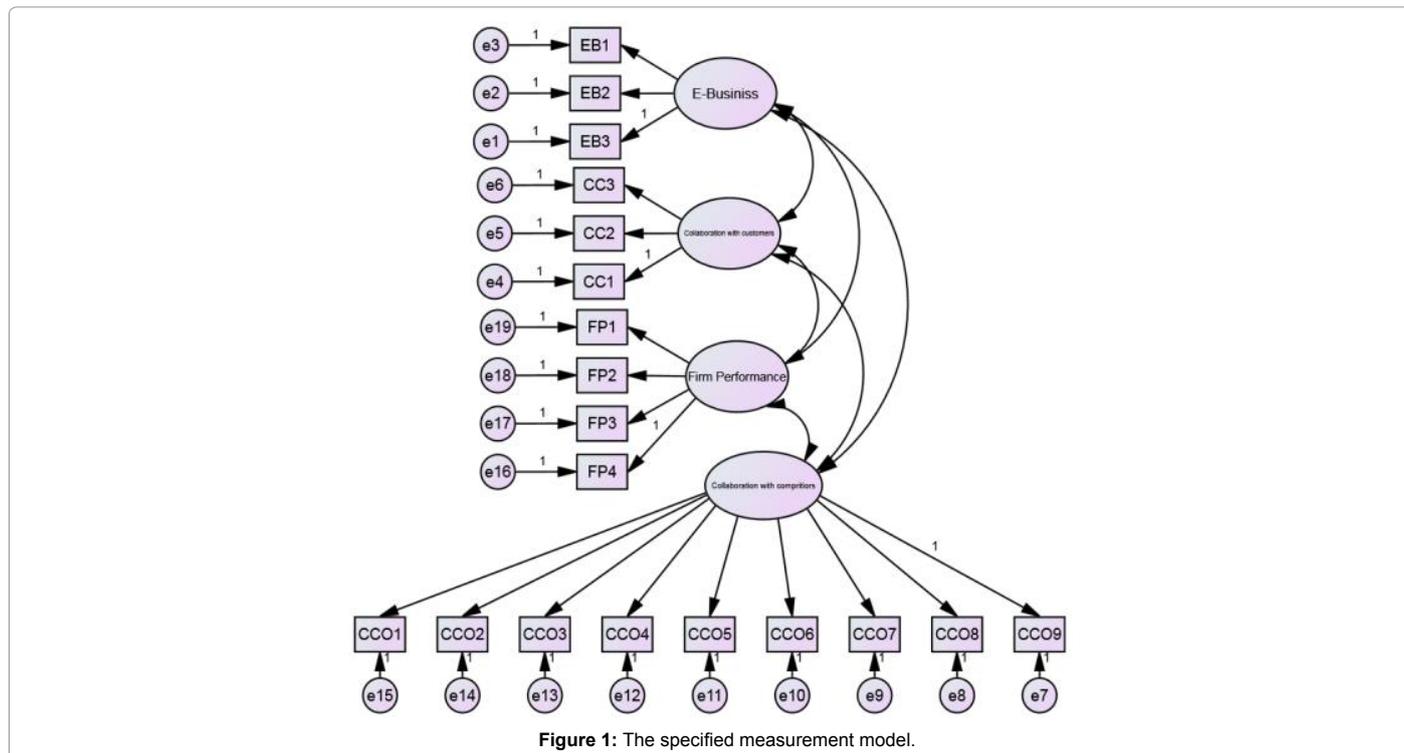


Figure 1: The specified measurement model.

frequently reported indexes (RMSEA<0.08, GFI>0.90, CFI>0.90 and, Chisq/df>3.0) to be used, their level of acceptance are also varied.

The output of CFA in Figure 2 shows factor loading for each item, the correlation between the constructs. The results indicated that fitness indices (RMSEA=0.069, GFI=0.864, CFI=0.956, and Chisq/df=1.855) did achieve the required accepted level. But there are some items have low factor loading less than 0.6) such as (CC3, FP4 and CCO1), deletion of them would improve the fitness of model.

Each item that have a factor loading lower than 0.6 and an R2 (R-Squared for the item) less than 0.4 were deleted. Low factor loading means that item is considered useless to measure that construct. There are many reasons for obtaining low factor loading, these reasons may include biased, double meaning, ambiguous and, sensitive statement etc. CC3 was not deleted because the construct CC have only three items, the deletion of this item made CC include 2 items, so the factor was under-identified. The researcher ran the new measurement model to improve model fit and examined the model fitness, fitness indices were achieved after low factor loading deletion and based on criteria mentioned (RMSEA=0.049, GFI=0.907, CFI=0.982, and Chisq/df=1.429). Figure 3 shows the items loading for the modified model.

