

EC-B2B Systems Boosts the Enterprise Performance

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Abstract: The growth of EC-B2B System adoption and capability has become a requirement for effectively servicing the businesses of many large and Small-to-Medium Enterprises (SMEs) around the world. In this current research, perceptions of enterprise managers of four indicators: specifically productivity, profits, sales and costs are used to measure the performance before and after the adoption of EC-B2B Systems. The study explored the perceptions of SMEs' managers in Jordan regarding the adoption of EC-B2B Systems and its effects on enterprises' performance improvements. This aim achieved through: identifying the current state of adoption of EC-B2B Systems by selected enterprises in Jordan. Discussing and determining performance concepts and influential factors that relate to EC-B2B System adoption within enterprises (SMEs) in Jordan. It is important for managers to understand how EC-B2B System activities affect the performance of the enterprise. Qualitative and quantitative approaches were used to gain a better understanding of these issues. After screening the data, responses are analyzed using Confirmatory Factor Analysis (CFA) and Structural Equation Modeling (SEM). The main findings of the current study that the EC-B2B Systems have a strong positive correlation with SME's performance which suggests that the SMEs' performance improved as the extent of the EC-B2B System adoption increased. This research also concludes that SMEs performance improvements in costs variables are important since enterprises expect to receive technology benefits that exceed costs. In addition, the study concluded that the four performance factors: namely productivity, sales, profitability and costs were the most important contributors and measures of the SMEs' performance in Jordan.

Key words: Electronic commerce, enterprise performance, information technology, Business-2-Business, structured equation model, SMEs

INTRODUCTION

The growth of Electronic Commerce (EC) Business to Business (B2B) System adoption and capability has become a requirement for effectively servicing the business of many large, Small and Medium Enterprises (SMEs) around the world (Kartiwi and MacGregor, 2007). EC-B2B Systems can be defined from several perspectives (Turban *et al.*, 2004). First, from a communication perspective, EC-B2B Systems are the technology to enable the delivery of goods, services, information or payments via computer networks or by any other electronic means. Second, from enterprise's functions and activities perspective, EC-B2B Systems includes enterprise processes such as buying, selling, transferring or exchanging products, services and/or information electronically by completing functions, activities and procedures over electronic networks. Third, from a commercial perspective, EC-B2B Systems provide the capability of buying and selling products, services and information on the internet and via other online services. Lastly, from a service perspective, EC-B2B Systems are tools needed by governments, enterprises and TPs to cut

the cost of services while improving the quality of TPs' services (Turban *et al.*, 2004). EC-B2B Systems offer SMEs alternatives or non-traditional transactions and delivery methods through which enterprise's products and services can be delivered or received from both TPs and/or suppliers more conveniently and economically without diminishing the existing transactions and relations level. In recent years and according to the Jordanian government reports (2008-2013) almost one fifth of Jordanian enterprises have started Web based, EC and internet adoption to offer on line products and services to their local and global TPs, suppliers and customers. Definitions of performance have ranged from general to specific and from quantitative to qualitative. In this current study, perceptions of SME managers of four indicators: specifically productivity, profits, sales and costs are used to measure the performance before and after the adoption of EC-B2B Systems. This study is concerned with SMEs because the majority of enterprises in Jordan and especially within its capital, Amman are small. In Jordan, the Department of Statistics (DOS, 2012a, b) classifies an enterprise with less than five employees as a small enterprise while those with 5-19

employees are classified as medium enterprises (DOS, 2012a, b). The current study focuses on the industrial and services sectors because the majority of SMEs in Jordan and particularly in Amman is regarded as industrial or services enterprises (MIT, 2011, 2012). At the same time, the total number of medium enterprises in industrial and services sectors in Jordan is 6,780, comprising 2,550 service-based enterprises and 4,230 industrial enterprises (DOS, 2012a, b).

Objectives: The main goal of this study is to explore the perceptions of SME managers in Jordan regarding the adoption of EC-B2B Systems and its effects on SMEs' performance improvements. This aim will be achieved through:

- Identifying and describing the current state of use, adoption and implementation of EC-B2B Systems by selected SMEs in Jordan
- Discussing and determining performance concepts and influential factors that relate to EC-B2B System adoption within SMEs in Jordan

Research questions: The study questions are as follows:

- What are the perceptions and experience of SME managers in Jordan of Information and Communication Technology (ICT) and EC-B2B Systems?
- Do SME managers in Jordan perceive that performance has improved since adopting EC-B2B Systems?

Importance and contribution of this research: It is important for SME managers to understand how EC-B2B System activities affect the performance of the enterprise. Hence, this study will:

- Contribute to a better understanding of EC-B2B Systems between SMEs and their TPs in Jordan; this, in turn, lead to improvements of performance
- Explain how IT and IS applications such as EC-B2B Systems have allowed SMEs in Jordan to use and adopt this technology which in turn lead the enterprises to provide their TPs quality services and save time and money

Literature review: The growth of the EC Systems is revolutionising the way that large enterprises and SMEs interact with their TPs. Turban *et al.* (2004) and Titi (2005) mentioned that the term 'EC Systems' describes

the process of buying, selling, transferring or exchanging products, services and/or information via computer networks including the Internet. EC Systems have been used for B2B Systems communication for almost a quarter of a century. EC Systems describe technologies that provide enterprises with on time associations with their TPs and internal functional areas.

