THE IMPACT OF USING E-COLLABORATION TOOLS ON COMPANY PERFORMANCE

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Abstract

Recent advances in inter-organizational software and communication technologies, along with the trends towards globalization, networking, mass customization, and digitization in the context of the supply chain, have led to the development of 'e-collaboration' concept. The central premise of this research is that e-collaboration plays a major role in achieving a sustainable performance. In particular, this paper proposes to examine the relative efficiency of electronic collaboration tools and assess their impacts on the performance of an individual organization positioned along its supply chain. Empirical data from both the company and its customers have been collected for the purpose of hypothesis testing.

Keywords: E-collaboration, Pharmaceutical, Performance, Jordan

Introduction

E-collaboration is a communication process between different parties through electronic devices to accomplish work goals. E-collaboration can be broadly defined as collaboration among individuals engaged in a common task using electronic technologies (Kock et al., 2001). Companies rely increasingly on e-collaboration tools to optimize the performance of supply chains. According to several authors, competitions in the future will be between supply chains, not between companies.

Companies work hard to create an effective supply chain that helps increase the performance of the organization. E-collaboration tools contribute efficiency to achieving that. It is considered more than a technological substitution for traditional face-to-face collaboration as it places special emphasis on the importance of structuring activities for balancing electronic communication during e-collaboration (i.e., video conferencing, email, chat session, distributed use of group support system) in order to bridge cultural and

stereotypical gaps, to increase profitable role repartition between the participants, and to prevent and help solve conflicts (Rutkowski et al., 2002). The relative impacts of e-collaboration tools depend on their diffusion within a supply chain, since these tools are basically interactive innovations (Lefebvre et al., 2003).

The following are a number of important e-collaboration tools in the supply chain which were adopted by Cassivi et al., (2002) and Lefebvre et al. (2001); for more details see Appendix 2:

- Direct procurement tool: the process of ordering materials from prequalified suppliers.

- The replenishment tool: the process of ordering material from warehouses which are needed in productions. It enables retailers and manufacturers jointly, to forecast demand and schedule production (Raghunathan, 1999).

- The projected shortage tool: the process of scanning the buyer behavior to protect the firm from any expected shortage.

- The delivery and tracking tool: the process of generating and delivering the requests automatically when the product moves from the supplier to customers.

- The forecasting tools: the process of managing the information that comes from suppliers and customers to enable the prediction of future sales.

- The capacity planning tool: the process of determining the required capacity to produce.

- The business strategy tool: supports actions which help the company achieve its objectives.

This research therefore, focuses on the e-collaboration tools and their impact on the organization performance in a pharmaceutical industry firm. "ALPHA" is one of reputable distribution companies for pharmaceutical products in Jordan. "ALPHA" started its operation in 2001, when the founder driven by his own beliefs and internal drive and encouraged by the guidance of his father, decided to start ALPHA in the Middle East region. Today ALPHA has multiple locations in Jordan which makes it Jordan's leading pharmacy chain. This renowned success of the ALPHA-Jordan has set the foundation for its rapid expansion in the region starting with Saudi Arabia and the extensive expansion plans it has for the whole Gulf region and also in the Middle East and North Africa (MENA) region.

Research Objectives

This research has a number of objectives which can be stated as follows:

1. Identifying the effect of e-collaboration tools in ALPHA's supply chain performance.

2. Finding out which of the e-collaboration tools are utilized and if there are variations in their impact on ALPHA's performance.

3. Understanding the supply chain management process in ALPHA and how it might have contributed to improving the overall performance.

Research Problem

Research problem is represented in the following research questions:

1- Is there any relationship between resource measures and organizational performance from the employees and customers point of views?

2- Is there any impact of output measures on the organizational performance?

3- Has flexibility any significant influence on the organizational performance?

4- Are there variations in how the different e-collaboration tools affect the performance?