Results indicated good fit as fitness indices have improved after deletion of items with low factor loading. Seventeen Items were resulted from the second measurement model estimation. Those items were confirmed and the requirement for unidimensional was achieved through the item deletion process for low factor loading items. Results also indicated that the modified measurement scale for the sample selected from manufacturing sectors in Jordan have four constructs as Standardized path coefficient for the four constructs are greater than 0.60 and the significances level are (P ≤ 0.05). After completion of CFA measurement model, the researcher must ensure that the model indicates validity and reliability of the construct. Assessment

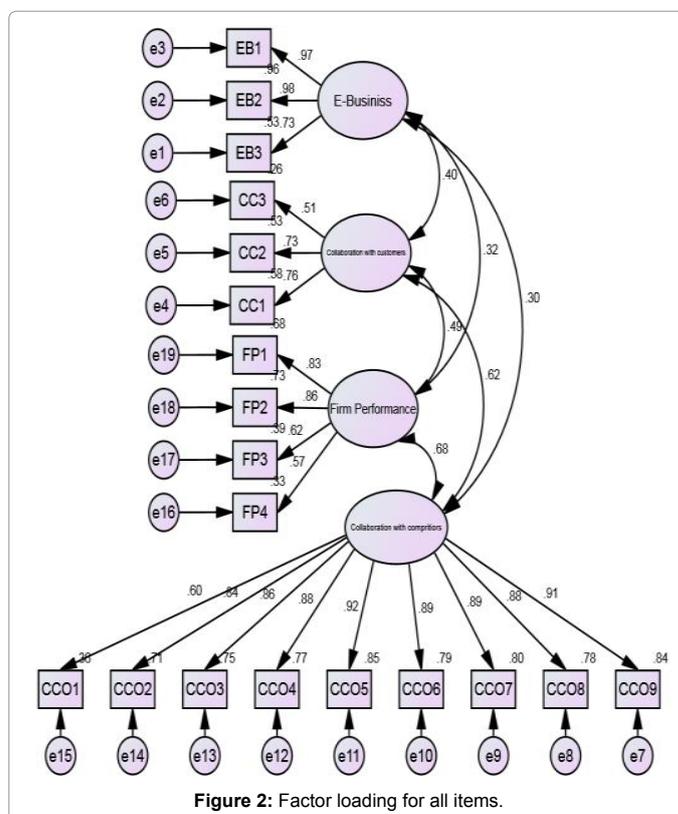


Figure 2: Factor loading for all items.

of model unidimensional, validity, and reliability is required before proceeding to modeling the structural model. Also examining the normality of the data to assess the distribution for each variable (items resulted in 2<sup>nd</sup> CFA Model) in a dataset after fitting the measurement

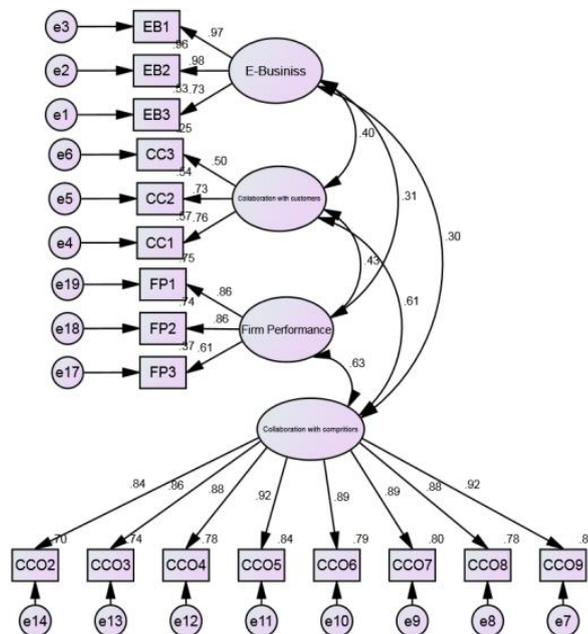


Figure 3: Factor loading for the modified measurement model.

