International Journal of Computer & Information Technologies (IJOCIT)
www.ijocit.org & www.ijocit.ir
ISSN = 2345-3877

Comparing and Applying the Approach of Supply Chain in Electronic Services Management

Hoda Ghavamipoor[1], S.Alireza Hashemi Golpayegani[2]
Department of Computer Engineering and IT[1], Amirkabir University of Technology[2]
Tehran[1,2], Iran[1,2]
{h.ghavamipoor[1], sa.hashemi[2]}@aut.ac.ir

Abstract:- With developing the use of digital systems, presentation of a large number of public services electronically is so prevailed. For supplying and producing electronic services in virtual space, various components and entities have relation to each other and compose a chain of components. Therefore, the approach of supply chain can also be used for supplying and producing electronic services. The main purpose of this paper includes applying the concept of supply chain in providing and managing electronic services. Furthermore, we propose the framework and structure of decision-making issues in electronic service supply chains (ESSC) based on comparing with decision-making issues in industrial supply chains (non-electronic services and goods) as well as classifying the approaches and solution methods of recognized issues in the area of electronic services supply chain.

Keywords: Supply chain, Electronic commerce, Electronic services, Supply chain Management, Quality of service.

1. Introduction

Over two last decades with developing information technology it was revealed a modern attitude of business called electronic business.

Internet provides new conditions in which suppliers, producers, distributors, retailers, wholesalers, customers, and all the entities involved in supply chain are able to have relation with each other in common virtual space and to exchange information, services, goods and money. So managing this chain became important and makes a variety studies and researches about it [1-12]. This management is the way in which the resources required for supplying the needs of customers plan, lead, and control.

Most research conducted about managing supply chain in the area of internet has dealt with designing and implementing electronic systems for management of industrial supply chain, called it as E-SCM or electronic-supply chain management. These studies aim at using the tools and resources of information technology for managing industrial supply chain better and more efficient.

On the other hand, internet and virtual space is a source of establishing another kind of business as electronic business which its product is electronic service. Various components and entities have relation to each other for supplying and producing electronic services virtual space. Therefore the approach of industrial supply chain can also be used for producing services to customers with having management and control uniformly among its components efficiently. The main purpose of this paper includes applying the concept of supply chain in providing and managing electronic services. Furthermore, we propose the framework and structure of decision-making issues in electronic service supply chains (ESSC) based on comparing with decision-making issues in industrial supply chains (non-electronic services and goods) as well classifying the approaches and solution methods of recognized issues in the area of electronic services supply chain.

In the next section some of the basic concepts of ESSM and the notation used in this paper were defined. In third section we will review some of the most important issues of industrial supply

chain management and the approaches and solution methods in this area. After that in forth section we represent the framework and structure of decision-making issues in electronic service supply chain and analyzing them, based on comparing with decision-making in the industrial supply chains and finally in fifth section conclusions and recommendations about next studies and researches will be proposed.

2. The Essential Concepts

Before we reconsider and compare structure and issues of decision-making between industrial supply chains and electronic service supply chain. We review the concepts of the electronic service supply chain and the notation used in this paper. The essential concepts are as follows:

- ✓ **Electronic Service**

Every kind of service receivable through internet and communication networks in virtual space.

- ✓ **Electronic Goods**

Every kind of digital content receivable through internet and communication networks.

- ✓ **The Producer of Electronic Services and Goods**

A component of ESSC which is creator of the electronic services or goods through compounding services and basic electronic steps presented by suppliers, resulted in making increased value and finally presenting through networks in virtual space.

- ✓ **The Supplier of Electronic Service or Goods**

A component of ESSC supplying basic goods and services such as communication or storage services for using it in the level of producer of services and goods.

- ✓ **The Distributor of Electronic Service or Goods**

A component of ESSC receiving electronic services from the producer of electronic services in high capacity and presenting it to retailer in little capacity.

- ✓ **The Retailer of Electronic Service and Goods**

A component of ESSC receiving electronic services from its distributor in high capacity and presenting it to customer within communication network in virtual space.