The importance of Electronic Commerce (EC) Systems in business:

The development of EC Systems is considered to be one of the major recent innovations in international trade. The reliance of businesses on EC Systems has intensified following increased availability of technology that enables e-Commerce at a reasonable cost per transaction. The markets of retailing, financial services, banks, marketing malls, publishing, communication, advertisements and travel have all been impacted by EC Systems. Turban *et al.* (2004) noted that the extent of impact was unlimited for some enterprises where the facilities used for the EC Systems are all available but it was restricted wherever the facilities were not in place or existed to more limited extent. The nature and structure of business enterprise has been changed as a result of the EC system adoption (Yap *et al.*, 1994). EC Systems have both negative and positive impacts on the enterprises. The potential effect of EC Systems has been dependent upon the availability of human resources capabilities in enterprises and the attitude of management to make a change. In addition, there are many barriers that face the deployments of EC Systems in different enterprises in different countries. These barriers vary from one country to another according to the level of technology distribution and the distribution of technology knowledge inside the country. Jordan, like many other developing countries, faces many barriers to deploy EC Systems in enterprises. One of the EC Systems models that will be studied in detail in this study is the EC-B2B System. This model of EC Systems is used widely in developed countries while it is still restricted in the developing countries such as Jordan due to many barriers including IT and human resources. One of the main advantages of EC System adoption by enterprises is the reduction of costs associated with using an internet standard rather than a traditional commercial transactions in relation to functions, activities and procedures with trading partners and suppliers (Kamel and Hussein, 2000). In EC Systems, the idea is to set up a relationship between two enterprises that will make some sort of complementary functions, activities and procedures (MOICT, 2012). This relationship involves the adoption of similar standards; extensive inter-enterprise communication and collaboration via compatible IT.

Theoretical framework: This study provides the theoretical framework of this research. The main theories which provide a foundation for this study are Diffusion of Innovation (DOI), Technology Acceptance Model (TAM) and Transaction Cost Theory (TCT). Cagno *et al.* (2004) and Bhatt and Stump (2001) conclude that B2B System adoption enables changes in business processes that improve productivity. This occurs through the automation of functions such as production planning, procurement business process order processing, inventory allocation and order fulfillment (Presutti, 2003; SSMR, 2002a, b). Prescott and Conger (1995) reviewed seventy IS-related studies and concluded that Rogers (2003, 1995)'s DOI theory appears to be most applicable to innovation with an intra-organisational locus of impact (Pavlou, 2001). Previous researchers have simplified TAM by removing the attitude construct found in TRA from the current specification (Venkatesh *et al.*, 2003). Figure 1 represents the TAM Model for IT and IS adoption in enterprise.

Davis (1989, 1986) found that TAM posits two most important variables: perceived usefulness and perceived ease of use which determine an individual's intention to use a system with intention to use serving as a mediator of actual system use. Straub *et al.* (2002) carried out a series of investigations in Arab countries using TAM and found it was applicable. Hence, this study depends on specific factors from TAM and DOI theories; perceived usefulness, perceived ease of use, technical compatibility, technical complexity and relative advantage to study the relation between the adoption of EC-B2B Systems in SMEs in Jordan and its influence on their performance. TCT is appropriate to use in this research which examines how EC-B2B Systems can reduce transaction costs associated with selling and purchasing activities (Kauffman and Mohtadi, 2004; Cagno *et al.*, 2004). The adoption and appropriate use of EC-B2B Systems can be expected to result in enhanced the enterprise's performance.

Measures of enterprise performance: Measurement of performance in all enterprises, no matter how structured and re-utilized they are depends on external judgments about what the important dimensions of the enterprise are and where the enterprise performance falls on each dimension. Many studies such as Tang *et al.* (2004) and Dewan and Kraemer (2000) show that IT applications such as EC-B2B Systems improve performance at a general level such as industry, supply chain level and economy level. However, Carr (2003) noted that few studies examine the effects of EC-B2B System adoption at the enterprise level. He added that these studies suggest that EC-B2B Systems affect specific indicators of performance such as

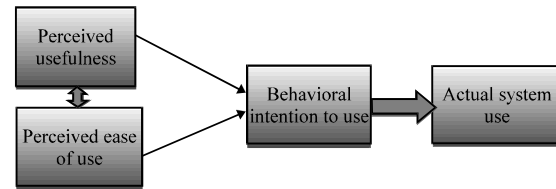


Fig. 1: Technology Acceptance Model (TAM) (Venkatesh *et al.*, 2003)

productivity and cost. The influence of EC-B2B System adoption may be moderated by the length of use because EC-B2B Systems may increase costs in the short term and reduce them in the long-term (Devaraj and Kohli, 2003). SSMR (2002a, b) suggests that production costs could be further reduced by improvements in productivity through adopting EC-B2B System of several processes such as production planning. The literature is mixed on how best to measure the effects of EC-B2B System adoption on enterprise performance. The major implication is that enterprise performance measures such as productivity, costs, sales and profitability have been used to evaluate performance more often than other metrics. The study presents several items which are used to measure the improvements in performance in enterprises.

