

# Investigation of the Influence of IT on Agility of Supply Chain and Corporate Performance (Case Study: Supplier Companies of Abadan Refinery)

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## ABSTRACT

Supply chain needs to be continuously improved in order to make a business succeed. Agile companies are able to monitor market changes rapidly and excel their competitors. The present research tries to investigate the influence of IT on agility of supply chain. Further, the influence of supply chain agility with the indices “ability to identify” and “response to market changes” on organizational performance was also investigated. The questionnaires were distributed among 210 companies which were considered as part suppliers of Abadan Refinery. SPSS software, Pearson correlation coefficient and regression analysis were used for analysis. Results showed that all hypotheses were verified. In other words, IT helps supply chain with finding better understanding and response to market changes. Furthermore, supply chain agility contributes to positive performance of the companies.

**KEYWORDS:** supply chain agility, market changes, IT, corporate performance

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## INTRODUCTION

In today's economy, competition has shifted from individual, corporate performance to supply change performance. Appropriate performance of supply chain lays a key role in organizational success and acquiring profitability targets. In order to be successful in business environment, companies need to improve their supply chains continuously. To this end, supply chain performance needs to be evaluated and its performance criteria need to be extracted (Feizabadi and Jafarnejad, 2005, p 94). These competencies are very important for firms and they must be used to identify market changes and a powerful supply chain must be used for responding to the changes (Christopher, 2000). These main competencies are expressed by “agility” concept (Ganguly et al, 2009). Agile companies are able to monitor market changes and excel other competitors (Zhang & Sharifi, 2000). Information and communicational advantages contribute to organizational agility and organizational agility helps with identifying market changes and response to changes (Sambamurthy et al, 2003).

Firms can benefit a lot from investment in IT and therefore increase their agility. Companies which lack agility may end up in market share loss and reduction in profitability (Ganguly et al, 2009). The present research aims to investigate the influence of IT on increasing agility throughout supply chain and its impact on organizational performance.

### Theoretical fundamentals and research background

IT is a key element in elimination of temporal and spatial limitations, better and quicker access to information, being up-to-date and in other words, information technology has changed methods of doing works and has changed the infrastructure which was formerly based upon paper to electronic infrastructure which is called information electronic trade. Information technology (IT) or to put it more thoroughly information and communications technology (ICT) refers to a collection of instruments and methods which are necessary for producing, processing, maintaining, distributing and disposing information-based systems in its comprehensive meaning (including text, sound and video).

Today, many firms are confronted with fierce, competitive and uncertain environment as a result of technological innovations and changing needs of customers. In such an environment, former approaches to supply chain are no longer useful. Agility is an approach to confronting with such challenges. Companies are confronted with challenges like rapid technological changes, market uncertainties, dynamic markets, reduction in products lifecycles and markets segmentation in global business environment. Therefore, an organization's ability to adapt to changes and market conditions is essential for their survival (Christopher, 2002).

In such conditions, the importance of agility in supply chain becomes obvious because an agile supply chain can respond rapidly and effectively to market changes (tess, 1997). Agile supply chains not only can respond to common changes but also they can respond to dramatic changes which take place for the first time. Therefore, it is believed that agility is necessary for future competitive pressures and acquiring competitive advantage (Yousef, 1999).

Agility concept was first introduced after a summit of industrial and scientific experts on finding the reasons for companies' inability to respond and adapt to environmental changes. A report was published by Yakoka institute titled "strategy of production firms in 21<sup>st</sup> century: industrial experts viewpoints" (yakoka, 1991). Immediately after that, agile production phrase became common (Gansekaran et al, 2001).

The word "agile" in dictionary means rapid, active and soft movement and ability to move rapidly and being able to think courageously and smartly. In the present world, however, the word agility means effective response to unpredictable and volatile environment and use of the changes as opportunities for organizational progress (Agraval, 2007). Moreover, the word agility also comes from agile production and agile production is a recently-popular concept and is used by producers in order to increase performance considerably (branshidel, 2005). Agility has many definitions. Christopher defines agility as "an organization's ability to respond quickly to changes in demand, both in volume and diversity" (Christopher, 2002). However, Tolon believes that agility "indicates effective merger of supply chain and emphasis on close and long-term relationships with consumers and suppliers" (14). In spite of the fact that there are many definitions for agility, none of them are contradictory or incomplete. The definitions normally indicate the idea of "change and speed in business environment". However, because of the novelty of agility concept, there is no unanimously-accepted definition for it (Jafar Nejad, 2007).