- ✓ **Electronic Inventory**

Including recorded data in various formats such as file, database tables or other formats in any component of ESSC.

- ✓ **Industrial Supply Chain**

A supply chain is a network of suppliers, producers, distributors and retailers who are changing row materials to final production and are delivering to customers. So far the approach of supply chain has widely been used for non-electronic services and goods.

Throughout the paper the following notation (Table 1) is used.

3. Industrial Supply Chain Management

3.1. The Main Problems in Industrial Supply Chain Management

Hereafter, we review some of the most important supply chain management problems.

Table 1: Notations

Constant	C
Stochastic	S
Multi Product	Mpro
Single Product	Spro
Multi Material	MMAT
Single Material	SMAT
Single Layer	SL
Multi Layer	ML
physical-Product	Ppro
Physical-Service	Pserv
Electronic-Product	Epro
Electronic-Service	Eserv
RETailer	RET
PROducer	PRO
Supplier	SUP
DIStributor	DIS

3.1.1. Coordination in Industrial Supply Chain

As supply chain members are often separate and independent economic entities, a key issue in SCM is to develop mechanisms that can align their objectives and coordinate their activities so as to optimize system performance. It have been conducted detailed studies within industrial chain [14-16], which their aim is making an stability in decision-makings, planning, and

strategic relation between the total components of chain to raise total efficiency of chain other than managing and controlling phenomena such as Bull whip effect.

3.1.2. Facility Location Problem in Industrial Supply Chain

Another important supply chain management problem in strategic level is determining the best location for settling the components of supply chain. Therefore, it is necessary that where indicated the location of settling facilities of chain components including settlement location of producers, suppliers, distributors, retailers and also how allocate facilities for supplying customer demands. As the facility location problem in related researches and papers [18-19] were reconsidered in three states:

- ✓ A state of p-median: In this state p location of candidate locations for settlement facilities is selected as it is minimizing their cost or distance for supplying customer demands in this state, it suppose that set up cost is equal for all facilities.
- ✓ Un-capacitated Facility Location Problem: If set up cost of facilities is different in p-median state, problem is defined in UFLP state. In this state, it is supposed that the capacity of supplying the demand of all customers is exceeding. In states, UFLP and p-median, any customer is allocating to a location which include minimum distance.
- ✓ Capacitated Facility Location Problem: There is another development about facility location problem in which a series of exogenous parameters is considering as maximum demand supply able by a potentially site, called CFLP. In this state dislike p-median and UFLP states there is not necessary that closest customer allocation to facilities is the best allocation.

3.1.3. Inventory Management in Industrial Supply Chain

Since inventory maintenance can impose many overload costs to supply chain and is caused raising final value thus inventory management problem is one of the key problems of tactical level in supply chain management.

In this area it is conducted the detailed studies [20-22] in which were attempt to was closed the quantity of maintained inventory to its optimal quantity. Also JIT policy was continued in these studies in which inventory in different components of supply chain is tending to zero in order to minimizing chain costs through controlling production quality and also managing transportation desirably.

3.1.4. Demand Management in Industrial Supply Chain

Demand management is one of the important tactical level problems in efficient management of supply chain. In fact the process of demand management aims to achieve a balance between the needs of customers on one hand and on the other hand the capacities of supply, produce and distribution in chain by supervising, controlling and forecasting demands.

It is noticeable that demand quantity is one of the most important resources of making the uncertainty in supply chain, then the accurate estimating and forecasting of customer demands and its management in final success of supply chain plan is so officious. Some issues reconsidered [23-24] in demand management of supply chain, including estimating and forecasting required goods of customers, forecasting the time of shopping of customers, coordination and sometimes accompanying between customer demands and production rate, logging and managing their information in order to decreasing non-certainly, determining the resources for supplying customer demands and other similar problems.

3.1.5. Transport Management in Industrial Supply Chain

Regarding to the layer structure of supply chain, after completing the process of processing products in any layer, it is necessary to

transporting them to the next layer. Some issues reconsidered [25-27] in transportation management of supply chain, including scheduling transition time between different layers, synchronization inventory amount in each layer and the transportation of goods to it, determining the optimal mode for transferring goods between different layers, Determining the optimal route for transferring goods between different layers and other issues like this.