Literature Review

The supply chain is the connected series of activities concerned with planning, co-ordinating and controlling material, parts and finished goods from the supplier side to that of the customer (Stevens, 1989). The supply chain is interrelated processes inside the firm or outside to produce a service or product to get the satisfaction of the customers. Supply chains will be with the supplier's supplier to customers as in the figure below. The process of organizing the flow of information with its suppliers and customers is called an effective supply chain.
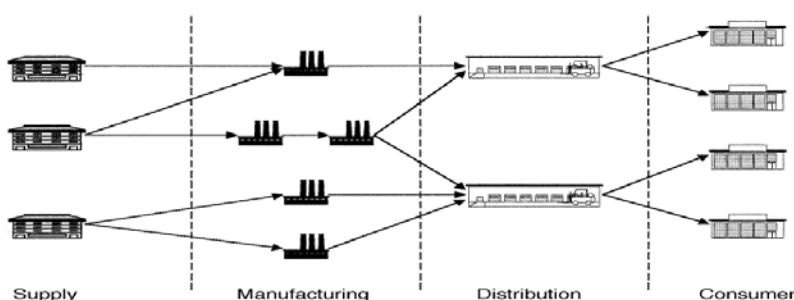

Figure1: simple supply chain

Supply Chain Management is a network of facilities that produce raw materials, transform them into intermediate goods and then final products, and deliver the products to customers through a distribution system. It spans procurement, manufacturing and distribution (Lee &Billington 1995) the basic objective of supply chain management is to "optimize performance of the chain to add as much value as possible for the least cost

possible". In other words, it aims to link all the supply chain agents to jointly cooperate within the firm as a way to maximize productivity in the supply chain and deliver the most benefits to all related parties (Finch 2006). Adoption of Supply chain management practices in industries has steadily increased since the 1980s. A number of definitions are proposed and the concept is discussed from many perspectives. However Cousins et al. (2006); Sachan and Datta (2005); Storey et al. (2006) provided an excellent review of the supply chain management literature. These papers define the concept, principles, nature, and development of SCM and indicate that there is an intense research being conducted around the world in this field they critically assessed developments in the theory and practice of supply management.

Tan (2000) proposed two alternative perspectives on supply chain management, Purchasing and supply perspective of the Industrial buyers; and Transportation and logistics perspective of the merchants. The purchasing and materials management represents a basic strategic business process, rather than a narrow specialized supporting function to overall business strategy.

The supply chain contains four levels (supply, manufacturing, distribution, and consumers), where each level of the chain may comprise numerous facilities. Thus, the complexity of the supply chain arises from the number of levels in the chain and subsequently the number of facilities in each of those levels. Given the inherent complexity of a typical supply chain, selecting appropriate performance measures for supply chain analysis is particularly crucial, since the system of interest is generally large and complex (Beamon, 1999). Beamon suggested three dimensions for measuring the performance of a supply chain namely: resource measures which emphasizes better resource utilization; output measures which are concerned with the responsiveness to customer needs; and flexibility which means how well the system reacts to uncertainty. Each of the three variables has different goals as exhibited in table 1.

Table1: The Goals and Purpose of Performance Measure Types

Performance Measure Type	Goals	Purpose
Resources	High level of efficiency	Efficient resource management is critical to profitability
Output	High level of customer service	Without an acceptable output, customers will turn to other supply chains
Flexibility	Ability to respond to a changing environment	In an uncertain environment, supply chains must be able to respond to change

In addition, the factors are interrelated and impact each other as can be seen in figure 2.
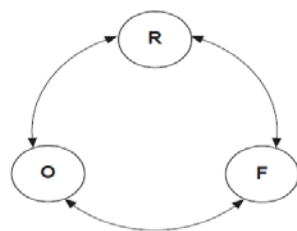

Figure 2: Co-relations among Performance Measure Types

Many broad definitions appeared in the literature to provide an explanation for the term e-collaboration. Every definition depends on the nature of work for the use of the e-collaboration. According to (Kock et al., 2001), e-collaboration is the collaboration using electronic technologies among different individuals to accomplish a common task. It can also be considered from a contextual perspective of the supply chain as an amorphous meta-concept that can be interpreted in many different ways by organizations and individuals.

The academic definition of the 'e' in the e-collaboration mainly focuses on B2B internet-based technologies, while practical definitions have wider scope referring to it as electronic technologies. Johnson and Whang (2001) define e- collaboration as a business-to-business interactions facilitated by the Internet. These interactions go beyond simple buy/sell transactions and may be better described as relationships. McDonnell (2001) considers e-collaboration as an internet-based collaboration which integrates people and processes giving flexibility to supply and service chains. Gray defined collaboration as a process of decision making among independent organizations involving "joint ownership of decisions and collective responsibility for outcomes" (Gray, 1991:227).