In order to acquire competitive advantage in business environment, companies must be coordinated with their suppliers and companies and acquire an acceptable level of agility (Christopher, 2002). In such conditions, an agile supply chain is formed. An agile supply chain is able to respond to changes in business environment efficiently (Agraval, 2007).

Agility in supply chain can be defined as follows: (Jafarnejad, 2007):

"The ability of a supply chain for responding rapidly to market changes and customers' needs"

Maon believes that agile supply means use of market knowledge and virtual company concept in order to seize market profitable opportunities appropriately (mason, 2000). Selection of agility approach to supply chain is a logical stage because it is important for survival of firms (Sharifi et al, 2006). They believe that agility in supply chain means the ability of a firm to adapt rapidly to customers' needs variations. Parallel developments in agility area and SCM resulted in agile supply introduction (Christopher, 2000).

Identification and collection of information about market and customers will be more effective when supply chain is considered as a whole. Therefore, it can be said that IT plays an important role in coordination of supply chain and responding to environmental changes and enables companies to respond to market changes rapidly (Sharon, 2013). Finally, the present research tries to answer the question: "whether IT brings agility to supply chain? And whether supply chain agility improves organizational performance?"

## METHODOLOGY

The present research is a descriptive and applied research considering its subject and hypotheses structures. The present research aims to describe conditions and phenomena (Bazargan, 2006). These phenomena include IT, supply chain agility and organizational performance. Regression test was used for hypotheses analysis because the research investigates the influence of IT on supply chain agility and corporate performance among Abadan Refinery parts suppliers.

Research hypotheses are developed as follows, based on the goals, the type and variables of the research:

**Hypothesis 1:** IT influences supply chain agility.

**Hypothesis 1-1:** IT influences supply chain ability to identify market changes.

**Hypothesis 1-2:** IT influences supply chain ability to respond to market changes.

**Hypothesis 2:** supply chain agility influences organizational performance.

**Hypothesis 2-1:** supply chain ability to identify market changes influences organizational performance.

**Hypothesis 2-2:** supply chain ability to respond to market changes influences organizational performance.

Figure 1 indicates relationships among hypotheses variables in the form of a conceptual model:

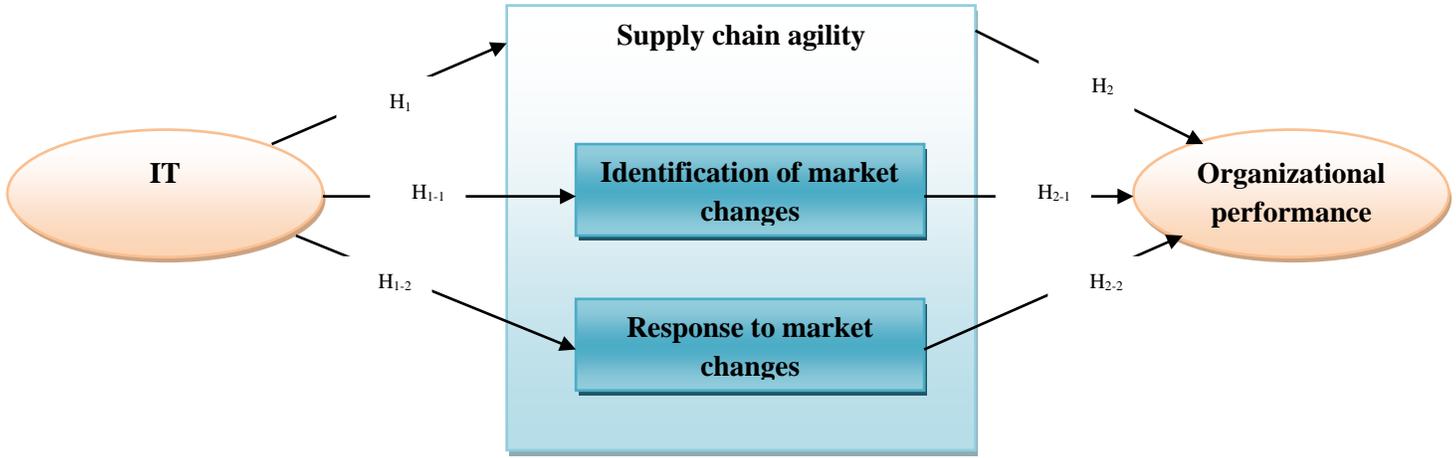


Figure 1: research conceptual model (Sharon et al, 2013)

In order to collect data for hypotheses analysis, a questionnaire was used considering the types of hypotheses and statistical population (all parts suppliers of Abadan Refinery). The questions of the questionnaire were based upon 5-point Likert scale and its validity and reliability coefficients were verified. Results of the test are summarized in table 1.

Table 1: results of reliability and validity of the questionnaire

	Number of questions	reliability	validity		
		Chronbach's alpha	KMO	Bartolt	Significance level
IT	12	0.930	0.804	323.655	0.000
Supply chain agility	16	0.927	0.733	415.275	0.000
Market changes identification	8	0.870	0.765	144.742	0.000
Response to market changes	8	0.866	0.754	150.168	0.000
Organizational performance	16	0.891	0.677	571.787	0.000

Statistical population of the research included all part suppliers of Abadan Refinery. Morgan table was used to obtain sample size (210 firms). Data were analyzed by descriptive indices like table of frequency, mean, median, percentage, standard deviation, variance and histogram. Simple regression analysis was used for testing the hypotheses.

**Data analysis**

**1. Research descriptive findings**

Results showed that 28.4% of respondents were female and 71.6% of them were male. Further, 24.2% of the respondents were below 30, 57.3% were between 31 to 40 years old, 14.7% were between 41 and 50 years and 3.8% were above 51 years old. 46% of the respondents had 6-10 years of working experience, 39.3% had 11-15 years of experience, 7.6% of them had 16-20 years of experience and 7.1% had above 21 years of experience. In terms of corporate activity experience, 34.1% of the respondents were below 5 years, 33.6% were between 6 to 10 years, 14.7% were between 11 to 15 years, 10.4% were between 16 to 20 years and 7.1% were above 21 years. In terms of organizational position, 36% of the respondents were managing directors, 22.3% were deputies, and 41.7% were supervisors. 19.4% of them were locally active, 46.4% were nationally active and 34.1% were globally active. In terms of activity type, 29.4% were production firms, 51.2% were intermediary firms and 15.6% were service companies. 13.7% of the firms were large, 62.6% were medium-sized and 23.7% were small firms.

Variables description: table 2 investigates the descriptive indices of research variables and dimensions. Minimum and maximum values are also indicated. Furthermore, means, standard deviations and variances are also depicted.

Table 2: research variables and dimensions description

kurtosis	skewness	variance	SD	mean	maximum	minimum	number	
-0.244	-0.548	0.573	0.75709	3.4622	5	1.33	211	IT
-0.196	-0.55	0.58	0.76138	3.4582	5	1.38	211	Identification of market changes
-0.06	-0.712	0.529	0.72707	3.5723	5	1.63	211	Response to market
-0.029	-0.73	0.462	0.67962	3.515	5	1.69	211	Supply chain agility
0.022	-0.431	0.341	0.5842	3.5877	5	1.94	211	Organizational performance

## 2. Research hypotheses

In this section, we discuss the results obtained and deal with research hypotheses. To this end, we first introduce each hypothesis and discuss its rejection or verification considering the results. Results of simple regression test are as follows:

### Hypothesis 1: IT influences supply chain agility.

Considering the R value in table 3, it can be seen that the intensity of the relationship between IT and supply chain agility is equal to 0.677. On the other hand, determination coefficient is also equal to 0.458. This indicates that IT predicts about 46% of supply chain agility. Moreover, Durbin-Watson statistic is equal to 1.880. This indicates absence of autocorrelation between remainders of the estimated equation. Considering the coefficients of regression model, it can be observed that the influence of IT on supply chain agility is significant and its impact intensity is equal to 0.677. Therefore, H<sub>0</sub> is rejected and H<sub>1</sub> is verified in (95%) certainty level. Considering beta sign, the influence direction is positive. In other words, an increase in IT increases supply chain agility.