Items of improvement in performance:

- Reduced enterprise direct labor cost, administration and production costs (costs)
- Improved enterprise on-time-delivery performance to your TPs and customers (sales)
- Reduced returns of products from TPs and customers due to quality issues (productivity and sales)
- Reduced the number of errors in transactions with TPs, suppliers and customers, due to products specifications, accounting, pricing and quantities (productivity, sales, profits and costs) (Iyer *et al.*, 2004; Kim *et al.*, 2006)

Effects of EC-B2B System adoption on performance in SMEs: EC-B2B Systems support the transactions between enterprises and TPs. They also contribute to new sources of revenue and opportunities for SMEs with carefully structured strategies (Al Bakri *et al.*, 2010). In addition, SMEs can adopt EC-B2B Systems and networks based as a business tool to provide and publish information about their products and services to targeted market and TPs and to offer technical support and to receive payments. EC-B2B Systems are expected to facilitate the interaction of the enterprise with TPs. In addition, EC-B2B Systems tools provide information directly about the suppliers of the enterprise and complete information about them

(Shaw and Subramaniam, 2002). In addition, performance will increase as the response of the executed tasks will be high using fast technological tools (Fang *et al.*, 2003). EC-B2B Systems are treated as one of the most important actions in the global economy during previous years and associated with the emergence of increase productivity and cost decrease. Kim *et al.* (2006) asserted that there were positive associations between multi activities on web based transactions and overall performance between enterprise and TPs and between the frequency of web and networks updates and overall performance. Adoption of EC-B2B Systems can improve the enterprise's overall performance level both within the enterprise itself and amongst its TPs (Auger and Gallagher, 1997). These improvements can be performed perfectly in large enterprises but in SMEs their use depends on the concepts applied for these categories (Bendoly and Schoenherr, 2005). Table 1 describes the drivers identified by Davies to adopt EC-B2B Systems in SMEs.

Proposed research model: Based on the literature this study develops a model and discusses the various factors that might have significant contributions to EC-B2B System adoption in SMEs in Jordan. The current study recognizes the importance of various factors to measure the extent of EC-B2B System adoption in SMEs in Jordan. It is measured in terms of two factors:

- Frequency of e-Transactions is defined from the range of communications between employees online to reporting and reviewing internal accounting online
- The extent of EC-B2B System adoption and practice by local and global TPs. The extent of EC-B2B System adoption by TPs is measures by how TPs communicate with SMEs

The main factor included in this model is covering the perceptions of SME managers in Jordan about the improvements in performance as a result of adoption of EC-B2B Systems. This research explores perceptions of SME managers about improvements in performance that is measured by four factors:

- Productivity
- Sales
- Profitability
- Costs

Table 2 shows the detailed of the factors descriptions are included in the research measurement model.

Table 1: Drivers to Adopt EC-B2B Systems in SMEs

Drivers to adopt EC-B2B	Percentage of respondent
Improve performance	28
Increase turnover	22
Stay ahead of competitors	21
Customers/Trading partners pressure	14
Develop new products or services	12
Enable collaboration	6
Follow the trend	5
Suppliers pressure	5

MacGregor (2004), MacGregor and Vrazalic (2005) and Davies (2003)

Table 2: Factors descriptions of proposed research model

Models	Factors
Extent of EC-B2B adoption	Frequency of e-Transactions Extent of practicing EC-B2B Systems with local and global TPs
Improvement in performance in SMEs	Productivity Sales Profitability Costs

Developed for this research

MATERIALS AND METHODS

Researcher adopts a positivist philosophy, reflected in the objectives of the current research attempting to measure social reality and subject it to address the research objectives and hypothesis testing. The current study mainly used both exploratory and explanatory techniques to explore the influence of the EC-B2B System adoption by SMEs in Jordan on their performance which the data collected through structured questionnaires and conducted interviews. For the purpose of clarity, the study structural and measurement model is shown in Fig. 2. The factors are described in Table 3.

Research hypotheses: The following hypotheses proposed a relationship between adoption of EC-B2B Systems in SMEs and the perceptions of SME managers of enterprise performance, measured in terms of productivity, sales, profitability and costs:

H1_o: There is no relationship between the adoption of EC-B2B Systems and the perceptions of SME managers of productivity.

H2_o: There is no relationship between the adoption of EC-B2B Systems and the perceptions of SME managers of sales.

H3_o: There is no relationship between the adoption of EC-B2B Systems and the perceptions of SME managers of profitability.

H4_o: There is no relationship between the adoption of EC-B2B Systems and the perceptions of SME managers of costs.

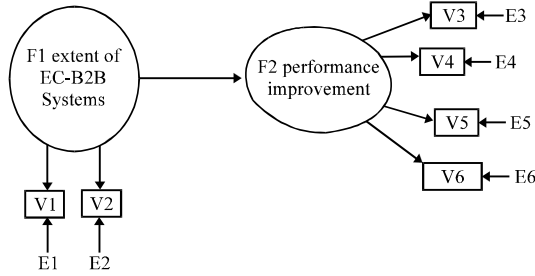


Fig. 2: Research measurement model

Table 3: Factors descriptions-first and second-order factors

First-order factors	Description	Second-order factors
Frequency of e-Transactions Practicing EC-B2B Systems with TPs Productivity	Extent of EC-B2B Systems	Extent of EC-B2B System adoption
Sales	Performance improvement	Not applicable
Profitability	-	Not applicable
Costs	-	Not applicable

Research approaches: The use of multiple methods or triangulation, reflects an attempt to secure an in-depth understanding of the phenomenon in question. Objective reality can never be captured. In this study, the following processes for multi-item measurement scales were followed and second step was supplemented with CFA:

- Defining theoretical constructs
- Generating a list of items and factors from literature and/or qualitative approach that relate to these constructs
- Purifying these measures using exploratory factor analysis

This procedure includes a survey of a sample of managers representing SMEs in Jordan. The questionnaire referenced in this study was used to explore the perceptions and the awareness of SME managers about the adoption of EC-B2B Systems in SMEs in Jordan and to examine its influence on their performance. Also, the purpose of the questionnaire is to produce quantitative descriptions of some aspects and issues of the study population. The questionnaire was developed based on the literature review and refined with results from the interviews and information collected from the previous procedures of the research. The questionnaire focuses on the relationship between the adoption of EC-B2B Systems in SMEs in both industrial and services sectors in Jordan and the perceptions of SME managers of performance. The last procedure is the data coding and

analysis. This procedure includes presentation, hypothesis testing and analysis of results (Al Bakri *et al.*, 2010). Various quantitative statistics of methods such as factor analysis t-test analysis of variance and correlation were employed on the interview and questionnaire data. SEM conducted to examine the hypothesised relationships between factors and lower and higher influence factors (Moore, 2004). 'SPSS v21' will be used to evaluate and perform all the analysis to test the hypotheses. The results in terms of rejecting or accepting the hypothesis, tests were conducted to compute the probability values (p). The p-values measure the extent to which the test statistics disagree with the null hypothesis. The definitions of 5 scales used to represent the percentage of the improvements in SME's performance since EC-B2B Systems have been adopted.

