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# Impact of ERP System Usage on Supply Chain Integration: A Structural Equation Modeling, Jordanian Pharmaceutical Manufacturing Case study

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## Abstract

This study aimed to investigate the impact of ERP System Usage on Supply Chain Integration at Jordanian Pharmaceutical Manufacturing firms. A random sample from employees working in the Jordanian Pharmaceutical Manufacturing firms (Human Resource Department, Financial Department, Production Department, Supply Chain Department as well as Operations & Quality Department) were chosen totaling (183) individuals. The study applied using SPSS and Amos to do the analysis. The study using a questionnaire to achieve the study objectives through Structural Equation Modeling (SEM). The study results revealed that the Customer Relationship Management System, Inventory Management System, Financial Management System, production and operation Management System has a significant positive effect on Integration with Supplier, Integration with Customer and internal processes integration. The study concluded that there exists a statistically significant relationship between ERP system on Integration with Supplier, Integration with Customer and internal processes integration at Jordanian Pharmaceutical Manufacturing firms. The study found out that there was huge contribution of the ERP system in supply chain integration at Jordanian Pharmaceutical Manufacturing firms.

**Keywords:** ERP System, Supply Chain Integration, Jordanian Pharmaceutical Manufacturing Firms and Structural Equation Modeling

## 1. Introduction

The world is facing constant changes of the requirements for the competitive environment, customer needs, the business challenges that have led to the invasion of digital technology, and finally the new innovations to the business environment across its various sectors, which contribute to improving its operations, achieving customer satisfaction and business objectives, and gaining a greater market share.

Accordingly, the pharmaceutical manufacturing organizations have been moving towards the adoption of enterprises' resources planning systems, which allow organizations to optimally exploit available resources to

allow for more efficiency and effectiveness in the implementation of business plans, reduce the response time due to the effective transfer of Information, and in turn, ease the decision making process in real-time through a set of integrated programs that contribute to the sharing of accurate information among all of business units. This is manifested through the improvement of communication and coordination between the internal processes and external partners such as: the relationships with suppliers, distributors, and customers through supply chain Integration, which supports coordination between supply chain members who manage inter and intra-organization activities starting from (receiving of customer order, provision of raw material, manufacturing, distribution, ending with delivery of the product to the end consumer) to achieve more efficiency in the flow of products, services, and information that provide customers with higher value at the right time, in the right place, suitable price, and high quality. On the other hand, the success of the supply chain integration reflects into the value added towards the customers, organizations' quality reputation, timely delivery, and ensuring the continuity and survival globally.

Tseng, et. al. (2011) stated that customer satisfaction is a primary cause that leads organizations to use information technology tools to access information and relationships with customers, in order to make the core processes of business more flexible and efficient. Moreover, Ince, et. al. (2013) believes that organizations need efficient and effective information systems like ERP system to obtain accurate data at the right time to compete at the global complex marketplace. Gollner, et. al. (2016) mentioned that organizations noticed that the competitiveness of business found into effective distribution of resources and improvement of business processes that are integrated and seek to accomplish the high quality of product, low cost, and delivery in the right time. Madanhire and Mbohwa (2016) explained that the use of ERP systems provides support for all of important activities such as (manufacturing and logistics, finance, sales, CRM, SCM, and HR) through the integration of data and shared knowledge among all business units. Furthermore, Ngai, et. al. (2011) said that supply chain integration is one of most important elements of SCI requirements to design a network in which the supply chain partners cooperate with internal business processes to reach to optimum practices. Ram, et. al. (2013) discussed that SCI seeks to linkage internal processes with external processes (outside partners) such as: suppliers and customers through the ERP system to achieve rapid responds to customers' needs. Marinagi, et. al. (2015) mentioned that supply chain management integration works on the controlling of information, materials, services and money to enhance the quality of business operations. Gollner, et. al. (2016) reported that ERP evaluation has to be considered through the stakeholders' involvement.

Therefore, this study aims to investigate the impact of ERP System Usage on Supply Chain Integration in Jordanian Pharmaceutical Manufacturing firms.

### **1.1. Significant of the study**

There are a few researches addressed the ERP System Usage in the Arab countries in general. In addition, there are a few studies are talking about the impact of ERP System Usage in Jordanian pharmaceutical manufacturing firms, and supply chain integration. Therefore, this study will have a small contribution to building further studies of this topic that can be used in other industries. The existing study might be considered as one of the studies that combined both variables (ERP and SCI) together to examine its impact on business processes and relationships with abroad partners, and level of alignment with ERP system. As well as, may provide managers with recommendations in some of pharmaceutical manufacturing firms in regard to re-discuss using of ERP system as an information system to develop their business, retain its market share to achieve the competitive advantage.

