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The relationship between knowledge management and agile supply chain management: Case study of Jihad-e-Agriculture Organization

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In recent years, different concepts have been expressed about organizational change in which business processes are considered as the conceptual bases for organizational design. Knowledge and knowledge management are the most important factors of progressive organizations that must be used as factors for organizational change and improvement. Acceptance of change and improvement is a primitive assumption to focus on appropriate response to what customers require. The other main factor for organizational change and competition in the recent world is knowledge obtained by employees, where these factors-competition and change- are basic for agile supply chain management. Because the important factors of agile supply chain management are data, information and knowledge, the researchers tend to review the relationship between knowledge management and agile supply chain management. In the present research, the sample size consists of 162 employees (34 women and 137 men) that were selected at random from about 900 personnel of East Azerbaijan Jihad-e-Agriculture Organization. Data analysis was carried out by using the statistical program packages SPSS 17.0 and LISREL 8.54. The results of the present study illustrated that there is a significant relationship between knowledge management (KM) and its dimensions and agile supply chain (ASCM) in the present organization. The results of Enter Regression showed that predictor variables significantly (knowledge creating, knowledge sharing, knowledge structuring, knowledge using and knowledge auditing) determined 76.5% of the variance of ASCM together. Also the result of LISREL statistical software illustrated that the data of present study involve significant goodness of fit.

Key words: Knowledge management, agile supply chain management, structural equation analysis, factor and path analysis, Jihad-e-Agriculture Organization.

INTRODUCTION

In modern organizations, knowledge is the fundamental basis of competition, and information technology (IT) is a necessity critical for managing knowledge (Ofek and Sarvary, 2001). In the new context, one of the major factors which determines the future survival or success of organizations is knowledge (Tsai and Shih, 2004). In other

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words, the success of business increasingly depends on knowledge management (Borges et al., 2007; Saeed et al., 2005).

Knowledge, defined as information combined with experience, context, interpretation and reflection (Davenport et al., 1998), can be divided into explicit knowledge and tacit knowledge (Nonaka, 1994). Knowledge management (KM) is the explicit and systematic management of vital knowledge and its associated processes of creation, organization, diffusion, use and exploitation.

Swafford et al. (2006) believed that agile supply chain is an effective survival factor for general and comprehensive competition of organization. According to Swafford et al. (2006), despite the approved benefits of agile supply chain generally, there are few studies about how an organization can obtain agile supply chain.

Considering the introduction, the present study is going to study the relationship between knowledge management (KM) and agile supply chain management (ASCM) and the effect of KM on improving ASCM. To clarify these issues, the article first discusses ASCM and KM and each of their dimensions; and then it will review the ways ASCM can be developed in organizations using KM.

LIRERATURE REVIEW

Agile supply chain management (ASCM)

One comprehensive definition of organizational agility as expressed by Kidd (2000) is organization which moves quickly, is adoptable and has business integration. These are the abilities in agile organizations and they can respond to unforeseen changes and events, market opportunities and needs.

Parallel progress in agile supply chain management areas has led to the introduction of agile supply chain (Harrison et al., 1999; Christopher, 2000). While agility is accepted as a win strategy for growth chiefly, even if it seems the basic for survival in some of business environment; agile supply chain management idea is expressed as a logical step for organizations. Agility in supply chain, according to theory of Ismail and Sharifi (2005), is the ability of total supply chain and its members to coordinate quickly within network and operations related to consistent turbulent and dynamic requirements and needs of customers.

The main focus on business activities implementation in the network structures is responsible for change, of course considering sufficient level of agility. Agile supply chain is defined as follows based on its general definition:

"Agility is the capability of supply chain to respond quickly to change in marketplace and requests of costumers".
The researchers in the 90s were interested in supporting producers in making agile supply chain systematically.