3.1.6. Operational Integrity in Industrial Supply Chain

Now one of the operational level problems in industrial supply chain management is to maintain operational integrity between chain components, their plans and activities, according to supplying the demands of end customers. Predominant concentration of conducted studies and researches [28] had been for making operating program within industrial supply chain by sharing information among supply chain components, programming harmoniously, and using the tools of information technology specially work flow management systems for the progression and improvement of the efficiency of supply chain.

3.2. Main Purposes in Industrial Supply Chain Management

To raise efficiency and effectiveness of whole chain, industrial supply chain management is continuing different purposes which some of the most important of them are maximizing total profit of chain, minimizing the costs of chain, maximizing the revenue of chain, delivering customer orders on-time and another cases such these.

3.3. Decision-Making Models in Industrial Supply Chain Management

Numerous models are used in industrial SCM for modeling various decision-making problems, following some of them:

- ✓ Analytic models based on mathematical programming
- ✓ Game theory based models
- ✓ Simulation based models
- ✓ Graph and network theory based models

3.4. Solving Methods for Industrial Supply Chain Management Problems

Numerous methods used for solving the different problems of SCM, following some of them:

- Mathematical programming methods
- Numerical methods
- Evolutionary and heuristic algorithms
- Game theory
- Simulation
- Graph and network algorithms

4. Electronic services supply chains

Electronic services supply chains including a network of the suppliers, producers, distributers, and retailers of electronic services have relation to each other in virtual space. Chain components are supplying final product (electronic services and goods) and providing customers through digital communicative networks such as internet. Here at this section we review the framework and structure of decision-making problems within electronic service supply chain, and analyzing them based on comparing with decision-making problems within industrial supply chains.

4.1. The Framework & Architecture of Electronic Services Supply Chain

The total framework and architecture of electronic services supply chain is represented in Figure 1. In this figure various layers of chain have relation to each other through communicative networks such as internet and intranet.

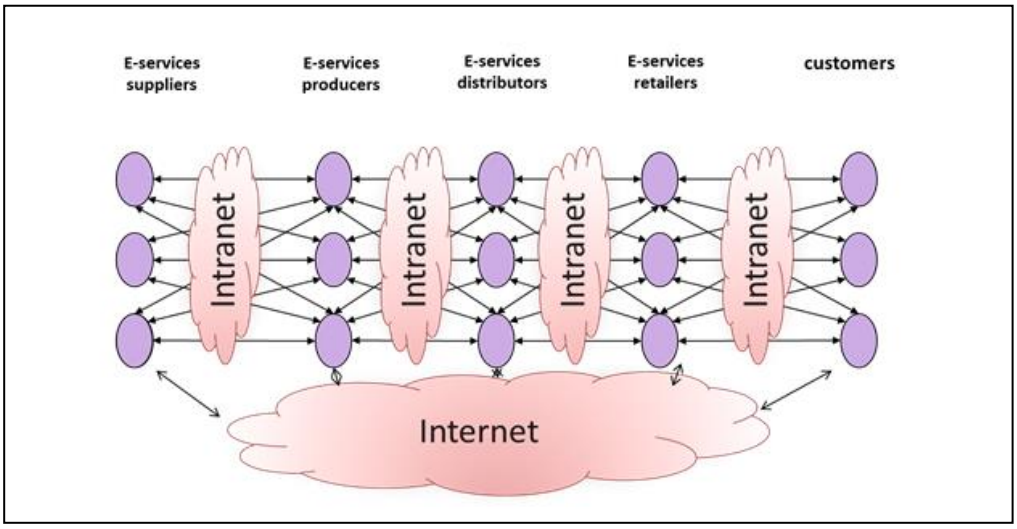

Figure 1: Total architecture of electronic service supply chain

4.2. Distinctions between Industrial and Electronic Services Supply Chain

Generally, most important different aspects of these two kinds of supply chain are high flexibility and dynamics of virtual space which is the context of electronic services.