model. Cronbach’s alpha was also calculated to ensure the internal consistency between variables. Hair indicated that validity is the ability of instrument to measure what it supposed to measure for a latent construct. They categorized three types of validity, convergent validity which is achieved when all items in a measurement model are statistically significant. AVE is calculated for each construct. Value of AVE should be greater than 0.5 to achieve convergent validity. This means that keeping the low factor loading in the measurement model not enhanced convergent validity. Construct validity on the other hand, can be achieved when fitness indices for construct be acceptable. Results indicated good model fit for the items in measuring their respective latent constructs. Finally, discriminant validity which indicates the extent to which the latent variables are different. Each item measures one latent construct and not measure deferent latent construct at the same time. It indicates that the measurement model of a construct is free from redundant items. Correlation between constructs should not exceed 0.85 to ensure discriminant validity. Correlation value exceeding 0.85 indicates the two constructs are redundant or having serious multicollinearity problem. Discriminant validity for all constructs is achieved when the square root of AVE values is higher than the values in its row and column. Thus, the researcher concludes that discriminant validity for all seventeen constructs is achieved (Table 4).

To assess reliability, cronbach alpha coefficient, composite reliability, and AVE had been calculated. Internal reliability which indicates how strong the measuring items are holding together in measuring the respective construct. Measurement reliability is achieved when the value of cronbach’s alpha exceeds 0.7. On the other hand, composite reliability indicates the reliability and internal consistency of a latent construct. AVE indicates the average percentage of variation explained by the measuring items for a latent construct. According to Hair, Holmes-Smith and Zikmund composite reliability should be greater than 0.7 and AVE is greater than 0.5 [33]. As can be shown in Table 5, the composite reliability and AVE values exceeded the minimum acceptable values, indicating that measures were reliable

Construct	EB	CC	CCO	FP	AVE
EB	0.9				0.811
CC	0.44	0.678			0.46
CCO	0.56	0.45	0.885		0.784
FP	0.66	0.38	0.28	0.789	0.618

Table 4: Discriminant validity index.

and no errors and introducing consistent results. The AVE for CC was found to be less than accepted AVE value (0.46), this was happened because the item CC3 (item loading was 0.504 less than 0.60) was retained and it has impacted the value of AVE. Results of cronbach’s alpha, composite reliability, and AVE for each construct in the model are presented in Table 5.

The researcher examined the normality of the data to assess the distribution of each variable in a dataset after fitting the measurement model. Measuring of skewness for each item was conducted to assess normality, the absolute value of skewness 1.0 or lower reveals that the data is normally distributed. Most of resulted skewness is lower than 1.0. Also, by looking to multivariate kurtosis, the researcher found the critical ratio of (CR) for the kurtosis does not exceed 3.0 [34]. According to Hair, SEM using the Maximum Likelihood Estimation (MLE) is robust to skewness greater than 1.0 and robust to kurtosis violations of multivariate normality as long the sample size is large and the Critical ratio (C.R) for the kurtosis does not exceed 3.0. Along with enough large sample and the values of skewness and kurtosis not exceeded 1.0 and 3.0 respectively, the researcher is able to proceed to further analysis to Structure Equation Analysis since the estimator used is MLE. Table 5 also shows the output resulted for the normality assessment for each item included in measurement model.

### Testing the structural model

The researcher hypothesized that there are structural effects in which CC, CCO are modeled as the mediator between the EB variable and the ultimate dependent variable FP. This mediation was proposed based on literature. According to Baron and Kenny, three conditions

Item	Cronbach alpha	Mean	SD	Skewness	Kurtosis	Standardized path coefficient	SE	C.R	P	SMC	Composite Reliability	Average Variance Extracted (AVE)
E-Business	0.814										0.927	0.811
EB1		4.61	0.52	-0.824	-0.562	0.966	0.102	13.46	0	0.933		
EB2		4.62	0.52	-0.851	-0.51	0.982	0.103	13.52	0	0.964		
EB3		4.68	0.5	-1.176	0.248	0.731				0.534		
Collaboration with Customer	0.966										0.709	0.46
CC1		4.55	0.55	-0.71	-0.573	0.757						
CC2		4.58	0.52	-0.568	-1.121	0.734	0.12	7.555	0	0.573		
CC3		4.74	0.455	-1.261	0.084	0.504	0.095	5.74	0	0.539		
										0.254		
Firm Performance	0.7											
CA1		4.37	0.64	-0.531	-0.652	0.864	0.162	8.283	0	0.746		
CA2		4.38	0.68	-0.759	-0.1	0.86	0.171	8.283	0	0.74		
CA3		4.48	0.68	-1.071	0.341	0.606			0	0.367		
Collaboration with Competitors	0.92										0.967	0.784
CCO2		3.74	0.95	0.274	-1.399	0.84	0.055	16.7	0	0.706		
CCO3		3.63	0.983	0.248	-1.209	0.862	0.054	17.78	0	0.743		
CCO4		3.37	1.143	0.302	-1.328	0.882	0.061	18.86	0	0.778		
CCO5		3.52	1.009	0.438	-1.119	0.919	0.05	21.21	0	0.845		
CCO6		3.54	1.014	0.32	-1.156	0.888	0.054	19.18	0	0.789		
CCO7		3.53	1.015	0.317	-1.139	0.892	0.053	19.46	0	0.796		
CCO8		3.46	1.069	0.301	-1.191	0.882	0.057	18.87	0	0.778		
CCO9		3.56	0.956	0.469	-1.061	0.916				0.839		