Van Hoek (2005) illustrated that three characters of supply chain activities can be related to agility directly:

1. Skills in using and enjoying vibration
2. Quick response
3. Unique response or answering in limited volumes.

Moreover, many researchers expressed collections of conceptual approaches that included different references and development models of agility (Kidd, 1994; Dove, 1994; Preiss et al., 1996; Gunasekaran, 1999; Preiss, 1997, 2005; Goldman et al., 1994; Gunasekaran, 1998; Sharp et al., 1999; Christopher, 2000; Sharifi and Zhang, 1999; Weber, 2002).

Swafford et al. (2006) believed that agile supply chain is an effective survival factor for general and comprehensive competition of organization. According to Swafford et al. (2006), despite the approved benefits of agile supply chain generally, there are few studies about how an organization can obtain agile supply chain. Figure 1 shows the primitive model of agile supply chain based on the study of Swafford et al. (2006).

According to the model of agile supply chain presented by Swafford et al. (2006) study items in the present research for measuring the agile supply chain are sensitivity of the market (Christopher, 2000; Christopher and Towill, 2002; Agarwal and Shankar, 2002), virtual integration (Christopher, 2000; Christopher and Towill, 2002), delivery speed, accurate information, introducing new, central planning and integration in the processes (Christopher, 2000), using IT, reducing time of supply and lead time (Cohen and Mallik, 1997; Sharifi and Zhang, 1999), improving the service levels (Stevens, 1989), minimizing and reducing costs, customer satisfaction, quality improvement, minimizing uncertainty, developing the spirit of confidence and increasing the level of confidence (Agarwal et al., 2006), minimizing resistance to changes, reducing the time of new products development (Goldman et al., 1994), increasing the level of customization (Van Hoek et al., 2001), increasing frequency of new products introduction (Goldman et al., 1994), aligning with the global distribution (Goldman et al., 1994), improving the customer services (Goldman et al. (1994), Sharifi and Zhang, 1999), improving the reliability of delivery (Sharifi and Zhang, 1999), improving accountability to market needs (Goldman et al., 1994), reducing the setup time (Sharifi and Zhang, 1999) and improving production capacity (Goldman et al., 1994).

Knowledge management

Knowledge management is based on the idea that an organization's most valuable resource is the knowledge of its people" (National Electronic Library for Health, 2008). There are a number of definitions on knowledge management. For the purposes of this paper, a straight
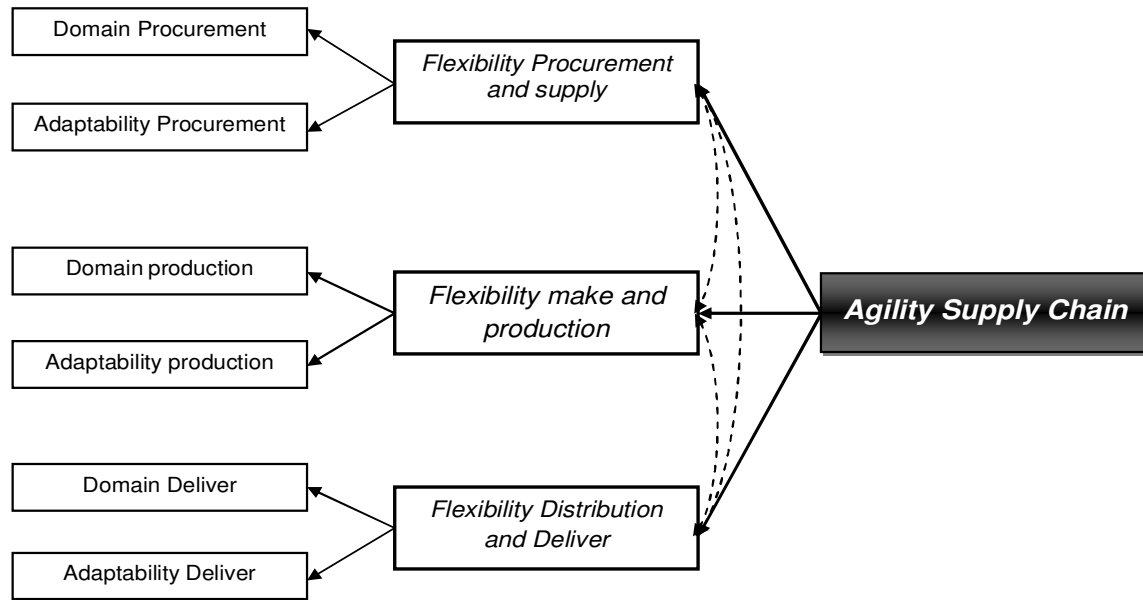
Figure 1. Dimensions of agile supply chain management (Swafford et al., 2006).