### Hypothesis 1-1: IT influences supply chain ability to identify market changes.

Considering the R value in table 3, it can be seen that the intensity of relationship between IT and supply chain ability to identify market changes is equal to 0.626. On the other hand, determination coefficient is also equal to 0.391. This indicates that IT predicts about 40% of supply chain ability to identify market changes. Moreover, Durbin-Watson statistic is equal to 1.895. This indicates absence of autocorrelation between remainders of the estimated equation. Considering the coefficients of regression model, it can be observed that the influence of IT on supply chain ability to identify market changes is significant and its impact intensity is equal to 0.626. Therefore, H<sub>0</sub> is rejected and H<sub>1</sub> is verified in (95%) certainty level. Considering beta sign, the influence direction is positive. In other words, an increase in IT increases supply chain ability to identify market changes.

### Hypothesis 1-2: IT influences supply chain ability to respond to market changes.

Considering the R value in table 3, it can be seen that the intensity of relationship between IT and supply chain ability to respond to market changes is equal to 0.621. On the other hand, determination coefficient is also equal to 0.386. This indicates that IT predicts about 39% of supply chain ability to respond to market changes. Moreover, Durbin-Watson statistic is equal to 1.828. This indicates absence of autocorrelation between remainders of the estimated equation. Considering the coefficients of regression model, it can be observed that the influence of IT on supply chain ability to respond to market changes is significant and its impact intensity is equal to 0.621. Therefore, H<sub>0</sub> is rejected and H<sub>1</sub> is verified in (95%) certainty level. Considering beta sign, the influence direction is positive. In other words, an increase in IT increases supply chain ability to respond to market changes.

### Hypothesis 2: supply chain agility influences organizational performance.

Considering the R value in table 4-29, it can be seen that the intensity of relationship between supply chain agility and organizational performance is equal to 0.754. On the other hand, determination coefficient is also equal to 0.568. This indicates that supply chain agility predicts about 57% of organizational performance. Moreover, Durbin-Watson statistic is equal to 2.166. This indicates absence of autocorrelation between remainders of the estimated equation. Considering the coefficients of regression model, it can be observed that the influence of supply chain agility on organizational performance is significant and its impact intensity is equal to 0.754. Therefore, H<sub>0</sub> is rejected and H<sub>1</sub> is verified in (95%) certainty level. Considering beta sign, the influence direction is positive. In other words, an increase in supply chain agility improves organizational performance.

**Hypothesis 2-1: supply chain ability to identify market changes influences organizational performance.**

Considering the R value in table 3-5, it can be seen that the intensity of relationship between supply chain ability is equal to 0.595. on the other hand, determination coefficient is also equal to 0.353. This indicates that supply chain ability to predict market changes predicts about 35% of organizational performance. Moreover, Durbin-Wattson statistic is equal to 2.08. This indicates absence of autocorrelation between remainders of the estimated equation. Considering the coefficients of regression model, it can be observed that the influence of supply chain ability to identify market changes on organizational performance is significant and its impact intensity is equal to 0.595. Therefore, H0 is rejected and H1 is verified in (95%) certainty level. Considering beta sign, the influence direction is positive. In other words, an increase in supply chain ability to identify market changes improves organizational performance.