First time application of real e-collaboration took place back in mid 1800s, with the invention of the telegraph by Samuel F.B. Morse. The telegraph allowed individuals to accomplish collaborative tasks interacting primarily electronically. Companies rely increasingly on e-collaboration tools to optimize the performance of supply chains. According to several authors, competitions in the future will be between supply chains and not between companies. They purport that "e-Collaboration is about companies working together to integrate their operations and eliminate barriers that impact their ability to satisfy consumers and drive out unnecessary cost. It is being used to integrate previously separate aspects of the supply chain and to enhance the value delivered to the consumer by providing a series of practical improvement concepts to unlock this value". Important components of successful collaborative relationships include: a commitment to working together, goal

congruence and benefit sharing. The success of collaboration depends upon the ability and willingness of managers to build meaningful relationships and create trust (Schrage, 1990).

There are many driving forces well documented in the literature behind the collaboration. The reasons why companies adopt e- collaboration are mainly driven by the increasing need of information visibility and sharing along the supply chain, the efficient communication in a distributed network, the cost reduction, JIT and time compression philosophy, process automation, increased potential opportunities for partnership, and the flexibility and adaptability. SCM initiatives in recent years such as VMI, CPFR, Cross docking, Continuous replenishment have proved that e-collaboration can fundamentally change the inter-organizational processes, reshapes business relationships and brings competitive advantages into the organization.

Theoretical Framework
The Research Model

ALPHA with its big size has a five tier supply chain. This supply chain is represented in figure 3.
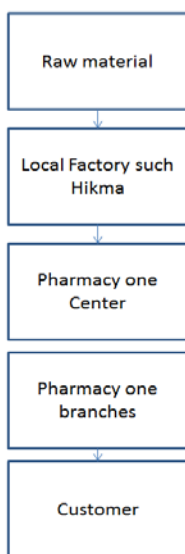

Figure 3: the ALPHA supply chain

Applying the Beamon's (1999) proposition (as detailed in table 1) for studying the ALPHA case and choosing what was deemed applicable to the ALPHA situation, figure 4 demonstrates the proposed model for this study. Details presented in the model were used to build the questionnaires for the purpose of data collection.
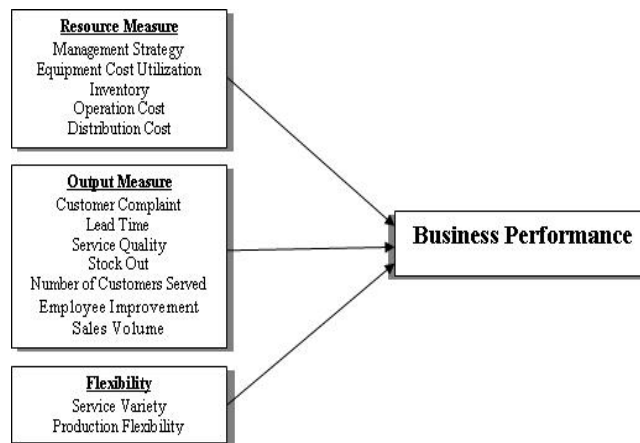
Figure 4: Research Model

Hypotheses

To achieve the goals of the study and answer its questions, four hypotheses were formulated as follows:

- *H1*: There is no impact of "resource measures" on business performance.
- *H2*: There is no impact of "output measures" on business performance.
- *H3*: There is no impact of "flexibility" on business performance.
- *H4*: The e-collaboration tools affect the organization tools.

Operationalization of variables

To find out about the e-collaboration tools most used in ALPHA questions were asked to the concerned people as follows:

- *Business strategy:* How e-collaboration helped ALPHA employee understand the business plan and supply chain process. In addition, the employees were asked if this tool gave them the ability to take the right decisions. This tool was addressed in question 15 on the management employee part and question 12 on the branch employee part.

- *Forecasting tools*: This tool was found to be used in ALPHA to predict the exact amount that needed for each of the branches in order to avoid extra inventory and ultimately higher cost. Question 16 in the management employee part addressed this tool.

- *Capacity planning:* This tool that is meant to help ALPHA respond to demand variations such as seasonal diseases as well as finding the monthly consumption and product movement. Questions 20 and 21in the management employee part addressed this tool.

- *Projected shortage:* This tool is used to help scan buyers' behavior in order to face any probable shortage that might occur. Question 18 in the management employee part addressed this tool.

- *Replenishment tool:* This tool helps forward purchase order to pre-qualified supplier and ensures that all resources are available in time. Questions 17 and 25 in the management employee part addressed this tool.