forward definition has been selected: "Knowledge management is the systematic process by which knowledge needed for an organization to succeed is created, captured, shared and leveraged" (Clemmons, 2002). Two definitions will be helpful in increasing our understanding of the term; the first is: KM promotes an integrated approach for identifying, capturing, retrieving, sharing and evaluating all enterprises' information assets. These information assets may include databases, documents, policies, procedures, as well as the uncaptured tacit expertise and experience stored in individuals' heads (Malhotra and Galletta, 2005).

The next is: KM is a process used by organizations and communities to improve how business is conducted by leveraging data and information that are gathered, organized, managed and shared. By using both explicit and tacit knowledge, knowledge management helps an organization deliver the right information to the right place and the right person at the right time. Organizations can use knowledge management approaches to fully leverage their information assets. Knowledge management contributes to the integration of systems, tools and processes, fosters the transfer of competence among individuals, and improves individual competence by promoting more efficient use of available information (Association of State and Territorial Health Officials, 2005).

Wong and Aspinwall (2004) suggested that KM model falls into three categories:

1. Knowledge Cycle Processes of Knowledge Management: the most commonly cited model and the one often credited as a foundational model for KM was developed by Nonaka and Takeuchi (1995) to describe the interaction between tacit and explicit knowledge. The so-called SECI model focuses on four different areas of knowledge conversion: socialization, externalization, combination and internalization (Hussi, 2004).

2. Measurement Model: model that measures the effectiveness of KM may provide a reference to facilitate the structuring, analysis and evaluation of the KM initiatives undertaken in various companies (Wong and Aspinwall, 2004). Apostolou and Mentzas (1998) and Lai and Chu (2002) developed model for measuring KM performance.

3. Implementation Model: implementation model for KM recommends a series of steps an organization can follow during the implementation of KM. This model provides a structure or set of guiding principles depicted in such a way to provide guidance and direction on how to carry out KM in an organization (Wong and Aspinwall, 2004), and can also help to determine future plans of action.

One of the major tasks in knowledge management is the evaluation of knowledge. The significance of this evaluation comes specifically from the fact that it brings about knowledge improvement and expansion. However, the first step in "evaluation of knowledge" is the possibility of measuring the level of knowledge (Probst et al., 2000). Glaser stresses that whatever cannot be measured does not exist at all (Glaser, 1998). There is another statement in this regard that "whatever cannot be measured cannot be managed either." This statement has been approved by different sources (Moore, 1999; Probst et al., 2000; Davenport and Prusak, 1998). In fact, in the case where organizations cannot measure their level of knowledge and cannot evaluate the methods of changing their level of knowledge, the cycle of knowledge management will be incomplete. That is because no feedback will be

received to make any improvements in various factors of knowledge management (Probst et al., 2000).

Actually, the model of knowledge management used in this study, based on the literature review (Rastogi, 2000), is expressed as follows:

1. Knowledge Creating: The first stage of managing organizational knowledge requires entering the knowledge kitchen. In other words, exploring knowledge creating stage which can be processed in organization leads us to focus on individual, group and department. If knowledge cannot be created in organizations, neither sharing nor auditing of knowledge can be carried out.

There are too many knowledge creators in knowledge kitchen due to the fact that organization cannot create collective knowledge by itself. Thus, organizational participants create knowledge through their intuition, ability, skills, behaviors and work experiments (Nonaka, 1995: 14).
2. Knowledge Sharing: The second important stage of knowledge management life cycle is knowledge sharing. Capar and Eksioglu (2006) emphasize the ways and tools for effective knowledge sharing as follows:

a. Formal social communication network,
b. Informal social communication network,
c. Teamwork,
d. Communities of practices,
e. Organizational learning,
f. Rumors and,
g. Formal structured technological communication networks (e-mail, mobile communications, teleconferences, videoconferences, etc.).