Definitions of the 5 scales used to represent the improvements in performance in SMEs:

- None = Did Not Change: means that EC-B2B System adoption did not change your enterprise performance
- <25% = Changed slightly: means that EC-B2B System adoption was used to make relatively minor changes in your enterprise performance
- 25-50% = Changed moderately: means that EC-B2B System adoption was used to make relatively important changes in your enterprise performance but most of existing process was left intact
- 51-70% = Changed significantly: means that EC-B2B System adoption was used to make relatively large changes in your enterprise performance changing most of the existing process
- >70% = Changed radically: means that EC-B2B System adoption was used to make completely changes and re-engineer existing in your enterprise performance (Dillman, 2000; Kline, 2005; Moore, 2004)

RESULTS AND DISCUSSION

Interviews results and descriptive analysis: All pre-tests are delivered in the same manner as the final instrument (questionnaire). After the pre-test the questionnaire through the group of interviewees, the questionnaire is updated and re-evaluated to ensure that it still meeting the research objectives. Using 22 questions in each interview with the ten of the SMEs interviewed in Jordan the following results are summarized and presented:

Regarding to the questions which explore the effect of EC-B2B System adoption on performance in SMEs in Jordan, the results are: based on the results from respondents that there is a positive direct effect of EC-B2B System adoption on SMEs performance through cost reductions, increase productivity and increase sales. They also noted that indirect effect could be a resulted of EC-B2B System adoption on their profit. EC-B2B System adoption has direct effect on productivity, sales and costs. Hence, this leads to the conclusion that the adoption of EC-B2B Systems in SMEs in Jordan leads to improvement in performance

Survey results

Reliability analysis: The results of factor analysis were represented the construct validity of the questionnaire. These factors are the extent of the EC-B2B System adoption, productivity, sales, profitability and costs. Each factor was combined with several items that participants were required to answer in the questionnaire. Factor analysis was used to examine the items and each of these factors. Table 4 presents the factor loadings for the five factors affecting EC-B2B System adoption.

Table 4 indicated that all factor loadings were larger than 0.70% which represented acceptable factors and items. This indicates that analysis was based on a well-explained factor structure. Cronbach's coefficient alpha was employed to measure the internal consistency reliability based on the mean or average correlation for each item in the scale with other items. Reliability was used in first and second-order factors and 23 items in this research. Each Cronbach's coefficient alpha of factors and items is shown in Table 5.

According to Leech *et al.* (2008, 2005), Cronbach's coefficient alpha should be above 0.70%. Hence, as shown in Table 5, all of Cronbach's alpha values were above 0.70% in this study. For the extent of the EC-B2B System adoption, 11 items were examined. Based on the prior research that was conducted by Thong and Yap (1995) the items were designed to be categorised into two factors: frequency of e-Transactions and practicing EC-B2B Systems with TPs. Table 6 presents the items and factor loadings for the rotated factors of the extent of EC-B2B System adoption.

The results indicated that all factor loadings were >0.70% which represented acceptable factors and items that were recommended by Igbaria *et al.* (1997). Moreover, all factors and items design were consistent with prior research that was conducted by Thong and Yap (1995). For the dependent factors: namely SMEs' performance improvement (productivity, sales, profitability and costs),

Table 4: Factor loadings-5 factors for EC-B2B System adoption

Factors	Items	F1	F2	F3	F4	F5
Extent of EC-B2B System adoption	1	0.86	0.21	0.15	0.37	0.25
	2	0.86	0.35	0.35	0.41	0.34
	3	0.86	0.38	0.16	0.36	0.19
	4	0.91	0.22	0.12	0.18	0.22
	5	0.85	0.24	0.25	0.25	0.31
	6	0.73	0.12	0.08	0.29	0.17
	7	0.72	0.28	0.19	0.11	0.12
	8	0.87	0.15	0.17	0.18	0.12
	9	0.82	0.24	0.15	0.17	0.22
	10	0.86	0.16	0.18	0.22	0.25
	11	0.86	0.08	0.17	0.23	0.28
Productivity	12	0.18	0.78	0.15	0.17	0.22
	13	0.26	0.79	0.12	0.41	0.41
	14	0.42	0.87	0.09	0.36	0.23
Sales	15	0.12	0.41	0.86	0.19	0.29
	16	0.16	0.25	0.89	0.22	0.18
Profitability	17	0.12	0.29	0.22	0.75	0.08
	18	0.35	0.33	0.14	0.71	0.16
Costs	19	0.34	0.27	0.19	0.23	0.89
	20	0.38	0.22	0.11	0.15	0.88
	21	0.22	0.18	0.06	0.14	0.75
	22	0.24	0.26	0.22	0.09	0.71
	23	0.26	0.28	0.25	0.11	0.87

*F1 is extent of EC-B2B Systems; F2 is productivity; F3 is sales; F4 is profitability and F5 is costs