Therefore, this study would discuss the extent of ERP System Usage at pharmaceutical manufacturing firms to look into its benefits that return on businesses. At the same time, what are they losing when they never apply these technologies to accomplish their business processes? Moreover, this study can be used to give a recent recommendation for decision makers and other managers about the importance of ERP and the effect of using the technology on business partnerships with suppliers, and customers to help in the right decisions in the real time; In general clarify the benefits of ERP System usage for all processes. Finally, provides a theoretical and academic framework about the impact of ERP System usage on Supply Chain Integration that could support researches about the benefits of ERP systems.

## 1.2. Objectives of the study

Investigate the impact of ERP System Usage (Human Recourse Management System, Customer Relationships Management System, Inventory Management System, Financial Management System, Production and Operations Management System) on Supply Chain Integration (Integration with Suppliers, Internal processes Integration, Integration with Customer) in Jordanian Pharmaceutical Manufacturing firms.

## 1.3. Research questions

Based on the research problem statement, its main question and the objectives to be achieved, the following research question needs to be answered:

Does ERP system dimension affect Supply Chain Integration dimensions (Integration with Suppliers, Internal processes Integration, Integration with Customer) at Jordanian Pharmaceutical Manufacturing firms?

## 2. Literature Review

### 2.1. Enterprise Resources Planning (ERP) System

The term of Enterprise Resource Planning arose from the Material Requirements Planning and Industrial Computerization systems; it is introduced by Gartner firm for Research and Analysis (Jagoda and Samaranayake, 2017). According to Mabert, et al. (2013) ERP systems currently seek to cover all the basic functions of any service or production organization, since service organizations, nonprofits and governments are all now able to use the ERP systems.

Garg and Khurana (2017) there are many examples of units in the ERP systems that have an individual application: manufacturing, supply chain, finance, customer relationship management, warehouse management, and decision support system.

Njihia & Mwirigi (2014) determined that information systems literature refers to the beginnings of events of What to know about "information systems integration", which is the basis in the work of ERP software to the sixties and seventies and specifically by developing what is known as inventory tracking systems through Material Requirements Planning and MRP II (Manufacturing Resource Planning) systems have also contributed to laying the foundation stone for ERP (Enterprise Resource Planning) software development. Indeed, many IT systems researchers' consideration Enterprise Resource Planning systems as a functional extension of manufacturing resource planning system.

Ullah, et. al. (2017) viewed the ERP systems as being system enhancing core business functions that can be supported through a comprehensive information system, that provides consistent information for each part of business, which including HR, finance, marketing and sales, customer service, and intra- and extra operations on time.

Ociepa (2017) mentioned that ERP system as system to manage of resource planning, business commitments, data flows. Finally, Syahid, et al., (2017) define ERP system as integrates data from each department under one centralized system contains a number of modules that designated based on department's needs.

The implementation of the ERP system requires prior systematic planning, especially with regard to the operations of the organization. Therefore, requires coordination with individuals who specialize in these systems, in addition coordination between the various divisions and departments constituting the organization (Abugabah, et al., 2015).

The implementation of the ERP system requires a major change in work practices and relationships from individuals to the management of the organization, because the process of change requires qualified individuals who are able to train workers and qualify them to adapt to the use of the ERP system (Fadlalla and Amani, 2015).

Many researchers have addressed the requirements of implementing the ERP system or critical success factors (Ahmad and Cuenca, 2013).

Hsu, et al., (2015) identify these requirements as teamwork, support for senior management, change of operations, project management, and effective communications training.

Costa, et al., (2016) go further, where he emphasized on a set of requirements that are re-engineering administrative processes, change management, work teams, organizational culture, support for senior management, future vision, effective communication, project management, Software development, performance evaluation, organizational structure, end-user participation, knowledge management.

Whereas, Hasheela-Mufeti and Smolander (2017) categorizes these requirements with four factors: organizational, technological, strategic and tactical factors. In addition, Baker and Yousof study (2017) emphasized on senior management support, project management, user training, communications, seller support and business engineering re-engineering.

While Al-Hadi and Al-Shaibany (2017) mentioned that these requirements are represented in the efficiency of project implementation, the product itself, the seller's point of view, the organizational climate, and technical factors.