3. Knowledge Structuring: After constructing a perfect infrastructure system for knowledge sharing, data, information and knowledge should be structured in order to store in organization's database for the future needs. Structuring knowledge is based on sorting, organizing, codifying, analyzing, and reporting information that provides what organization needs in the future (Awad and Ghaziri, 2004).
4. Knowledge Using: Organizations use knowledge for three reasons: (1) Knowledge can be used for determining organization's work processes and making strategies for sustainable competitive advantage. (2) Knowledge can be used for designing and marketing product. (3) Knowledge plays a critical role of organization's services quality (Nonaka, 1995).

Also, Alavi emphasized that knowledge can be used through three basic mechanisms: Directives refer to specific set of rules, standards, procedures and instructions developed through the conversion of the specialist's tacit knowledge to explicit and integrated knowledge for efficient communication to non-specialist. Organizational routines refer to the development of task performance and coordination patterns, interaction

protocols and process specifications that allow individuals to apply and integrate their specialized knowledge without the need to articulate and communicate what they know to others. Self-contained task teams refer to task uncertainty and complexity that prevent the specification of directives and organizational routines, in which teams of individuals with prerequisite knowledge and specialty are formed for problem solving (Alavi and Leidner, 2001: 122).
5. Knowledge auditing: Knowledge auditing means the amount of knowledge that can be used in organization's products, services and processes. This knowledge management life cycle stage refers to the capacity of information processing in organizations.

From the above context the conceptual framework of present study is shown in Figure 2.

Knowledge management and agile supply chain management

In Murali et al. (2009)'s study, titled, 'The impact of knowledge management on supply chain management: A study in Malaysian manufacturing companies', they stated that environmental knowledge is found to have moderating effect on the relationship between Applied Supply Chain Process Knowledge (SCPK) and Organization Performance. This paper demonstrates the application of KM in SCM and shows its effect on Organization Performance. This may guide supply chain managers to create an environment conducive for the acquisition and application of knowledge.

Karine and Goury (2010) did a study titled, 'Knowledge management in supply chain: An empirical study from France'. The results of their study showed that knowledge management (KM) are a major enabler of supply chain management, and is a critical element in intensive information and multi-cultured enterprise environments. Realizing the importance of knowledge management in supply chain (SC), an attempt has been made in this paper to propose a conceptual framework for KM in SC and to validate the framework with the help of an empirical study conducted with French companies. Finally, a summary of findings and conclusions is presented for KM in SC.

Questions of present study

The aims of the present study are to investigate the relationship between ASCM and KM, and how to promote ASCM by using KM. Based on the conceptual framework, the questions of the study are as follows:

1. Are there significant relationships between ASCM and KM and its dimensions?
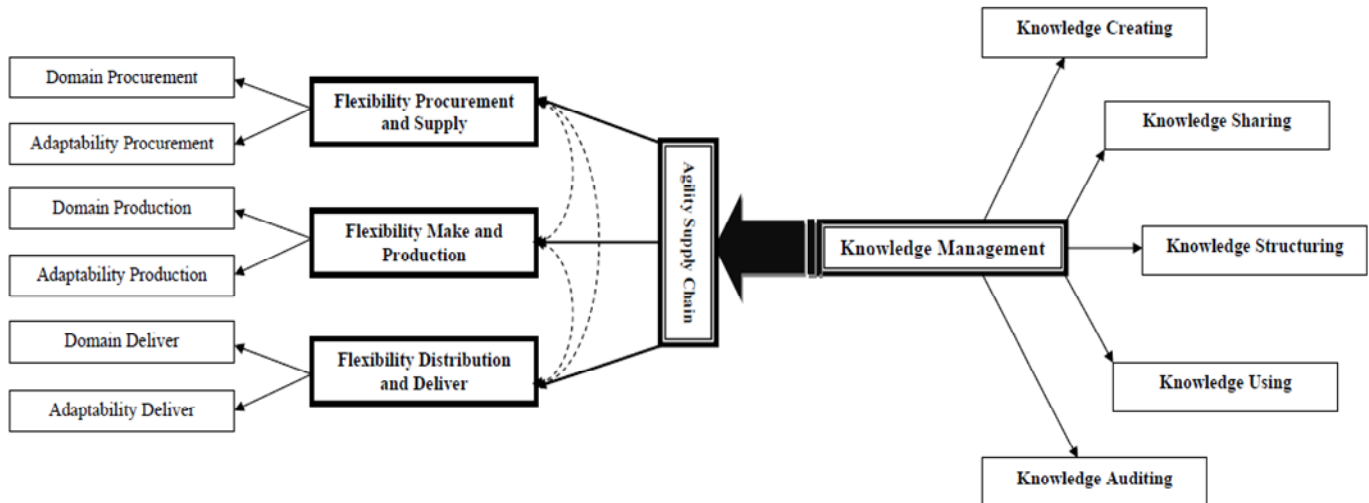2. Is the Regression Equation of ASCM based on dimensions of KM significant?

Figure 2. The conceptual framework of the study.

3. Does the Structural Model of present study based on the data collected have goodness of fitness?

METHODOLOGY

This study was survey research. The sample size of the present study is 162 selected from four of East Azerbaijan Jihad-e-Agriculture Organization by using Krejcie and Morgan's (1970) sample size determining table. East Azerbaijan Province Agricultural Affairs includes all fields related to agriculture, gardening, livestock and natural resources. Also, activities related to livestock and poultry are the duty of this organization.

KM questionnaire was designed by Haddad (2006). It contains 20 items and has five dimensions namely: Creating, Sharing, Structuring, Using and Auditing. Its reliability was reported to be 0.903. ASCM was assessed by researchers according to the most important factors which have effect on ASCM; it has 25 items and 3 dimensions namely: Flexibility Procurement and Supply, Flexibility Make and Production and Flexibility Distribution and Delivery for measuring ASCM in organizations. Its reliability was reported as 0.862. Both are in 7 points Likert-type scale ranging from "I strongly disagree" to "I strongly agree". Data analysis was carried out by using the statistical program packages SPSS 17.0 and LISREL 8.54. Among the respondents, 82% were males and 18%, females; most of the respondents were bachelor and Master Degree holders, which were about more than 80%.

RESULTS

The Pearson correlation for the study variables is given in Table 1. Knowledge management (KM) and its dimensions correlated with Agile Supply Chain (ASCM). KM and its dimensions were significantly related to ASCM and its dimensions. The results of Table 1 illustrate that there is a positive relationship between all items.

In Table 2, the significant predictors (Creating, Sharing, Structuring, Using and Auditing) determine 76.5% of the

variance of ASCM. To predict creation based on KM and its dimensions, p-variable regression was applied; KM as predictor variable and ASCM as dependent variable were analyzed.

Data of Table 3 illustrated that KM and its dimensions predict ASCM. Eventually, for each increase or decrease in dimensions of KM, there is the same change in ASCM. As shown in Table 4, *Knowledge Creating* has satisfied the entrance criterion of the regression and entered as a first important predictor (Beta = 0.545). In second step, *Knowledge Structuring* has satisfied the entrance criterion of the regression and entered as a second important predictor (Beta = 0.489). In third step, *Knowledge Auditing* has satisfied the entrance criterion of the regression and entered as a third important predictor (Beta = 0.137). In fourth step, *Knowledge Using* nearly satisfied the entrance criterion of the regression and entered as a fourth important predictor (Beta= - 0.115). However, the other dimension of KM namely *Knowledge Sharing* could not satisfy the entrance criterion of the regression. The regression equation of ASCM on KM and its dimensions are as follows:

ASCM = 0.545 (Creating) + 0.489 (Structuring) + 0.137 (Auditing) + (-0.115) (Using)