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.

This equation was used to calculate AVE and composite reliability [30].

$$AVE = \sum \lambda^2 / n$$

$$CR = (\sum \lambda)^2 / [(\sum \lambda)^2 + (\sum 1 - \lambda^2)]$$

Table 5: Results of multivariate normality and CFA model.

are required for mediation effects. Firstly, that the independent variable must affect the dependent variable [35-38]. In this model, EB must have effect on FP then the mediator must have effect on the dependent variable. In this model CC, CCO must effect on FP. These conditions were examined; it appeared that the three conditions were not met. Hair indicated that testing mediation effect using SEM requires significant correlations between independent variable, mediating variable, and the dependent variable. The researcher estimated the path of each variable regarding the theoretical framework. In this case, four variables are performed including two mediator's variables. ML estimation has been recognizes as a best formal estimator as stated by Hair. As results, standardized regression weight and the probability values which indicate the significant path have been achieved. Figure 4 represents the results for standardized regression weights and factor loading for each construct.

The path coefficient of standardized regression weight for causal effect of exogenous variables on endogenous variables are represented in Figure 4. To improve fitness required in structural model, researcher has proposed a new relationship between CCO and CC, testing the modified model revealed that CCO has significant impact on CC (estimation 0.543 P<0.000), this relationship has increased the power of mediators to explain the changes in FP. Many researchers supported this relationship who pointed to the impact of CCO on CC. The researcher is seeking to certify whether the mediator variables are to be interested to apply for the subsequent analysis. CC, CCO were selected for testing the statistical power analysis using Sobel test technique. The results of standardized regression weight and probability values (P-value) were implemented. Baron, Kenny indicated that Independent variable →

Mediator variable → Dependent variable of which value of standardized regression weight for both path should be multiplied (e.g.: value of Independent and Mediator \* value of Mediator and Dependent). They also indicated that indirect effect should be higher than direct effect to indicate that mediation effect is occurs in a structural model. Means that, value related to mediator should be higher than causal effect. Logically, the mediation variable is deemed has an influenced to increase or decrease the causal effect of independent on dependent variable. However, if some of the sort cases judges the presence of mediator variable (P-value>0.05) does not give any shift to effect on the main factor can be defined as non-mediation occurs [39-41]. Table 4 shows the Standardized Regression Weights, Critical Ratio, Probability Value and, results of testing hypothesis of the direct impact.

To assess the mediation in the structural model, calculation bellow explains deeper understanding about the mediation affect:

$$\text{The indirect effect EB} \rightarrow \text{CC} \rightarrow \text{FP} = 0.238 * 0.029 = 0.0069.$$

0.0069 is lower than 0.133, No mediation Accrue

$$\text{The indirect effect EB} \rightarrow \text{CCO} \rightarrow \text{FP} = 0.297 * 0.568 = 0.169$$

0.169 is greater than 0.133, Mediation Accrued

$$\text{The indirect effect EB} \rightarrow \text{CCO} \rightarrow \text{CC} = 0.297 * 0.543 = 0.161$$

0.161 is lower than 0.238, CCO does not mediate EB-CC

$$\text{The indirect effect EB} \rightarrow \text{CCO} \rightarrow \text{CC} \rightarrow \text{FP} = 0.297 * 0.543 * 0.029 = 0.005$$