Table 5: Reliability statistics

First and second-order factors	Description	No. of items	Cronbach's Alpha (α)
Frequency of e-Transactions	Extent of EC-B2B System adoption	5	0.864
Practicing EC-B2B Systems with TPs	-	6	0.791
Productivity	Performance improvement	4	0.836
Sales	-	2	0.923
Profitability	-	2	0.891
Costs	-	4	0.929

Table 6: Factor loadings for the extent of EC-B2B System adoption

Factors	Items	Factor loadings		Eigen value	Variance (%)
		1	2		
Extent of EC-B2B System adoption	-	-	-	1.564	9.77
Frequency of e-Transactions	1	0.866	-	-	-
	2	0.864	-	-	-
	3	0.860	-	-	-
	4	0.911	-	-	-
	5	0.859	-	-	-
Practicing EC-B2B Systems with TPs	6	-	0.733	-	-
	7	-	0.723	-	-
	8	-	0.876	-	-
	9	-	0.826	-	-
	10	-	0.868	-	-
	11	-	0.862	-	-

*1 is e-Transactions and 2 is practicing EC-B2B

the factor analysis was conducted to examine the underlying structure for the 2 factors and 11 items. Table 7 presents the items and factor loadings for the SMEs' performance improvement.

Table 7: Factor loadings for SMEs' performance improvement

Factors	Items	Factor loadings				Eigen value	Variance (%)
		1	2	3	4		
SMEs' performance improvement						2.338	15.232
Productivity	12	0.785	-	-	-	-	-
	13	0.793	-	-	-	-	-
	14	0.875	-	-	-	-	-
Sales	15	-	0.868	-	-	-	-
	16	-	0.895	-	-	-	-
Profitability	17	-	-	0.755	-	-	-
	18	-	-	0.710	-	-	-
Costs	19	-	-	-	0.894	-	-
	20	-	-	-	0.886	-	-
	21	-	-	-	0.755	-	-
	22	-	-	-	0.710	-	-
	23	-	-	-	0.877	-	-

1: Productivity; 2: Sales; 3: Profitability; 4: Costs

The next stage of the data analysis was estimating the reliability of the respondents using the questionnaire's items and the factors' scores. Two hundred and eighteen small service enterprise respondents were labeled as SS. A total of 107 small industrial enterprises respondents were labeled as SI. While 15 a medium service enterprise respondents were labeled as MS, the total of 28 medium industrial enterprise respondents were labeled as MI. All 368 respondents were labeled as Small Services and Industrial enterprises (SSI), Medium Services and Industrial enterprises (MSI), Small and Medium Services enterprises (SMS) and Small and Medium Industrial enterprises (SMI). In this study, reliability was examined by using the Pearson correlation coefficient. The Pearson's correlation coefficient across all of 23 questions in part two and part three in the questionnaire were calculated for SS and SI, MS and MI, SMS and SMI and SSI and MSI. The correlations between SS and SI, MS and MI, SMS and SMI and SSI and MSI for each of the scored factors and items were presented in Table 8. Table 9 summarised the results of Pearson's correlation coefficient across groups for all factors.

All correlations between SS and SI, MS and MI and SMS and SMI were significant for the respondents' scores for the questionnaire's items and factors scores. In contrast, all of the correlations between factors scores have values >0.70% which implied that the factors' scores have adequate reliability for the CFA.

Data screening of the full sample: This study used the control variables such as enterprises size, enterprise economic sector and EC-B2B Systems' use duration to identify these responses and cases. Therefore, after deletion of the 17 suspect enterprises and six multivariate outliers, data from 345 SMEs (368-23 = 345) are left for analysis. Descriptive statistics for the 345 respondents as final sample are reported in Table 10. Since, the control

Table 8: Pearson correlation coefficient between items a cross sample groups

Factors	Items	Correlation			
		SS and SI	MS and MI	SMS and SMI	SSI and MSI
F1	1	0.855	0.997	0.897	0.983
	2	0.997	0.980	0.780	0.844
	3	0.980	0.889	0.836	0.955
	4	0.875	0.897	0.826	0.999
	5	0.873	0.856	0.983	0.975
	6	0.879	0.878	0.865	0.984
	7	0.789	0.879	0.972	0.985
	8	0.897	0.856	0.892	0.856
	9	0.999	0.897	0.980	0.990
	10	0.975	0.942	0.830	0.880
	11	0.984	0.978	0.834	0.998
F2	12	0.985	0.952	0.760	0.982
	13	0.876	0.772	0.872	0.782
	14	0.874	0.935	0.744	0.985
	15	0.876	0.876	0.891	0.856
	16	0.783	0.937	0.955	0.977
	17	0.896	0.978	0.834	0.947
	18	0.788	0.952	0.856	0.658
	19	0.839	0.772	0.822	0.955
	20	0.999	0.935	0.733	0.998
	21	0.975	0.658	0.911	0.658
	22	0.984	0.955	0.875	0.955
	23	0.985	0.715	0.842	0.715

F1: Extent of EC-B2B System adoption; F2: SMEs' performance improvement

Table 9: Pearson correlation coefficient between factors a cross sample groups

Factors	Correlation			
	SS and SI	MS and MI	SMS and SMI	SSI and MSI
F1	0.991	0.789	0.985	0.759
	0.792	0.955	0.781	0.973
F2	0.875	0.957	0.847	0.985
	0.770	0.994	0.877	0.978
F3	0.890	0.879	0.940	0.955
	0.893	0.826	0.956	0.978
F4	0.892	0.962	0.984	0.987
	0.890	0.986	0.896	0.998
F5	0.758	0.777	0.927	0.975
	0.794	0.749	0.993	0.984
	0.775	0.966	0.894	0.873
	0.890	0.939	0.786	0.789
	0.998	0.975	0.978	0.780