In accordance with Byrne (1998), a ratio of χ^2 to Degree of Freedom (DF) of less than 3 was generally considered an indicator of good model fit, and a ratio of less than 5 was considered acceptable. An adjusted goodness-of-fit index (AGFI) of more than 0.90, a root-mean-square error of approximation (RMSEA) of less than 0.08, Root Mean Square Residual (RMR) of less than 0.045 and a normal fit index (NFI), Non-Normed Fit Index (NNFI), Comparative Fit Index (CFI) and Incremental Fit Index (IFI) of more than 0.90 were considered indicators of "good fit". Given their complementary features all four

Table 1. Pearson correlation coefficient between km and ascm and their dimensions (N=162).

Pearson correlation	Correlations			
	Flexibility procurement and supply	**Flexibility make and production**	**Flexibility distribution and delivery**	**Agile supply chain management**
Knowledge creating	0.679**	0.645**	0.409**	0.711**
Knowledge sharing	0.372**	0.380**	0.483**	0.483**
Knowledge structuring	0.421**	0.452**	0.869**	0.660**
Knowledge using	0.182*	0.292**	0.841**	0.472**
Knowledge auditing	0.411**	0.340**	0.600**	0.526**
Knowledge management	0.568**	0.581**	0.912**	0.795**

**, Correlation is significant at the 0.01 level (2-tailed);*, correlation is significant at the 0.05 level (2-tailed).

Table 2. Model summary of regression of KM and ASCM (n=162).

R	R^2	Adjusted R^2	Std. error of the estimate
0.874[a]	0.765	0.756	0.28640

[a] Predictors: (Constant), creating, sharing, structuring, using and auditing.

Table 3. ANOVA of KM and its dimension on the ASCM (n=162).

Model	Sum of squares	DF	Mean square	F	Sig.
Regression	34.886	5	6.977	85.060	0.000[a]
Residual	10.746	131	0.082	-	-
Total	45.632	136	-	-	-

[a] Predictors: (Constant), creating, sharing, structuring, using and auditing. Dependent variable: ASCM.

Table 4. Regression analysis to predict km and its dimension on the ASCM (n=162).

Predictor variable	B	Std. error	Beta	T	Sig.	O.K. or Not
(Constant)	0.380	0.172	-	20.210	0.029	O.K.
Knowledge creating	0.461	0.043	0.545	100.750	0.000	O.K.
Knowledge sharing	0.090	0.058	0.075	10.534	0.127	Not
Knowledge structuring	0.366	0.041	0.489	80.903	0.000	O.K.
Knowledge using	-0.087	0.044	-0.115	-10.961	0.052	Near to O.K.
Knowledge auditing	0.102	0.040	0.137	20.572	0.011	O.K.

indexes were used to evaluate the path model.

In this model, we use an abbreviation of criteria dimensions (Knowledge Creating = KCR; Knowledge Sharing = KSH; Knowledge Structuring = KST; Knowledge Using = KUS; Knowledge Auditing = KAU; Flexibility Procurement and Supply = FPS; Flexibility Make and Production = FMP and Flexibility Distribution and Delivery = FDD; Domain Procurement = DPR; Adaptability Procurement = APR; Domain Production = DPO; Adaptability Production = APO; Domain Delivery = DDE and Adaptability Delivery = ADE).