Finally, Kiran and Reddy (2019) stated that the requirements for implementing the ERP system in the organizations are in terms of consultants support, knowledge transfer, senior management support, user's support of the system, effective communications, and conflict resolution.

## 2.2. Supply chain integration

Supply chain integration consists of internal processes, partnerships with suppliers and end-consumers, that to ensure information flow and raw materials in the real time, with high quality and price (Poranki, et. al., 2015).

Supply chain integration is “an effective method that enhances the performance of an organization’s suppliers and customers” (Flynn, et al., 2010).

Supply chain integration as “the degree to which a manufacturer collaborates with its supply chain partners and coordinates intra- and inter-organization processes” (Poranki, et. al., 2015).

Qi, et al., (2017) defined supply chain integration as “cooperation plans and activities between suppliers, manufacturers, warehouses distributors, and retailers that aim to develop products by transforming raw materials into finished goods for customers”. While, the supply chain integration “intends to provide the products to the end consumer starting with purchasing materials ending with delivery to the end consumer” (Wheelen, et al., 2018).

According to Lii and Kuo (2016) the supply chain integration enables organization to design products faster, with higher qualities and lower costs. Annan, et al., (2016) demonstrated that the supply chain integration able organization to minimize the cost of serving and monitoring customers and suppliers.

In the current study, the researcher relied on Poranki, et. al., (2015); Mehralian, et. al., (2015); Tiwari, et. al., (2015); Huo, et. al., (2014); Xu, et. al., (2014) in determining the dimensions of measuring Supply Chain Integration.

### 3. RESEARCH MODEL AND HYPOTHESES

Our research model is shown in Fig. 1. The definitions of various constructs in the model. In this study, the authors construct the research model based on reviewing the selected literature on ERP System and Supply chain integration.

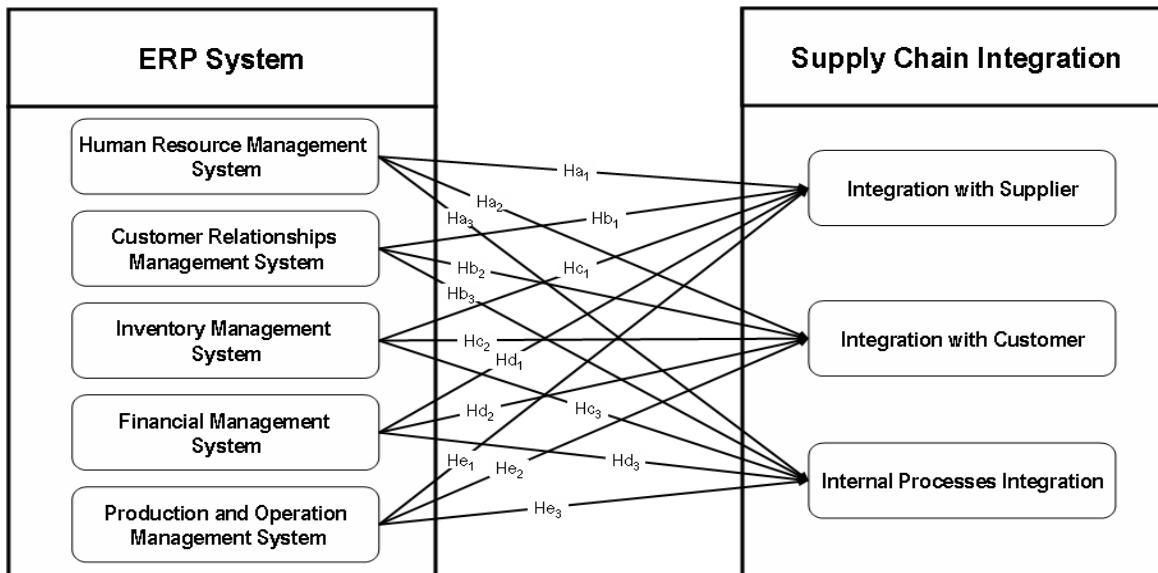


Fig. 1. Research model

Based on the above discussions, the researcher proposes the following hypothesis:

- Ha1.** The Human Resource Management System positively affects on Integration with Suppliers.
- Ha2.** The Human Resource Management System positively affects on Integration with Customer.
- Ha3.** The Human Resource Management System positively affects on internal processes integration.
- Hb1.** The Customer Relationship Management System positively affects on Integration with Supplier.
- Hb2.** The Customer Relationship Management System positively affects on Integration with Customer.
- Hb3.** The Customer Relationship Management System positively affects on internal processes integration.
- Hc1.** The inventory Management System positively affects on Integration with Supplier.
- Hc2.** The inventory Management System positively affects on Integration with Customer.
- Hc3.** The inventory Management System positively affects on internal processes integration.
- Hd1.** The Financial System positively affects on Integration with Suppliers.
- Hd2.** The Financial Management System positively affects on Integration with Customer.
- Hd3.** The Financial Management System positively affects on internal processes integration.
- He1.** The production and operation Management System positively affect on Integration with Supplier.
- He2.** The production and operation Management System positively affect on Integration with Customer.
- He3.** The production and operation Management System positively affect on internal processes integration.

### 4. Methodology

#### 4.1. Study Population

The study population included all employees working in the Jordanian Pharmaceutical Manufacturing firms from three levels.

#### 4.2. Study Sample

The sample size appropriate from study population were (183) employees working in the Jordanian Pharmaceutical Manufacturing firms (Human Resource Department, Financial Department, Production Department, Supply Chain Department as well as Operations & Quality Department) who were chosen in a randomly sampling method.

#### 4.3. Data collection and instrument

The data was obtained through a survey. This consisted of the questions in the questionnaire that were sent the responded. Using scale of ERP system based on Gupta, et. al., (2018); Hasan, et. al., (2017); Poranki, et. al., (2015); Ram, et. al., (2014); Heizer; Render and Zubi (2013). As well as, to measure the supply chain integration the researcher adapted the Poranki, et. al., (2015); Mehralian, et. al., (2015); Tiwari, et. al., (2015); Huo, et. al., (2014); Xu, et. al., (2014) scale. A questionnaire was prepared to gain answers to specific questions. The items of questionnaire were mainly closed. Likert-type scale was used ranging from 1 = strongly disagree to 5-strongly agree.

### 5. DATA ANALYSIS

The study uses Statistical Package for social science (SPSS) to measuring reliability of the ERP system constructs and Supply chain Integration constructs. Structural Equation Modeling (SEM) in data analysis through using the Amos version 23 to test the study hypotheses was used.

#### 5.1. Measuring Reliability

Reliability test was performed one more time to verify whether the ERP system and supply chain integration constructs are reliable. Reliability results as shown in table 1 clarify that all constructs were higher than the acceptable level stated by Hair, et al., (2010) stated.

TABLE 3. Reliability Analysis Results for Measurements items

Construct (or factor)	Cronbach's alpha	
	No of items	Value
HRMS	6	0.890
CRMS	6	0.889
IMS	6	0.903
FMS	6	0.895
POMS	6	0.916
<b>ERP System</b>	30	0.970
Integration with Supplier	8	0.922
Integration with Customer	8	0.925
internal processes integration	8	0.946
<b>supply chain integration</b>	24	0.963

#### 5.2. The hypotheses testing

The examination the hypotheses using structural equation modeling through AMOS 23.0. However, the model provided a good fit indicators as:  $\chi^2/df = 1.418$ , with the goodness of fit index (GFI) and adjusted goodness of fit index (AGFI) was .0962 and 0.934, the normed fit index (NFI) was 0.973, the Tucker-Lewis coefficient (TLI) was 0.984, as well as, the comparative fit index (CFI) was 0.984 and the root mean square error of approximation (RMSEA) was 0.049, indicating a good fit between the theoretical model and the data. Table 4 presents each parameter's C.R., Estimate and S.E.

Hence, Customer Relationship Management System has a significant positively effect on Integration with Supplier, Integration with Customer and internal processes integration ( $\beta = 0.268; 0.324$  and  $0.182$ ;  $C.R = 3.385; 3.755$  and  $2.473$ ;  $P\text{-value} = 0.003; 0.000$  and  $0.014$ ) or Hb1; Hb2 and Ha3 is supported).

Inventory Management System has a significant positively effect on Integration with Supplier, Integration with Customer and internal processes integration ( $\beta = 0.254; 0.221$  and  $0.213$ ;  $C.R = 2.868; 2.451$  and  $2.271$ ;  $P\text{-value} = 0.005; 0.015$  and  $0.024$ ) or Hc1; Hc2 and Hc3 is supported).