- *Direct procurement:* This tool helps ALPHA avoid stock outs. Question 11 in the branch employee part addressed this tool.

In addition, table 2 contains details of how the variables were operationalized:

Table 2: Operationalization of Performance Measure Types

Resource Measures	
Management strategy	Defined as how much the software gives employees the ability to take the right decisions. Question 15 in the management employee part addressed this tool.
Equipment cost utilization	Defined as the process of minimizing the cost of communication between management and branches. The management employee part (questions 22).
Inventory Level	Defined as helping ALPHA avoid extra inventory, forecasting, scanning buyers' behavior and determining monthly consumption. The management employee part (questions 16,18, and 21).
Operation cost	Help ALPHA forward the purchase order to prequalified suppliers to minimize the operation cost. The management employee part (questions 17).
Distribution costs	It is indicated in how ALPHA minimizes distribution costs for transactions between the headquarters and the Branches. The management employee part (questions 19).

Output Measures	
Sales	This means how the ALPHA system improves the sales volume. This was covered in question 9 of the branch employee part.
Response time or Customer response time (lead time)	It is defined as the time needed to serve a customer inside ALPHA or by email or through social networking, and how the ALPHA system helps minimize this time. Questions 15 and 16 in the customer part.
Number of customers served	It is defined as the number of customers served per hour and how e-collaboration affects this. Question 10 in the branch employee part.
Stake out	Stock-out means that the product is not available in the inventory and for determining how the ALPHA system helps avoid out of stock status for medicines. This was covered in question 11 of the branch employee part.
Customer complaints	Defined as the number of complaints from customers about the quality of service offered. This was covered in question 13 of the branch employee part.
Employee improvement	The process of understanding the business plan and supply chain processes. This was covered in question 12 of the branch employee part.
Service quality	It's how ALPHA serves the customers more than their expectations. This was covered in question 5 of the customer part.

Flexibility	
Production flexibility	The ability to respond to demand variations, such as seasonal diseases. This is addressed in question 20 of management employee part.
Services variety	Defined as how many varied services are introduced. This was addressed in questions 3, 4, 6 and 7 of the customer part. The services chosen depended on what is offered by ALPHA.
Performance	Efficient management, availability of all resources when needed, minimizing the operational cost and overall cost, increasing the number of customers, sales volume, helping to adapt to change and service Variety. This was addressed in questions 8, 14, 23, 24, 25, 26, 27 and 28.

Methodology
Research Design

The research design comprised of two steps; the first one is an exploratory interview to identify the e-collaboration tools which were used in ALPHA and what were the expected benefits to the company and to customers. The second step was a survey that involved distributing a general questionnaire containing three parts of questions. The three parts could be considered as separate questionnaires that were in turn distributed to customers, management employees and branch employees.

Population and Sample

ALPHA had 52 branches in Jordan that worked 24 hours a day for the full 7 days a week. Every branch has a different number of employees per shift depends on the size of the branch, location and the shift. There were three shifts per day. So the total number of employees was approximately 400 employees in total. In the management building, the number of employees was approximately 100.

It was difficult to estimate the number of ALPHA customers as one could consider that everybody living in Jordan would be a potential customer. In total 69 filled in customer questionnaires were returned. The number was 60 for the management employee part and 52 for that of the branch employee. For analysis an equal number of returning questionnaires were randomly selected from returning questionnaires. Therefore, a unified sample size of 50 was deemed sufficient for analysis.

Data Collection Methods (instruments)

At the initial stage, preliminary exploratory interviews were carried out by ALPHA staff who were involved in building the system and with some training leaders who were considered to have had detailed insights about the system and its e-collaboration benefits.

The questions in those interviews were semi-structured to allow interviews to give details on the open-ended parts. The questions were mostly about what tools were used and how

customers would benefit from the system. The second part involved surveying the relevant parties (Management employees, branch employees and customers). Customers were randomly selected and found considering the spread since ALPHA had many customers. The other two parts of the survey were relatively easy to distribute in branches and in the main building (headquarters) of the company.

Hypotheses Testing

Following data collection, data items were coded and entered to be analyzed using SPSS as shown in appendix 3.

- **H01: There is no impact of "resource measures" on business performance.**

Based on the results, one can conclude that there is a relationship between resources and performance.In addition, if the power increases by one in the scale the motivation will be increased by .552 (B value).