In virtual space, we faced with high uncertainty of customer demands, variety of provided electronic services and goods, competition of electronic service providers, and very short acceptable responsibility time. Therefore, the planning and delivery of electronic services in the supply chain components should be dynamically. For example, in electronic services supply chain the capacity of providing different services in any chain should able to be converted each other based on the frequent of customer demands or the role of any component at every moment based on the quantity of customer demands and chain conditions should be determined, that is, a component According to its environment and chain conditions may play the role of producer at the moment and at the another moment the role of distributer and so on. Furthermore, managing these changes can be done centrally or distributed in electronic supply chain.

As well as the development of distributed commercial systems such as cloud computing, electronic supply chain components are able to increase or decrease their own capacity in required basis at any moment to providing electronic services supply chain and providing high flexibility in chain level.

4.3. Comparative Analysis of Main Problems in Electronic Services Supply Chain Management

Hereafter, we reconsidered problems in third section within electronic services supply chain management and suggesting their diffractions and similarity aspects.

4.3.1. Coordination in Electronic Services Supply Chain

Coordination among the components of the chain is essential for optimal performance. However, due to the rapidly changing environment, such as customer demands,

diversity of services and the like, a good supply chain coordination mechanism should be enough dynamic and flexible. One of the most important strategies for increasing the level of coordination in industrial supply chain is organizing information and making timely access to information of components to make decisions correctly. According to [16], in studies of this approach in the area of industrial supply chain, the profit increasing up to 35% have been reported. Similarly, in electronic services supply chain information sharing and coordination through the proper management of components' data is very effective but perhaps a most important diffraction aspect in order to sharing information is very high speed required for updating components' information. In industrial supply chain, information transmission can mostly be done periodically but in electronic service supply chain because of fast environment changes, it is necessary to transmission updated components' information immediately.

In electronic services supply chain capacity changes, increase or decrease, is perfectly possible in various components of chain regarding to distributed systems such as cloud systems. This flexibility for changing the capacity of the components makes coordination mechanism among chain components more dynamic and complicated than industrial supply chain.

Due to its dynamic nature of electronic services supply chain, changing and transforming components' capacity is more feasible than industrial supply chain and this specialty should be reconsidered in designing the mechanisms done in order to coordinate the components of electronic services supply chain.

4.3.2. Facility Location Problem in Electronic Services Supply Chain

In electronic services supply chain supply chain like industrial supply chain, the location of settling facilities such as servers, routers, and other required equipments for providing electronic services have an important role in

supplying customer demands properly, decreasing the distribution and production costs and increasing chain's efficiency.

In spite of industrial supply chain the equipment's and facilities of different components are too similar in electronic services supply chain. Furthermore, the facilities provided by new distributed systems such as cloud systems makes it possible for different members of the chain to play the appropriate role of either the manufacturer, distributor and supplier at any moment and even for any user request. On the other words, the role of each facility can be a function of its location and also its location can be a function of its role based on the customer demands and conditions of supply chain. Also multi electronic services supply chain can determine the location of providing services based on the location of customer demands and can transform different services capacity to allocate customers with facilities by minimum possible time and cost.

For mapping facilities to customers in electronic services supply chain in particular, it is noticeable that if mobile customers use services then the mapping of facilities is required to be done dynamically.

4.3.3. Inventory Management in Electronic Services Supply Chain

At here such as industrial supply chain holding inventory is expenditure but usually it is not avoidable to maintain inventory for supplying customer demands. The important specialty of electronic inventory than inventory in industrial supply chain is its reusability. Therefore a noticeable problem in electronic inventory management is that electronic inventory was maintained with regard to customer demands as the number of its frequent usages is more. So the cost of holding inventory is decreasing.

4.3.4. Demand management in electronic services supply chain:

In electronic services supply chain like industrial supply chain, demand is an important factor in

making uncertainty, therefore forecasting, controlling and managing it is very important. In addition, the provision of electronic services, such as Web services, due to the wide selection of customers, variety of products, and intense competition of service provider and high uncertainty of demands is more complicated.