**Hypothesis 2-2: supply chain ability to respond to market changes influences organizational performance.**

Considering the R value in table, it can be seen that the intensity of relationship between supply chain ability to respond to market changes and organizational performance is equal to 0.808. On the other hand, determination coefficient is also equal to 0.653. this indicates that supply chain ability to respond to market changes predicts about 65% of organizational performance. Moreover, Durbin-Wattson statistic is equal to 1.717. This indicates absence of autocorrelation between remainders of the estimated equation. Considering the coefficients of regression model, it can be observed that the influence of supply chain ability to respond to market changes on organizational performance is significant and its impact intensity is equal to 0.808. Therefore, H0 is rejected and H1 is verified in (95%) certainty level. Considering beta sign, the influence direction is positive. In other words, an increase in supply chain ability to respond to market changes improves organizational performance.

Table 3: results of regression coefficient test for hypotheses analysis

Hypotheses	R value	R2	Durbin-Wattson	F statistic	coefficient	beta	Constant value	T statistic	Significance level	result
Hypothesis 1	0.677	0.458	1.880	176.627	0.613	0.677	1.525	13.290	0.000	supported
Hypothesis 1-1	0.626	0.391	1.859	134.428	0.654	0.626	1.165	11.594	0.000	supported
Hypothesis 1-2	0.621	0.386	1.828	131.501	0.572	0.621	1.884	11.467	0.000	supported
Hypothesis 2	0.754	0.568	2.166	274.760	0.730	0.754	0.920	16.576	0.000	supported
Hypothesis 2-1	0.595	0.353	2.080	114.255	0.499	0.595	1.906	10.689	0.000	supported
Hypothesis 2-2	0.808	0.653	1.717	393.695	0.777	0.808	0.607	19.842	0.000	supported

**Conclusion**

Considering the fact that the present research investigated hypotheses on Abadan Refinery suppliers, results of the main and subsidiary hypotheses analyses revealed that all the hypotheses were supported. Results of the hypotheses tests have been summarized in tables 2-5 and 3-5. Of course, it is important that research process never stops especially in humanities. This means that results of one research are not definite and may be proven to be incorrect in future studies (Iran Nejad, 2003).

Results of the tables show that all hypotheses were supported.

Research restrictions are challenges ahead of data collection desirable results acquisition. Every research has some limitations. The present research also confronted some limitations as follows: 1. Absence of access to suppliers due to their scattering nationwide was a limitation. The author(s) collected data by means of fax and email and tried to establish direct contact with management and agencies officials. 2. The influence of variables which cannot be controlled by researcher was also an important limitation which is common in humanities. One of the most fundamental functions of doing research is providing new insights for accessing optimum functions. This is expressed in recommendations. The following recommendations are proposed based on research results: 1. Because IT has an influence on supply chain agility, companies are proposed to implement information systems and new technologies in acquiring data from market, storing and analyzing the data. By this, every kind of variation in market is considered in parts sales and purchase and appropriate decisions are made. 2. Further, companies are proposed to establish marketing information systems in order to identify target markets and respond to market changes. 3. Competitors' behaviors should be monitored so that supply chain agility is maintained and response to target market changes is facilitated. 4. Personnel should receive enough training in order to be able to use IT so that they can play role in corporate performance efficiency increase. 5. High-rank managers should be justified about IT and supply chain agility improvement so that they can invest in implementation of IT-based systems. 6. Firms should employ IT and supply chain experts. 7. Making supply chain agile requires finding effective factors and establishment of relationship between them. Main factors of supply chain agility success are proposed to be identified and investigated. 8. Development of employees' skills, application of IT and appropriate planning are infrastructures in

supply chain. This means that these factors must be considered for agility start. Therefore, higher levels factors agility (merger of processes, sensitivity and response to market, flexibility and delivery speed) are facilitated and leads to customers' satisfaction. 9. Firms should use production technologies which give adequate flexibility to the organization. 10. IT should be used to merge processes. As processes merge in supply chain, agility is strengthened. 11. Systems should be used in a way that main changes in customers' tastes are identified.

The present research proposes the following hints to future researchers: 1. The influence of marketing information systems on supply chain agility should be investigated. 2. The influence of IT on supply chain performance should be measured. 3. Supply chain performance should be evaluated by means of AHP method on suppliers. 4. The influence of IT on supply chain performance over time should be specified in a period of time so that it can be monitored that whether performance grows or not.

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