- **H02: There is no impact of "output measures" on business performance.**

From the table of the analysis (appendix 3), one can conclude that the null hypothesis, which states that there is no relationship between output measures and business performance, is accepted.

- **H03: There is no impact of "flexibility" on business performance.**

The null hypothesis, which states that there is no relationship between flexibility and business performance is accepted based on the results of the analysis of data collected as shown in appendix 3.

Finally, the independent variables were found to explain 38.4% of business performance which is concluded from the R square value. The fact that this research is of the social type, this value can be considered satisfactory.

- **H04: The e-collaboration tools affect the organization tools.**

To identify the e-collaboration tools that have the most impact on business performance, a linear regression was conducted and the result showed that the business strategy, capacity planning, projected shortage and replenishment tool have an impact on business performance with the replenishment tools having the strongest effect on the business performance.

Conclusion

- The ALPHA system provides the management employee data from all branches which allows them to make different analyses such as rush peak sales timing. This helps ALPHA identify rush-hours sales which facilitates managing the workflow based on the relevant analysis. The appropriate number of employees is deployed as required for each shift or the necessary contingency action could be taken for the peak periods.

- The most effective variable was found to be the "resource measures", which indicate that ALPHA was doing well in terms of managing inventory levels and operation costs.

- The most effective tool that gives an impact on the business performance was found to be the "replenishment tool" for contacting prequalified suppliers in order to maintain availability of all resources.

- The majority of customers were not aware of all services offered by ALPHA through the Internet.

- Few of the customers complained from high lead-times because they were asked to fill-in their personal information on the different branches that they visited.

Recommendations

- Since most of the customers were not aware of the variety of services offered by ALPHA, it is suggested that some kind of awareness campaign would be beneficial to the customers and to ALPHA.

- It might be useful for ALPHA to offer free services to customers so they are aware of their medical history and other useful information.

- ALPHA would benefit greatly from linking branches and headquarters together. In addition, customer details would be available regardless which branch of ALPHA the customer visit to make a purchase.

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<u>Appendix 1 : Questionnaires</u>
The Impact of Using E-collaboration
Tools on Company Performance
This survey is conducted to collect data for research purposes. Shall appreciate your help in giving some of your valuable time to fill-in this questionnaire:

Are you ALPHA's :

☐ Customer ☐ Management employee

☐ Branch employee

Based on the previous question, please tick the most appropriate answer in the relevant part:

Customer	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1) I need a little time inside ALPHA to order and receive what I want.					
2) ALPHA gives me a fast response for advices I request by email, phone, and social media (Facebook, Twitter…)					
3) Using toll free (telephone service) helps to save my time by guiding me to the closest branch to my location.					
4) The ALPHA management helps me find the needed medicine even if it's not available in Jordan.					
5) ALPHA serves me more than my expectations.					
6) ALPHA reminds me when my medicine is finished.					
7) ALPHA stores my medical history, and permits easy and fast retrieval of my information in any of its branches.					
8) At the overall service provided by the ALPHA is varied and creative					
Branch Employee	**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
9) The ALPHA system improves the sales.					

10) The ALPHA system helps to increase the number of customers served per hour.					
11) The ALPHA system helps me to avoid out of stock status for medicines.					
12) The ALPHA system helps me to understand the business plan and supply chain processes.					
13) There are many complaints from customers regarding the quality of service.					
14) The ALPHA system helps me to locate in which other branch I can find the unavailable medicine at my branch					
Management Employee	**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
15) All information available on the ALPHA system gives the ability to take the right decisions.					
16) To avoid extra inventory; ALPHA system helps me to forecast the expected amount for each branch.					
17) The ALPHA system helps to forward purchase order to pre-qualified suppliers.					
18) ALPHA system scans buyer's behavior to help face any possible coming shortage					
19) The ALPHA system helps to minimize distribution costs for transactions between the Headquarters and the Branches.					
20) The ALPHA system increases the ability to respond to demand variations, such as seasonal diseases.					
21) The ALPHA system gives good					

information about monthly consumption and product movements.					
22) The ALPHA system helps to minimize the cost of communication between management and branches					
23) Generally, the ALPHA system leads us to efficient resource management					
24) Generally, the ALPHA system helps to minimize the overall operational cost					
25) Generally, ALPHA software helps to ensure that all resources available when they are needed					
26) Generally, the number of customers has increased since using the ALPHA software					
27) Generally, sales have improved since using the ALPHA software					
28) Generally, ALPHA software helps to make rapid response to new changes					