Regarding to available infrastructure in electronic services and transactional information of customers in different components of chain, the pre-conditions required for using analytical and forecasting tools like business intelligence including data mining, customer relationship management, decision support systems … is providing and with using them the total efficiency of supply chain can increase. The study and survey of using these tools and their role in total efficiency and profit of electronic services supply chain system and demand management by this way can be one of the most important problems in this area.

Another important dimension of demand management is how customer demands is supplying, supplying demand from available inventory or producing services, regarding to high speed of the responsibility of cyber space within electronic service supply chain. According to the reusability of electronic inventory said in previous section, indicating the models of customer requests, maintain inventories which have high frequent use, and supplying customer demands with the method is one of the most important problems of electronic services demand management.

4.3.5. Communication Network Management in Electronic Services Supply Chain:

Transportation management among different chain layers, in electronic services supply chain can be called as selection and management of digital networks among layers. In addition to effective factors on transportation management within industrial supply chain such as transportation mode, transportation cost, network routing, in the communication network management of

electronic services supply chain another factors should also be reconsidered. Some of these special factors including information security, reliability, stability in different remittance routes and the ownership of networks (public or private). The way that these factors effect on decision-makings related to the communication network management of electronic services supply chain management is one the important issues in this area.

4.3.6. Operational Integrity in Electronic Services Supply Chain:

The preservation of integrity among the components is an important problem in electronic services supply chain and is very similar to establishing integrity among the components of industrial supply chain.

Generally operational integrity problem in electronic services supply chain is reconsiderable from two aspects, operation and data; in both we have some diffractions and similarities to industrial supply chain. At the operation aspect, commonly work flow process and the performer of each process is visible but this performer change instead of providing services in any time and this specialty makes establishing integrity among the chain components of electronic services supply chain more intricate. At the data aspect, mostly storage formats and data updating frequents is constant in industrial supply chain whereas in electronic services supply chain these can change, so establishing data integrity among components is more complicated.

4.3.7. Experimental Results

The results of comparing problems of electronic services supply chain management is mentioned in Table 1. These results are indicated the comparing results of above problems in industrial supply chain with electronic services supply chain.

Table 1: Comparing the main management problems of industrial supply chain with electronic services supply chain

Issues		Industrial Supply chain (ISC)	E-services supply chain (ESSC)
Coordination	Coordination through information sharing	Usually periodically informatio	Usually on-line information sharing

		n sharing	
	Coordination by changing the value of supplying, production and distribution in different layers of chain	Changing the value is restricted to component s' capacity	By using cloud systems, the value changes dynamically and without restrictions
	Coordination by changing the capacity of each component for each product	Usually the capacity of each component for each product is fixed (in a period)	The capacity of services dynamically can change to each other in each component
	Coordination by changing the role of nodes	Usually the role of each component is fixed in a period of time	The role of nodes dynamically can change based on the chain's conditions
Facility location	**Location of facilities**	Usually is permanent for a long time period	By using cloud systems, the location of components can change dynamically to preserve customers' QOS
	Mapping the facilities to mobile customers	Often no mobile customers	Dynamic mapping of facilities to mobile customers
	Changing the capacity of products for optimal mapping of facilities to customers	Usually the capacity of each product is fixed (in a period)	for optimal mapping can change the capacity of products
Inventory management	**A supply chain without inventory**	Applying JIT policy	Presenting real-time services
	Reusability of inventory	Often not reusable	Often reusable
Transportation management	**Decision making factors**	Transmission mode, cost, capacity, routing method	Transmission mode, cost, capacity, security, reliability, routing method, ownership of network(public/private)
Operational integrity	**Integrity of operations**	Usually the steps and the performer of each step are predetermined. (structured process)	Usually the steps are determined but the performer of each step may change for every request
	Data integrity	Often the storage format and frequency of data updating is fixed	Often the storage format and frequency of data updating changes dynamically

4.4. Possible Purposes in Electronic Services Supply Chain Management

In order to raise the total efficacy and efficiency of chain, electronic services supply chain management is continuing various purposes, such as; maximizing that total profit of chain, minimizing chain costs, maximizing the time of responsibility to customer, and maximizing the quality of providing electronic services.