The data in Figures 3 and 4 and Table 5 illustrated that the exploratory model, including all hypothesized variables provided an adequate fit (x^2 = 112.86; DF = 41; p = 0.33668; a ratio of X^2 to DF of less than 3; goodness of fit index [GFI] = 0.91; adjusted goodness-of-fit index [AGFI] = 0.87; root-mean-square error of approximation [RMSEA] = 0.067 and [RMR] = 0.037) for the data and indicated the relationship between KM and ASCM because of the strong direct effects of KM on ASCM. The figures are respectively structural equation modeling (Estimate State and T-value) and the model summary of goodness of fit statistics. All data are in conformity with
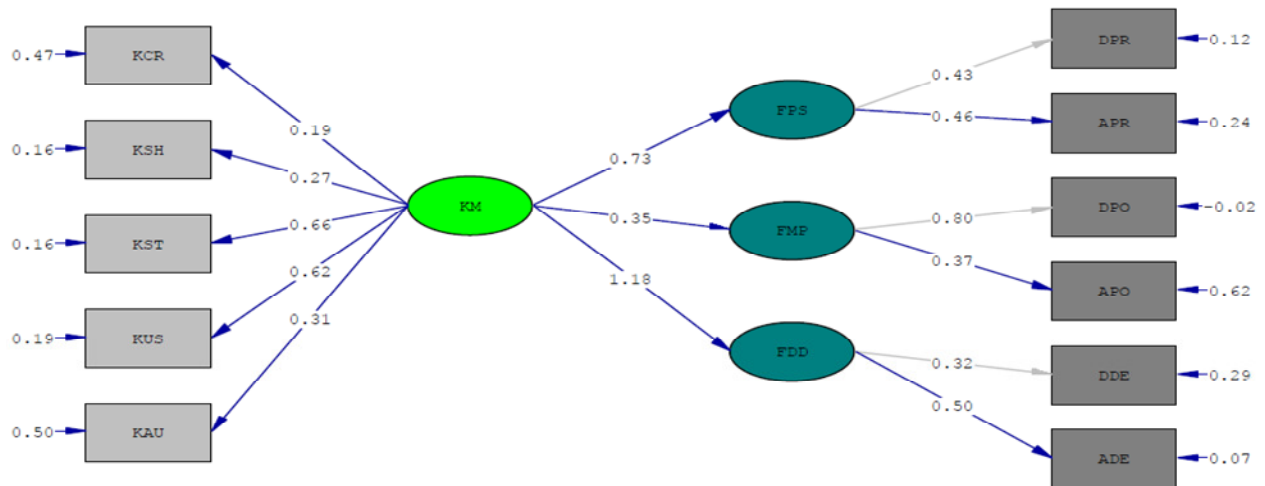
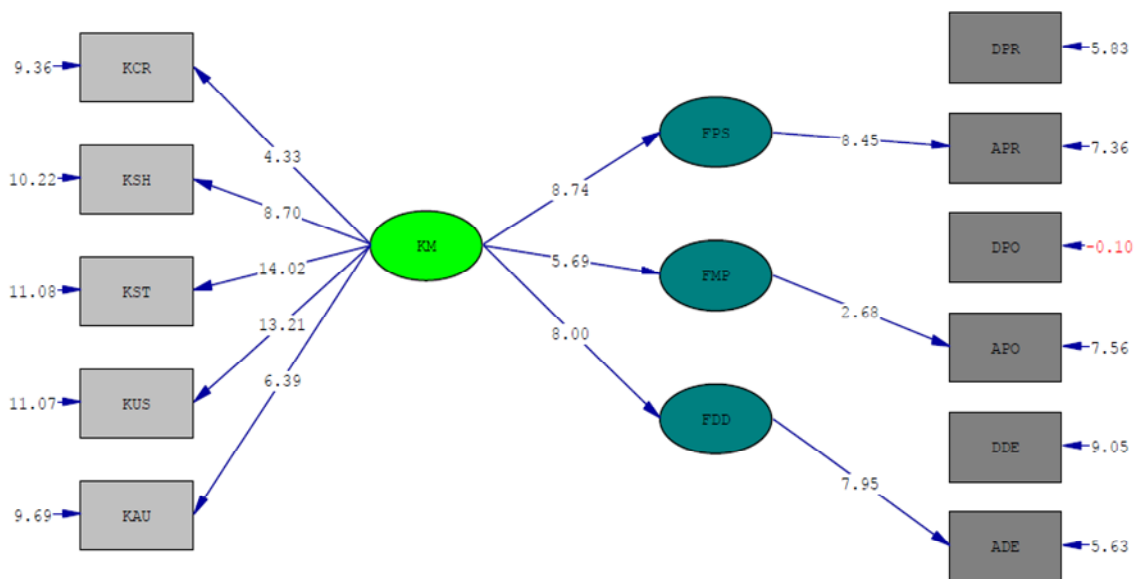**Figure 3.** Structural equation modeling (estimate state) of KM and ASCM.