Financial Management System has a significant positively effect on Integration with Supplier, Integration with Customer and internal processes integration ( $\beta = 0.250; 0.235$  and  $0.246$ ;  $C.R = 2.255; 2.080$  and  $2.597$ ;  $P\text{-value} = 0.025; 0.039$  and  $0.011$ ) or Hd1; Hd2 and Hd3 is supported).

Finally, production and operation Management System has a significant positively effect on Integration with Supplier, Integration with Customer and internal processes integration ( $\beta = 0.354; 0.274$  and  $0.263$ ;  $C.R = 3.736; 2.799$  and  $2.617$ ;  $P\text{-value} = 0.000; 0.014$  and  $0.010$ ) or He1; He2 and He3 is supported).

TABLE 4. HYPOTHESES TESTING RESULT

<b>Hypothesis</b>	<b>Regression Weights</b>		<b>Estimate</b>	<b>SE</b>	<b>C.R.</b>	<b>P Value</b>	<b>Results</b>
	<b>From</b>	<b>To</b>					
<b>Ha1</b>	HRMS	Integration with Supplier	-0.041	0.069	-0.595	0.552	Rejected
<b>Ha2</b>	HRMS	Integration with Customer	0.055	0.071	0.772	0.441	Rejected
<b>Ha3</b>	HRMS	internal processes integration	0.080	0.084	0.944	0.346	Rejected
<b>Hb1</b>	CRMS	Integration with Supplier	0.268	0.079	3.385	0.003	Accepted
<b>Hb2</b>	CRMS	Integration with Customer	0.324	0.086	3.755	***	Accepted
<b>Hb3</b>	CRMS	internal processes integration	0.182	0.073	2.473	0.014	Accepted
<b>Hc1</b>	IMS	Integration with Supplier	0.254	0.088	2.868	0.005	Accepted
<b>Hc2</b>	IMS	Integration with Customer	0.221	0.090	2.451	0.015	Accepted
<b>Hc3</b>	IMS	internal processes integration	0.213	0.093	2.271	0.024	Accepted
<b>Hd1</b>	FMS	Integration with Supplier	0.250	0.110	2.255	0.025	Accepted

<b>Hd2</b>	FMS	Integration with Customer	0.235	0.112	2.080	0.039	Accepted
<b>Hd3</b>	FMS	internal processes integration	0.246	0.094	2.597	0.011	Accepted
<b>He1</b>	POMS	Integration with Supplier	0.354	0.094	3.736	***	Accepted
<b>He2</b>	POMS	Integration with Customer	0.274	0.097	2.799	0.014	Accepted
<b>He3</b>	POMS	internal processes integration	0.263	0.100	2.617	0.010	Accepted

## 6. DISCUSSION

From analysis, it was observed that the Customer Relationship Management System has a significant positive effect on Integration with Supplier, Integration with Customer and internal processes integration. This means that the increased one unit in Customer Relationship Management System can significantly increased the same degree in Integration with Supplier, Integration with Customer and internal processes integration. As well as, Inventory Management System has a significant positive effect on Integration with Supplier, Integration with Customer and internal processes integration. This means that the increased one unit in Inventory Management System can significantly increased the same degree in Integration with Supplier, Integration with Customer and internal processes integration.

Financial Management System has a significant positive effect on Integration with Supplier, Integration with Customer and internal processes integration. This means that the increased one unit in Financial Management System can significantly increase the same degree in Integration with Supplier, Integration with Customer and internal processes integration.

Production and operation Management System has a significant positive effect on Integration with Supplier, Integration with Customer and internal processes integration. This means that the increased one unit in production and operation Management System can significantly increase the same degree in Integration with Supplier, Integration with Customer and internal processes integration.

Human Resource Management System not positively affects on supply chain integration (Integration with Supplier, Integration with Customer and internal processes integration).

## 7. CONCLUSION

From the analysis, it can be concluded that there exists a statistically significant relationship between some of ERP system on Integration with Supplier, Integration with Customer and internal processes integration at Jordanian Pharmaceutical Manufacturing firms. The study found out that there was huge contribution of the ERP system in supply chain integration at Jordanian Pharmaceutical Manufacturing firms.

### 7.1. Limitation

The study was limited to the Jordanian Pharmaceutical Manufacturing firms. The study was also limited to Human Resource Department, Financial Department, Production Department, Supply Chain Department as well

as Operations & Quality Department in Jordanian Pharmaceutical Manufacturing firms and not the other firms in other sector.

## 7.2. Further research

The studies recommend the extension of this research to examining the effect of ERP system on creative performance.

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