4.5. Various Dimensions of Decision-Making in Electronic Services Supply Chain Management

Various dimensions of decision-making in electronic services supply chain management problems including chain components and their attributes have been indicated in Table 2. Each of these attributes in different problems can be suggested as the parameter or the variable of decision-making.

Table 2: Various dimensions of decision-making in electronic services supply chain management problems

Index	Component	Attribute	Attribute's code	Types of value
1	Customer	Location	CL	C, S
		Demand	CD	C, S
		SLA parameters	CSLA	C
2	Each node of chain (X)	Cost	XC	C, S
		Processing capacity	XPCAP	C, S
		Storage capacity	XSCAP	C, S
		Inventory level	XSAV	C, S
		Role	XR	{RET, DIS, PRO, SUP}
		Number of possible roles	XNR	1..4
		Number of processing resources for each service	XPR	1..n
		Number of storage resources for each service	XSR	1..n
		Network bandwidth	XBW	1..n
		Type of resources assignment	XTA	Dedicated, Shared
		Set-up time	XST	Dedicated, Shared
		Assignment to other nodes	XA	Dedicated, Shared
		Number of services	XNS	1..n
3	Communication network	Routing method	Route	C, S
		Transmission mode	Mode	C, S
		Capacity of links	NCAP	C, S
		Number of links	NL	1..n
		Reliability rate	NR	[0,1]
		Security rate	NS	[0,1]
		Type	NT	Private, Public
7	Level	Strategic	STL	Dynamic, Periodic
		Tactical	TAL	Dynamic, Periodic
		Operational	OPL	Dynamic, Periodic
8	Product	Type	TP	EPro, EServ
		Bill of service	BOS	C, S
		QOS	QOS	C
		Number of basic services	NPS	1..n

The following Table shows some examples of electronic services supply chain management

issues with regard to goals, parameters and variables are shown:

Table 3: Purpose, parameters, and variables of electronic services supply chain management problems

Index	Problem definition	Purposes	Parameters (Type of value/attribute)	Variables (Type of value/attribute)
1	**Determinig role and assignment of components dynamically with demand uncertainity assumption**	Minimizing total cost Minimizing response time	S/CD, C/CSLA, S/CX, S/XPCAP, S/XST, Dynamic /STL	S/XR, S/XNR, S/XA
2	**Determining the required capacity of each component for each service dynamically in multi-service supply chain with using cloud providers assumption**	Prividing required QOS Maximizing total income	C/CL, S/CD, C/SLA, S/XC, C/XR, C/XNR, C/XNS, C/XQOS, S/SDC, n/NPS, Dynamic /STL	S/XPCAP, S/XSCAP, S/XA
3	**Determining the location of servers and mobile customers allocation to them dynamically**	Prividing required QOS Minimizing total cost	S/CL, S/CD, C/CSLA, S/CD, C/XPCAP, C/XSCAP, S/XST, C/QOS, S/SDC, Dynamic /STL	S/XR, S/XNR, S/XNS, S/XA
4	**Determinig the type and amount of electronic inventory ineach component dynamically with demand uncertainity assumption**	Prividing required QOS Maximizing total income	S/CD, C/SLA, S/XC, C/XSCAP, C/XR, C/XNR, C/XA, C/XQOS, C/SDC, Dynamic /TAL	S/XNS, S/XSAV
5	**Dynamically detrmining the number of services in each node and the role of node in supplying it with demand uncertainity assumption**	Prividing required QOS Maximizing total profit	S/CD, C/SLA, S/XC, C/XPCAP, C/XSCAP, C/XST, C/XQOS, C/BOS, Dynamic /STL	S/XNS, S/XR, S/XNR, S/XA, S/NPS
6	**Dynamically detrmining the optimal BOS for user-level services with uncertainity in price and amount of supplied basic services**	Minimizing response time Minimizing total cost	S/CD, C/SLA, S/XC, C/XPCAP, C/XSCAP, C/XST, C/XQOS, Dynamic /STL	S/BOS, S/NPS
7	**Dynamically detrmining the resources' assignment to each service and the type of assignment (dedicated or shared) with demand uncertainity assumption**	Prividing required QOS Minimizing total cost	S/CD, C/SLA, S/XC, C/XPCAP, C/XSCAP, C/XA, C/XNS, C/XQOS, Dynamic /OPL	S/XSR, S/XPR, S/XBW, Dedicated ? Shared/ XTA