0.005 is lower than 0.133, No mediation accrues

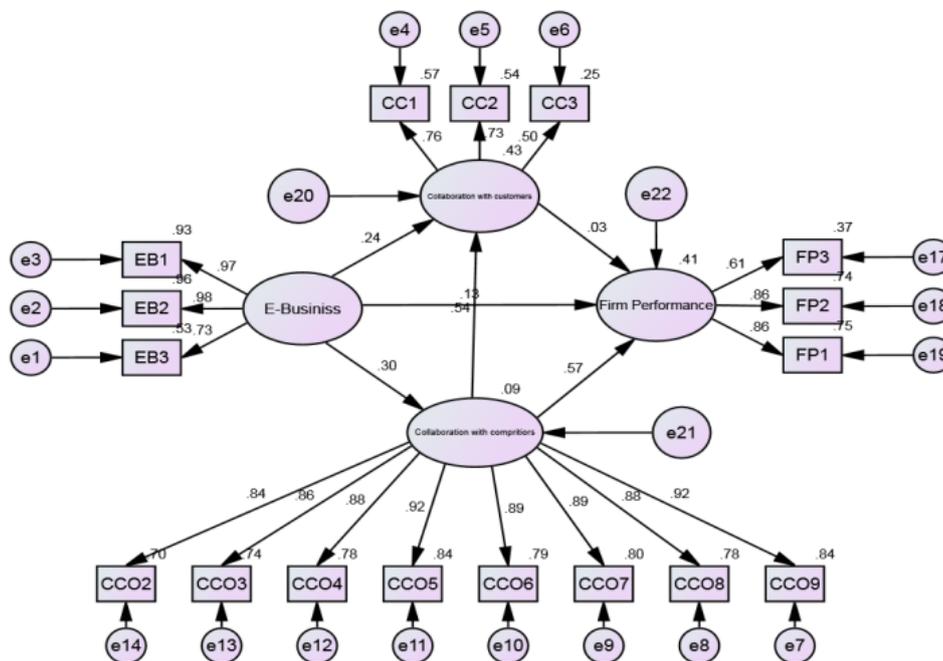


Figure 4: Standardized regression weights for structural model.

Hypothesis	Estimate	Critical ratio	p-value	Result
H <sub>1</sub> : There is a positive impact of EB on FP	0.133	1.738	0.082	Not Supported
H <sub>2</sub> : There is a positive impact of EB on CC	0.238	2.96	0.003	Supported
H <sub>3</sub> : There is a positive impact of EB on CCO	0.297	3.84	0	Supported
H <sub>4</sub> : There is a positive impact of CC on FP	0.029	0.263	0.793	Not Supported
H <sub>5</sub> : There is a positive impact of CCO on FP	0.568	5.108	0	Supported
H: There is a positive impact of CCO on CC	0.543	6.261	0	Supported

This hypothesis was added later based in the model modification

Table 6: Results of testing the direct hypothesis.

The indirect effect  $CCO \rightarrow CC \rightarrow FP = 0.543 * 0.029 = 0.015$

0.015 is lower than 0.568, CC does not mediate CCO-FP.

Testing the mediation effect using SEM indicated that CC does not meet the condition to be mediator variable, this leads us to reject hypothesis (H6). While CCO play as a significant variable to mediate the relationship between EB and FP (hypothesis H7). The variable CC is fail as a mediator and having insignificant path on endogenous construct. Since the result of direct effect is unchanged once include a mediator variable, thus, the mediation effect is not occurring. Results which revealed no mediation effect have accrued from CC cannot be presume as a fail findings or analysis but can be elaborate as no effect on endogenous construct. This might be happened due to less correlation with endogenous construct, or view of respondent at the targeted population that deem this factor is unnecessary to be addressed.

## Discussion and Implications

The main objective of this study is to investigate the role of EB in FP: impact of SCC in manufacturing sectors in Jordan as a mediator variable. To achieve objectives of this study, the study has developed a model to measure impact of EB on FP, impact of EB on CC and CCO and the impact of CC and competitors on FP. An extensive literature review has been conducted to build the study model and measurement scale. The results of EFA, have indicated