F1: Extent of EC-B2B System adoption; F2: Productivity; F3: Sales; F4: Profitability; F5: Costs

Table 10: Descriptive statistics for 23 items from the final 345 SMEs

Factors	Items	Mean	SD	Skew	Kurtosis	Min.	Max.
1	1	2.18	1.20	0.71	-0.55	0	4
	2	2.97	1.16	0.02	-0.65	0	4
	3	2.55	1.28	0.30	-1.06	0	4
	4	3.10	1.19	-0.25	-0.80	0	4
	5	3.02	1.16	-0.17	-0.85	0	4
2	6	2.45	1.20	0.42	-0.80	0	4
	7	1.66	0.80	1.16	0.50	0	4
	8	1.70	0.95	1.20	0.22	0	4
	9	2.03	1.03	0.90	0.45	0	4
	10	2.50	1.65	1.08	0.60	0	4
3	11	2.50	1.50	1.00	0.40	0	4
	12	1.99	1.33	1.44	1.28	0	4
	13	2.30	1.69	1.31	0.91	0	4
4	14	1.70	0.92	1.07	0.17	0	5
	15	2.66	1.67	1.30	0.98	0	4
5	16	1.80	1.30	1.90	2.75	0	4
	17	3.09	1.99	0.85	-0.50	0	5
6	18	2.15	1.67	1.54	1.55	0	4
	19	3.55	2.09	0.55	-1.04	0	6
	20	2.96	1.91	0.92	-0.22	0	6
	21	3.75	2.01	0.42	-1.05	0	6
	22	2.14	1.65	1.50	1.55	0	6
	23	3.52	2.07	0.56	-1.02	0	6

Standard errors for Skew and Kurtosis are 0.166 and 0.333, respectively; 1 and 2 are the extent of EC-B2B System adoption, 3 is productivity, 4 is sales, 5 is profitability, 6 is costs

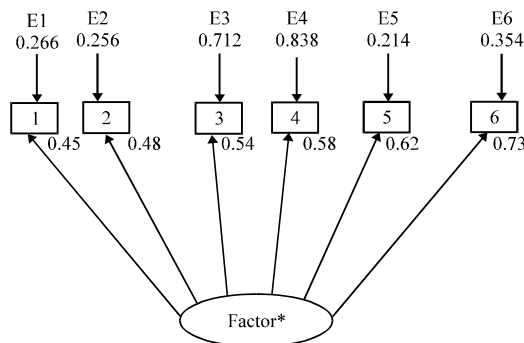


Fig. 3: Single factor model

variables were identified and analysed separately in the end of this study, they are not shown in Table 10.

Single factor model: In this research, the CFA was conducted on two measurement models to test convergent and divergent validity between factors. The first model is a Single-Factor Model (SFM) where all factors were hypothesised to load on one factor. SFM often was reported in SEM studies in operations management. Fixed parameters are shown with a (*). In testing the model, the variance of the latent factor is set to 1.0*. Hence, all relationship coefficients were freely estimated. Figure 3 shows the SFM with related percentage for each factor.

In addition to the SFM as shown in Fig. 3, the following Table 11 reports the fit indices and statistics for the SFM.

Table 11: Fit indices and statistics for SFM

Statistics	Single factor
Chi-square	335.300
Degrees freedom (df)	367.000
Mardia's normalised estimate	9.200
Free parameters	27.000
Fixed parameters	16.000
Comparative Fit Index (CFI-ML)	0.740
CFI-robust	0.740
Standard Root Mean-Square Residual (SRMR)	0.092
Root Mean Square Error of Approximation (RMSEA-ML)	0.180
RMSEA-robust	0.120

Table 11 shows a CFI 0.74% and RMSEA 0.18% this indicates that the SFM is inadequate for representing these factors. According to Kline (2005), the poor fit indices suggests that there is more than one latent factor. Since, the literature did not support testing a two, three or four-factor models, a five-factor model was conducted and examined in this research. Previous researchers such as Kline (2005) and Brews and Tucci (2004) have shown that a five-factor model fits the data better than models with three or four factors.

Five-Factor (CFA) Measurement Model: In this research, the five-factor (CFA) model was used to examine convergent and discriminant validity. In this research also the test in this model was performed with the variance of all factors set 1.0*, allowing all loadings and covariance to be freely estimated. The pattern coefficients (i.e., the values on the arrows) were represented the factor loadings. The loadings were estimated while controlling for covariance between factors. Therefore, the five-factor model in Fig. 4 is the theoretical CFA research model to test the multiple factors.

Note that in CFA five-factor model the associations between factors were modeled as standardised covariance rather than relationship coefficients. Table 12 reports the fit indices and statistics for the CFA five-factor measurement model.

From Table 12, the evidence indicates that the research model meets the minimum recommended fit indices for acceptable fit with a CFI 0.91% and RMSEA 0.093%. The minimal difference between the ML and Robust results was indicated that there is no adverse effect due to non-normality in the few questionnaire's items and factors that had kurtosis values above 3.0. Table 13 represents the CFA pattern matrix, the pattern coefficients with "0" value means that the research model was tested without cross-loadings because CFA did not tested for varying degrees of simple structure as found in exploratory procedures.