4.6. Solving methods for electronic services supply chain management problems

The solution methods related to industrial supply chain such as numerical methods, linear and nonlinear programming, simulation,

game theory can be used for solving various problems of ES supply chain management.

Additionally software engineering methods can also be used in order to measuring the level of customer level, the speed of responsibility to customers and the quality of providing electronic services regarding specially in electronic services supply chain.

5. Conclusion and future works

In this paper, industrial supply chain framework and structure of management issues in this area was expanded to electronic services and the decision-making problems in electronic services supply chain were analyzed based on comparing with decision-making problems in industrial supply chain.

In addition, new issues and challenges were proposed specifically in the field of electronic services supply chain management.

The following cases are suggested as our future works:

- Modeling and solving problems were proposed in this paper specially related to electronic services supply chain management.
- Comparing other available problems in industrial supply chain with electronic service supply chain.

References

[1] Eric Johnson M. and Whang S., "E-Business and Supply Chain Management: An Overview and Framework". Productlon andOperanons Management, vol. 11, No. 4, 2002.

[2] Grieger M., "Electronic marketplaces: A literature review and a call for supply chain management research". European Journal of Operational Research, vol.144, 2003, pp. 280–294.

[3] Xue X., Wang Y., Shen Q. and Yu X., "Coordination mechanisms for construction supply chain management in the Internet environment". International Journal of Project Management, vol.25, 2007, pp. 150–157.

[4] Skjøtt-Larsen T., Kotzab H. and Grieger M., "Electronic marketplaces and supply chain relationships".Industrial Marketing Management, vol. 32, 2003, pp. 199–210.

[5] Lancioni R. A., Smith M. F. and Jensen Schau H., "Strategic Internet application trends in supply chain management". Industrial Marketing Management, vol. 32, 2003, pp. 211–217.

[6] Ranganathana C., Teob Th. S.H. and Dhaliwal J., "Web-enabled supply chain management: Key antecedents and performance

impacts". International Journal of Information Management, vol. 31, 2011, pp. 533–545.

[7] Gunasekaran A. and Ngai E.W.T., "Information systems in supply chain integration and management". European Journal of Operational Research, vol. 159, 2004, pp. 269–295.

[8] Webster J., "Networks of collaboration or conflict Electronic data interchange and power in the supply chain". The Journal of Strategic Information Systems, Vol. 4, No. 1, 1995, pp. 31-42,.

[9] Lancioni R., Jensen Schau H. and Smith M. F., "Internet impacts on supply chain management". Industrial Marketing Management, vol. 32, 2003, pp. 173–175.

[10] Wang M., Liu J., Wang H., Cheung W. K. and Xie X., "On-demand e-supply chain integration: A multi-agent constraint-based approach". Expert Systems with Applications, vol. 34, 2008, pp. 2683-2692.

[11] Feicheng M., Guoliang Zh. and Tao L., "A New Approach of Modern Supply Chain Management: Electronic Supply Management Based on Information Lifecycle Management". International Conference on E-Business and Information System Security, EBISS '09, 2009, pp. 1-5.

[12] Gebauer J. and Buxmann P., "Electronic commerce and supply chain management". Proceedings of the 33rd Annual Hawaii International Conference on System Sciences, 2000, p. 1846.

[13] Stevens G. C., "Integrating the supply chain".International Journal of Physical Distribution and Material Management", vol. 19, 1989, pp. 3-8.

[14] Li X. and Wang Q., "Coordination mechanisms of supply chain systems", European Journal of Operational Research, vol. 179, 2007, pp. 1–16.