four factors (EB, CC, CCO and FP) explained 68.833 of the variance in the pattern of relationships among the items. All the four factors had high reliabilities (all Cronbach's  $\alpha > 0.70$ ), the first questioner was 40 items then the researcher performed EFA many time to investigate which variables (Items) are attributable to each factor. According to Hair it was confirmed that the data included in this study was appropriate to conduct a valid EFA based on the descriptive statistics analysis. Based on the results of the exploratory factor analysis, this study has successfully achieved the simple solution with four factors structure using CFA. Testing the structuring model indicated that the directs effects EB has no significant impact on FP (path coefficient = 0.133,  $P = 0.082$ ). On the other hand, EB has significant impact on CC (path coefficient = 0.238,  $P = 0.003$ ), this result was supported by many researchers like Shams, Moosavi, Azeem. Also, it was found that EB has a significant impact on CCO (path coefficient = 0.297,  $P = 0.00$ ), this result was supported by who indicated that e-business technologies can facilitate collaboration with external partners and competitors. Many researches have supported the result that CC has no significant impact on FP (path coefficient = 0.029,  $P = 0.793$ ). This is because many organizations, especially in the manufacturing sectors, do not see collaboration with customers as necessary except in limited areas. CCO has a significant impact on FP (path coefficient = 0.568,  $P = 0.00$ ), and CCO has a significant impact on CC (path coefficient = 0.543,  $P = 0.00$ ). On the contrary of collaboration with customers, collaboration with

competitors is necessary to achieve higher levels of performance. An important aspect of collaboration with competitors is collaboration in research and development. In addition, collaboration with competitors can include the development of new products, access to new technologies and exchange of information on new markets. Finally, cooperation with competitors may be necessary to identify customer needs. This explains the role of collaboration with competitors to have direct and significant impact on collaboration with customers. The results of the study revealed the important and influential role played by collaboration with competitors in increasing the impact of the using of e-business solutions in improving performance levels in manufacturing companies in Jordan. With the fast development of EB and the adoption of channels, manufacturers are executing benefits sharing procedures to improve channel of Collaboration and SC performance. SC Management includes Collaboration between Customers, Competitors, distributors and suppliers. Associations rely on SCC to develop the performance of SC. Additionally, Collaboration should enhance organizational performance by allowing SC members to define the significant objectives and share many techniques and information. Finally, Recommendations for Practice Based on the study results have been performed, some recommendations can be proposed by the study; Firstly, manufacturing sectors need to focus on Supply Chain Collaboration (Collaboration with Customers and Collaboration with Competitors) by utilizing E-business effectively to improve the quality of Firm Performance. Secondly, Supply Chain officers' need to contribute significantly to increase the quality of Firm Performance provided to different beneficiaries. Thirdly, Manufacturing sectors should focus on recruiting highly skilled and specialized personnel in the Supply Chain departments and subject them to intensive training courses in international quality standards; therefore, they can deal with Customers and Competitors in accordance with specific guidelines. Fourthly, there are growing needs to arrange training courses for staff members who work in Manufacturing sectors on the Supply Chain Collaboration and enhance the performance of manufacturing sector. Finally, Adopting manufacturing sectors for Supply Chain Management authorization a change in thinking ways as well as practices. It means that Supply Chain Management needs to define its role, tasks, and begin to employ value-added activities across the value chain aspects to improve quality of manufacturing sectors. Of the results achieved during the stages of development of the scale, the researcher recommends administrations in manufacturing sectors to focus on the dimensions contained in the scale (E-business, Collaboration with Customers, Collaboration with Competitors and Firm Performance). The fact that this measure has undergone tests of validity and reliability in its various stages, and because these dimensions have a high explanatory power.

### Recommendation for future research

This study was limited in manufacturing sectors in Jordan, and these results cannot be generalized. The researcher recommends that future research should include other sectors such as services, other industries, telecommunications, etc. The study was limited to managers, recommending the inclusion of all employees as they are the most targeted group in the collaboration process. Finally, the study determined the collaboration factors in two types (Customers and Competitors), the researcher recommends that the future researches should include other types of collaboration such as retailers, suppliers, wholesalers, distributors, academic institutions, etc.

### Conclusion

This study measures the impact of EB on FP in the manufacturing

sectors. The study assumes that CC and competitors mediate the relationship between EB and FP. In the end, the researcher developed a measurement scale to measure the dimensions of the study. For verifying the validity and reliability of the study scale, the researcher used the EFA, the CFA and verified that the scale is characterized by validity and reliability. The SEM method was used to examine the relationship between the dimensions of the study and to measure the impact of EB on FP and measure the mediating effect of CCO and CC. The study found that EB doesn't have a statistically significant impact on FP. The study followed the descriptive and analytical approach to achieve the results. The descriptive statistical methods were used to describe the dimensions of the study and its variables and to describe the sample of the study. The analytical method was used to test the relationships between the variables of the study. Finally, the study presented applications of the study model, recommendations from the study findings, and recommendations for future research.

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