As all factors were loaded above 0.50%, they were presumed to measure the relationships among factors (first and second-order factors) to test their convergent

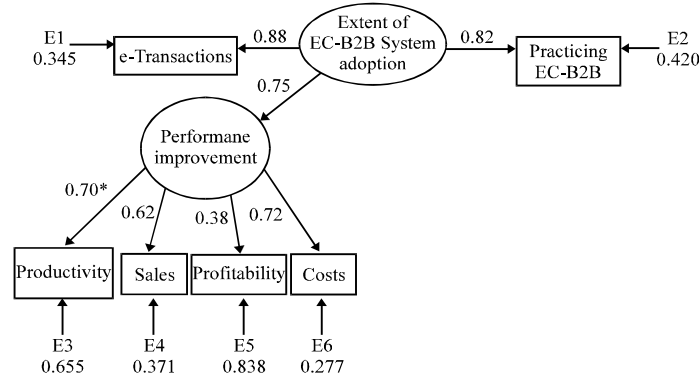


Fig. 4: CFA Five-Factor Measurement Model

Table 12: Fit indices and statistics for Five-Factor (CFA) Measurement Model

Statistic name	Five factor statistics results
Chi-square	182.850
df	344.000
Mardia's normalised estimate	9.100
Free parameters	35.000
Fixed parameters	20.000
CFI-ML	0.910
CFI-robust	0.890
SRMR	0.064
RMSEA-ML	0.093
RMSEA-robust	0.090

Table 13: CFA pattern Matrix-Five Factor (CFA) Measurement Model

Factors	Extent of EC-B2B adoption F3	Performance improvement F4	R ² (communalities)
1	0.702	0.000	0.685
2	0.681	0.000	0.785
3	0.000	0.751	0.511
4	0.000	0.652	0.664
5	0.000	0.650	0.425
6	0.000	0.822	0.567
Eigenvalues	1.380	2.650	-

1 is e-Transactions, 2 is practicing EC-B2B, 3 is productivity, 4 is sales, 5 is profitability and 6 is costs

Table 14: Factor Correlations Five Factor (CFA) measurement model

Factors	F1	F2	F3	F4	F5
F1	1.000	0.604	0.600	0.490	0.660
F2	0.604	1.000	0.656	0.556	0.676
F3	0.600	0.656	1.000	0.380	0.770
F4	0.490	0.556	0.380	1.000	0.720
F5	0.660	0.676	0.770	0.720	1.000

F1: The extent of EC-B2B System adoption; F2: Productivity; F3: Sales; F4: Profitability; F5: Costs

validity through a perfect simple structure and all eigen values were >1.0 , it evident that a simple structure existed in this model. Furthermore, since all of the factors loadings were exceed 0.60%, it was concluded that the validity power level at the CFA analysis is high. Table 14 shows the correlation matrix which was used to examine divergent validity. The factor correlations in Table 14 justify testing the existence of EC-B2B System adoption as a second-order factor.

Table 15: Fit Indices and Statistics for Structural Equation Model (SEM)

Statistic	Structural model
Chi-square	180.500
df	344.000
Mardia's normalised estimate	9.200
Free parameters	33.000
Fixed parameters	18.000
CFI-ML	0.920
CFI-robust	0.920
SRMR	0.069
RMSEA-ML	0.087
RMSEA-robust	0.084

Since, none of the factor correlations were above 0.85%, it was concluded that sufficient divergent validity existed in the model. In addition, a CFA analysis was performed with all factors correlations were fixed to 1.0, hence, this result in a Chi-square of value 332.15. A Chi-square difference test is then performed with the model in Fig. 5 ($\chi^2 = 182.85$). The evidence suggested that each factor is measuring a different phenomenon of activity.

Structural Equation Model (SEM): Figure 5 represents the theoretical model. As part of analysis, the variance of EC-B2B System adoption was fixed, hence, the structure coefficients as shown in the arrows in Fig. 5 were freely estimated. Furthermore, the parameters which were marked with asterisks (*) were fixed to a value of (1.0). One relationship between factors was fixed in order to scale the factors, e.g., the relationship between the extent of EC-B2B System adoption and productivity. Figure 5 reflects the standardised coefficients. Constraining the relationships to be equal between the extent of EC-B2B System adoption and enterprise performance improvement tested the proposition that the first-order factors contributed equally to the composition of the second-order factor (the extent of EC-B2B System adoption). The fit indices and statistics for the model are summarised in Table 15.

Table 16: Chi-square hypothesis tests

Relationships (Fig. 5)	No. tests	Chi-square	Chi-square constrained	Results unconstrained H_0 : Tests
From EC-B2B to productivity	3	220.95	179.60	Rejected H_1 , H_2 , H_3 , H_4
From EC-B2B to sales				
From EC-B2B to profitability				
From EC-B2B to costs	4	181.99	179.60	Not rejected
From EC-B2B to productivity				
From EC-B2B to sales				
From EC-B2B to profitability	7	177.80	179.60	Not rejected
From EC-B2B to profitability				

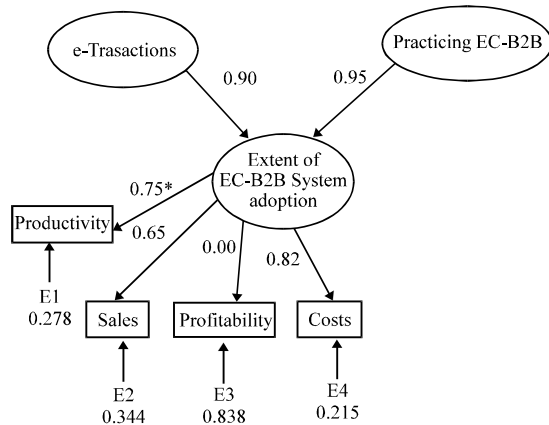


Fig. 5: Structural Equation Model (SEM) (first and second-order factors)

The CFI 0.920% and RMSEA 0.087% implied that the model has an acceptable fit. The low Mardia's estimate and small difference between the ML and robust estimate indicates that the results were not affected by non-normal data. This implies that the model is reliable and valid for partially explaining the relationships between factors. The standardised structural coefficients are shown on the arrows in Fig. 5. Table 16 is reported the results which first column is listed the relationships that are constrained as shown in Fig. 5.