Appendix 2: Description of the Web-based collaboration tools

The design tool: Enables the use of interactive engineering drawing and storage of computer-assisted design (CAD) designs by all the key supply chain stakeholders involved in the product design activity. The collaborative design tool may be used to ensure that the final design meets all of the stakeholders' requirements. Meanwhile, it should help reduce the time to market while maximizing the quality and minimizing the costs of the product.	*The capacity planning tool*: Determines the amount of capacity required to produce. It establishes measures and adjusts the levels of capacity in terms of labor, machine resources and material necessary to accomplish the operational tasks. For instance, a supplier, with the increased visibility of capacity planning information, monitors its inventory levels according to its customer's inventory targets.
The delivery and tracking tool: Generates a payment and a delivery request automatically when a product goes from a supplier to its customer. It is also designed to collect shipping information from the third-party logistic providers. It reduces the number of communications between partners and is tightly linked to the direct procurement tool to automatically close purchase orders.	*The projected shortages tool:* Scans the buyer's production plan to project expected component or material shortages. Suppliers access the tool frequently (weekly) and provide the delivery schedules of items with potential shortages. The tool also provides real-time information for manufacturing and supply management units and reduces the response time for communication between them.
The replenishment tool: Drives an ordering system from the shop floor. When material is needed on a production line, an order is placed through the replenishment system. The supplier usually has a specific amount of time to deliver ordered material either to the production line or to a stockroom.	*The forecasting tool*: Frequently exchanges the forecast information provided by both the buyer and supplier. The forecast, which is a prediction of sales and use of products in order to purchase the appropriate quantities in advance, is usually obtained from ERP software or from an advanced planning and scheduling (APS) tool.

The direct procurement tool: Forwards purchase orders (POs) to pre-qualified suppliers. Mostly Web-based, direct procurement replaces fax systems, is usually an alternative to EDI and is often linked to an enterprise resource planning (ERP) system. The supplier usually posts an acknowledgment of receipt and a confirmation of quantity, date and price on the direct procurement tool.	*The business strategy tool*: Collects and shares the actions that need to be taken to support the objectives and mission of the supply chain (or networked enterprise). Typically, general supply chain objectives are drawn from each organization's goals for participating in a collaborative relationship.

Sources: [Cassivi et al., (2002); Lefebvre et al. (2001)]

Appendix 3: Description of the Web-based collaboration tools

Linear regression test showing variables impact on business performance:

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	Flexibility, resource measurement , output measurement	.	Enter

a. Dependent Variable: performance
b. All requested variables entered.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.620[a]	.384	.344	.41820

a. Predictors: (Constant), flexibility, resource measurement , output measurement

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	5.019	3	1.673	9.565	.000[b]
	Residual	8.045	46	.175		
	Total	13.064	49			

a. Dependent Variable: performance
b. Predictors: (Constant), flexibility, resource measurement , output measurement

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.298	.739		1.757	.086
	Resource measurement	.552	.111	.592	4.966	.000
	Output measurement	.077	.179	.052	.431	.669
	Flexibility	.090	.106	.104	.850	.400

a. Dependent Variable: performance

The following shows the e-collaboration tools that most impact business performance:

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	direct.procureme nt, projecte. . Shortage, capacity planning, business. strategy, forecasting, replenishment. tool[b]	.	Enter

a. Dependent Variable: performance
b. All requested variables entered.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.755[a]	.571	.511	.36119

a.   Predictors: (Constant), direct.procurement, prjected.shortage, capacityplanning, business.strategy, forecasting, replenishment.tool

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	7.454	6	1.242	9.523	.000[b]
	Residual	5.610	43	.130		
	Total	13.064	49			

a. Dependent Variable: performance
b. Predictors: (Constant), direct.procurement, prjected.shortage, capacityplanning, business.strategy, forecasting, replenishment.tool

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.213	.532		4.156	.000
	business.strategy	-.208	.096	-.238	-2.163	.036
	forecasting	-.047	.071	-.079	-.659	.514
	capacityplanning	.265	.093	.370	2.862	.006
	prjected.shortage	-.164	.076	-.217	-2.160	.036
	replenishment.tool	.406	.097	.541	4.177	.000
	direct.procurement	.121	.062	.222	1.945	.058

a. Dependent Variable: performance