[15] xu L. and Beamon B. M., "Supply Chain Coordination and Cooperation Mechanisms: An Attribute-Based Approach". Journal of Supply Chain Management, vol. 42, 2006, pp. 4–12.

[16] Arshinder, A. Kanda and S.G. Deshmukh, "Supply chain coordination: Perspectives, empirical studies and research directions". Int. J. Production Economics, vol. 115, 2008, pp. 316–335.

[17] Gao G., Wang T., Taudes A. and Shukuan Zh., "Coordination of quality, retail price, marketing investment and logistic investment based on the game of quality and price in SCM". International Conference on Service Systems and Service Management, 2008, pp. 1-6.

[18] Melo M.T., Nickel S. and Saldanha-da-Gama F., "Facility location and supply chain management - A review". European Journal of Operational Research, vol. 196, No. 2, 2009, pp. 401-412.

[19] Wu T.-H., Low C. and Bai J.-W., "Heuristic solutions to multi-depot location-routing problems".Computers & Operations Research, vol.29, 2002, pp. 1393–1415.

[20] Fujimoto Y., "Supply chain inventory management based on demand model with structured uncertainties". IEEE Conference on Emerging Technologies and Factory Automation, Proceedings. ETFA '03, 2003.

[21] Sarkar B., "A production-inventory model with probabilistic deterioration in two-echelon supply chain management", Applied Mathematical Modelling, 2012.

[22] ZanjiraniFarahani R. and Elahipanaha M., "A genetic algorithm to optimize the total cost and service level for just-in-time distribution in a supply chain", Int. J. Production Economics, vol. 111, 2008, pp. 229–243.

[23] Liang W. Y. and Huang Ch., "Agent-based demand forecast in multi-echelon supply chain".

Decision Support Systems, vol.42, 2006, pp. 390– 407.

[24] Fangzhong Q., Da Y. and . Holtkamp B, "A logistics demand forecasting model based on Grey neural network". Sixth International Conference on Natural Computation (ICNC), 2010.

[25] Hongwei Zh., Xiaoke C. and Shurong Z., "Multi-Objective Fixed-Charged Transportation Optimization in Supply Chain Management". International Conference on E-Business and E-Government (ICEE, 2010), pp. 3247-3250.

[26] Tsao Y. Ch. and Lu J. Ch., "A supply chain network design considering transportation cost discounts", Transportation Research Part E, vol. 48, 2012, pp. 401–414.

[27] Chan F. T. S. and Zhang T., "The impact of Collaborative Transportation Management on supply chain performance: A simulation approach", Expert Systems with Applications, vol. 38, 2011, pp. 2319–2329.

[28] Power D., "Supply chain management integration an implementation: a literature review". Supply Chain Management: An International Journal, vol. 10, No. 4, 2005, pp. 252–263.

[29] Van der Vaart T. and Pieter van Donk D., "A critical review of survey-based research in supply chain integration", Int. J. Production Economics, vol. 111, 2008, pp. 42–55.

Author Profile:

Seyed Alireza Hashemi Golpayegani is an Assistant Professor of Computer and Information Technology Engineering Department at Amirkabir University of Technology (Tehran Polytechninc). He received his B.S., M.S. and Ph.D. degrees from Amirkabir University of Technology in Industrial and System Engineering. He has worked as the consultant of many government and private institutes, for developing various kinds of information organizational information systems, including intelligent decision support systems for facility location and project management. Dr. Golpayegani has taught Electronic commerce systems Engineering, Supply Chain management and Business Process Re-Engineering at Amirkabir University since 2005. His present research interests include intelligent decision support systems, Electronic Services Engineering, Social Networks and information technology management.

Hoda Ghavamipoor is a Ph. D. student of Computer and Information Technology Engineering Department at Amirkabir University of Technology (Tehran Polytechninc) in Information Technology field of study. She received her B.S., M.S. and Ph.D. degrees from Shahid Beheshti University of Tehran in Computer Science. Her present research interests are supply chain management, Adaptive systems and E-services management.