The second column in Table 16 is listed the number of the test and third column is shown the Chi-square value of the model with the corresponding relationships constrained. The forth column is listed the Chi-square value of the model with no relationships constrained and the last column is shown the results of the null Hypothesis test (H_0) that there were not a statistical difference between the two Chi-square values of $p < 0.001$. Not rejected statement in the last column is indicated that the equality constraint is properly imposed across the relationships. Test number 3 which was used to tests the relationships between the extent of the EC-B2B System adoption and performance improvement's factors (i.e., productivity, sales, profitability and costs) were constrained to be equal. The last column was reported that the results of the H_0 test that the models were equal.

In this case, H_0 is rejected which is indicating that the factors were not contributed equally to the composition in relation to the EC-B2B System adoption. Based on examination of the differences in the relationship coefficients, the relationship was selected that may be the source of inequality (Costs) was dropped from the model prior to retesting. Thus, test number 4 was shown the results of the retested model where only productivity, sales and profitability were constrained to be equal. The results of the χ^2 -test were indicated that the relationships were statistically equal. This means that costs with the highest relationship of coefficient is statistically different from three of other factors (productivity, sales and profitability) which was appeared to be equal. The remaining tests were interpreted in a similar manner.

Hypothesis testing and control variables: The four hypotheses were tested the relationship between the EC-B2B System adoption in SMEs in Jordan and SMEs' performance improvement through four factors. They are tested in null form as:

H1₀: There is no relationship between the extent of the adoption of EC-B2B Systems and the perceptions of SME managers of productivity.

H2₀: There is no relationship between the extent of the adoption of EC-B2B Systems and the perceptions of SME managers of sales.

H3₀: There is no relationship between the extent of the adoption of EC-B2B Systems and the perceptions of SME managers of profitability.

H4₀: There is no relationship between the extent of the adoption of EC-B2B Systems and the perceptions of SME managers of costs.

Four null hypotheses were tested by using the structural model shown in Fig. 5. Based on the significant positive relationship coefficients and direct effect between the EC-B2B System adoption and productivity (0.75%), sales (0.65%) and costs (0.82%), H_1 , H_2 , and H_4 were rejected. This supports the alternative hypotheses

that EC-B2B System adoption has a direct effect on productivity, sales and costs. However, the direct relationship coefficient from EC-B2B System adoption to profitability is insignificant as shown in Fig. 5 and consequently, H3₀ was not rejected. This concludes that the EC-B2B System adoption in SMEs in Jordan did not directly improved the enterprise profits. The indirect effect and relationship between the EC-B2B System adoption and SMEs' profitability was calculated as the factors of three direct relationship coefficients ($0.75 \times 0.650 \times 0.82 = 0.40\%$). The rejection of H1₀, H2₀ and H4₀ leads to the conclusion that EC-B2B System adoption in SMEs in Jordan, account for the benefits that EC-B2B System adoption creates in SMEs sector in Jordan.

CONCLUSION

This study contributed the following conclusions to the literature and SME managers in Jordan:

- The EC-B2B system adoption in SMEs in Jordan has had a positive influence on SMEs' performance improvement
- Some of the factors in SMEs' performance improvement such as productivity and costs, appear to factors that are more affected by EC-B2B System adoption than other factors
- The findings suggest that the effect of EC-B2B System adoption on profitability is indirect, mediated by other factors such as productivity, costs and sales
- EC-B2B System adoption can remove many of the competitive advantages of larger enterprises in Jordan and provide opportunities for SMEs

The evidence and results in this research concluded that the EC-B2B System adoption explains 37% of the variance in SMEs' performance when performance is measured as a composite of productivity, costs, sales and profit. This quantifies the relationship between the EC-B2B System adoption and improvements in SMEs' performance that was one of the principal objectives of this research. The fully mediated relationships between the extent of the EC-B2B System adoption, SMEs' performance improvements concluded that changes in productivity, costs reductions and sales processes are the drivers for improved performance. SMEs' performance improvement in terms of cost reduction is important since enterprises expect to receive technology benefits that exceed costs. Cost benefits involve reductions in both material and labor costs. While this study did not collect objective cost data for SMEs, cost information would be

available to practicing SME managers to calculate the payback period or Net Present Value (NPV), etc. Which may be important to justify the investment in EC-B2B Systems. In addition, reduction in costs could include price-concessions from TPs for ordering on-line and labor-intensive activities that could be eventually automated.

RECOMMENDATIONS

The following recommendations are made to SME managers in Jordan:

- SME managers in Jordan should proceed to adopt EC-B2B Systems with the expectation that productivity, sales, costs and profits will improve. This is especially important for managers who must cost justify EC-B2B System projects
- SME managers in Jordan should first identify and plan for changes in structured business process that have the best chance for automation. Hence, the SME managers can expect improvements in performance through a cost reduction in order tardiness with TPs
- SME managers in Jordan should first identify the type of information sharing that will most benefit SME performance and then develop an infrastructure to support it. Otherwise, unnecessary or insufficient infrastructure may be adopted and extend the time it takes to realize performance improvement benefits. The literature shows that many SMEs tend to adopt EC-B2B Systems widely with little consideration for how it will be used

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