Figure 4. Structural equation modeling (T-Value) of KM and ASCM.

Byrne's (1998) procedures.

DISCUSSION AND CONCLUSION

The results of Table 1 illustrated that there is a positive and significant relationship between KM and ASCM, hence it can be concluded that there is direct relationship between these two items, and increase or decrease in KM has direct effect on ASCM. So, the result of Table 1 which represents the first question of present study is acceptable.

The results of Table 2 revealed that significant predictor variables, namely *Knowledge Creating, Knowledge*

Sharing, Knowledge Structuring, Knowledge Using and Knowledge Auditing determine 76.5% variance of ASCM. Also, according to results of Table 4, *Knowledge Creating* is more significant than the others. This means that present organizations pay attention to other dimensions of KM such as *Knowledge Creating* item. This is because we have an ASCM organization which can promote KM totally. So, the results of Tables 2 to 4 which represent the second question of the present study are acceptable. Likewise, Table 5 and Figures 3 and 4 indicated that there is a relationship between KM and ASCM because of the strong direct effects of organizational KM on ASCM. Also, it can be said that present model for measuring all items is favorable. So, the result of Table 5

Table 5. Model summary of goodness of fit statistics (N=162).

Chi-square	DF	RMSEA	GFI	AGFI	NFI	NNFI	CFI	IFI	RMR
1120.89	41	0.067	0.91	0.87	0.94	0.91	0.93	0.91	0.037

$$\begin{cases} KM = 0.19 * FPS + 0.35 * FMP + 1.18 * FDD; \\ FPS = 0.43 * DPR + 0.46 * APR; \\ FMP = 0.80 * DPO + 0.37 * APO; \\ FDD = 0.32 * DDE + 0.50 * ADE. \end{cases}$$

and Figure 3 and 4 which represent the third question of present study are acceptable.

The results of the third question have shown that the dimensions of each concept related to Km and ASCM are acceptable for witting structural and regression equations. Also, it is illustrated that the score of correlation between every dimension of KM and ASCM is comfortable with Pearson correlation (Table 1). The structural equation is as follows (Figure 3): The findings of all questions of present study are in conformity with researches of Murali et al. (2009) and Karine and Goury (2010).

Increases in ASCM require the using of some strategies such as paying attention to the virtual integration, delivery speed, accurate information, introducing new, central planning integration in the processes, using IT, reducing time of supply and lead time, improving service levels, minimizing and reducing costs, customer satisfaction, quality improvement, minimizing uncertainty, developing the spirit of confidence and increasing the level of confidence, minimizing resistance to changes, reducing the time of new products development, increasing the level of customization, increasing frequency of new products introduction and also increasing the horizontal and vertical relations between units of organization, and preparing backgrounds for improving trust among people of organization and management, creating close communication between managers and staffs by preventing the heterogeneity and not preventing informal networks' growth, so that ASCM for each organization is very important and vital. But these works are not possible unless the organizations increase their organizational knowledge. KM is an important element for ASCM, and we are going to propose to organizations which tend to increase agility of supply chain to increase their KM both at organizational and employee levels. This is because increasing KM in organization is converting the organization from static mode to dynamic mode that is knowledge-based. On the other hand, for increasing KM in organizations we need to improve confidence among employees than to share their knowledge in organization.

The results of data analysis in the present study prove the hypotheses theoretically, because any organization which has high KM can lead to the growth of new ideas of their employees, by using informational transaction among people in the organization. And these new ideas will result in agility, which in turn would improve the supply chain in the organization.

Finally, to achieve success with supply chain management (SCM), an organization must possess KM about the different facets of the supply chain. Organization can increase the agility of supply chain by using information creating, knowledge sharing and knowledge using between members.

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