

Research article

# Processes Model Presentation and Analysis in Virtual Business Environment for Supply Chain Integration

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## Abstract

The Virtual Enterprise (VE) represents a new operational model – a new operational form which is particularly drawn in order to satisfy the requirements that are created by the contemporary dramatically changes in the operational environment. Consequently, a new way of Logistics process practice and management of a Supply Chain is created which is characterized by great potential and automation and is based on the Internet. An environment is created where new Logistics Process Models can be applied.  
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**Keywords:** Virtual Enterprise, e-logistics, e-commerce

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## 1. Introduction

In particular, this environment is created when the enterprises adopt virtual collaborations in order to remain competitive. These collaborations form temporary or permanent Virtual Enterprise networks, whose basic characteristics are the lack of geographical borders, the absence of information transfer limits, the operational form fluidity, the ability of collaborative and direct cooperation, the exceptional speed and flexibility as well as the appearance of the unity towards customers. These characteristics make this collaboration business model survive in a continuously unsettled market.

The success of a Virtual Enterprise Network depends on:

### **1. The Logistics information systems management.**

A big challenge is constituted by this fact, as well as one of the biggest problems, because the Logistics systems “suffer” from communication and distribution problems of the information available (Pfohl and Buse 2000).

### **2. Value added Logistics services management.**

Logistics services in a virtual environment are defined as the applications and services which are required in order to solve a specific Logistics customer / collaborator necessity. Their additional value is based on material, information and financial flow transactions among the network members (suppliers/customers) (Folinas et al. 2001, Manthou et al. 2002)

### **3. The inter-enterprise Logistics process co-ordination.**

The collaborators of various abilities combination automatically creates the problem of unification and Logistics process synchronisation which are executed by the network members for their objectives implementation. This co-ordination is hard to be achieved because of the network members refute objectives (Simchi-Levi et al 2000). In order to quickly and reliably create and manage virtual co-ordinations so as to exploit their offering advantages the enterprises have to create an environment/ platform based on the internet, which will be able to manage high data/information volume, complicated transactions and have high automation and unification levels. This platform should be able to satisfy the demand for coordinated inter-enterprise Logistics processes.

The coordination of Logistics processes which connect the enterprises can be achieved by the standardization of services, technical / operational contacts as well as the criteria for the realization of agreements provided service level, aimed at supporting a complete value chain for each project. The dynamic Logistics services agreement creation and achievement require explicit models among the collaborators determining the information that will be exchanged and the steps which should be followed in it. Moreover, a network is required which would provide the mean for the secure and reliable content and processes exchange among the collaborators and business-to-business Logistics systems. This network will allow the most optimal management of cooperative relations in the frames of Virtual Enterprise network transactions /common processes.

## **2. Logistics process models management in contemporary enterprise environments**

It is a fact that there are contemporary enterprise models for the Logistics process management in a Virtual Enterprise. The model classification was based on some of their basic characteristics such as the stability, the applicable administration model, the rate of independence, the level of collaboration etc. However, before the various models are presented and analyzed, there should be determined which the exact meaning of the “enterprise model” is and its necessity must be comprehended particularly in an open dynamic environment such as the examined Virtual Enterprise.

### **2.1 Enterprise model definition and necessity**

The meaning of enterprise model is applied in both traditional enterprises and in those which are activated in the Internet area. Theoretically, enterprise model is the effort of the abstract representation of the way that an enterprise/ organization functions and is activated. The construction of enterprise models occurs for the better and more complete perception of the enterprise processes. The more the complexity of those models grows, the more the necessity of an exact enterprise model existence is. This also leads to another conclusion, that the enterprise model is the center of the enterprise operation service and optimization effort without the necessity of the thorough description of either its services or its functions (Eriksson and Magnus 2000). Consequently, the enterprise model planning should be approached by its strategic level.

Many definitions have been given for the business model, which has led to its real meaning confusion. For example, if the business model is considered to be the business vision and future plans determination and development frame, it can easily be identified with its strategy (Keen 1999). Besides, the Mayo and Brown claim that the model is the work of its business strategy development and practice (Mayo and Brown 1999). Moreover, Venkatraman and Henderson define the business model as the complete strategy planning, taking into account 3 basic axes: customers' interaction,

capital management and knowledge management (Venkatraman και Henderson 1998). Others believe that the planning and implementation of a business model constitute a critical factor for the success in the new competitive market, because it provides the ability of finding new business opportunities and possible factors of value added (Patel 1999, Emigh 1999).

Sometimes, the definition is identified with the model/ way of income acquisition, benefited from the particular characteristics of the new market or/ and the Internet (Emigh 1999, Green 1999). So, Osterle has extended the business model definition by proposing that it should cover both the business and the network issues (Osterle et al. 1999). Likewise Scharl and Brandtweiner propose a frame which gives emphasis to competitive and cooperative relationships among the enterprises, the suppliers and the customers who constitute the EC (Scharl και Brandtweiner 1998). Timmers has made one more step forward by supporting that for the business model definition the definition of product/ services architectural flow as well as for the involved entities description (Timmers 1999) is required in a e-commerce. In this case the business model explains how the various business entities (roles) conceive their roles into the e-commerce network. Consequently, there is a movement of the business model definition focalization from the enterprise individually to the position of the enterprise in the e-commerce. If it is taken into account that the e-commerce is constituted by a Virtual Enterprise network, then the business model presents (describe) the inward and inter – enterprise Logistics processes execution, forming a network process map (Papakiriakopoulos et al. 2001). Besides, the enterprise model is able to attribute the business rules which are the restrictions and the demands for the successful strategy development and application, by significantly reducing the possibility of enterprise failure (Appleton 1996). From the above, it is obvious that on the one hand the business model planning and development in an environment such as the examined network, is an essential condition for its effective function, and on the other hand the problem is related with the Logistics process modeling which are executed by the supply chain members.

## 2.2 Logistics processes business models in e-commerce environment

In the past few years many business models classifications in the contemporary business e-commerce environment have been proposes based on some characteristics such as the structure, the risk and benefits distribution, the confidence, the distance among the enterprises, the stability, the developing relationships, the available resources management, the applied technology (Miles και Snow 1992, Scholz 1994, Staehle 1994, Mertens και Faisst 1995, Sydow 1996, Papazoglou et al. 2000, Rappa 2000, Pfohl και Buse 2000). In this unit it is estimated that the three more representative model types with regard to the Logistics processes in the e- commerce environment are the following:

1. The strategic Logistics processes model.
2. Third entrusting Logistics processes model (contracting model).
3. The virtual Logistics processes model.

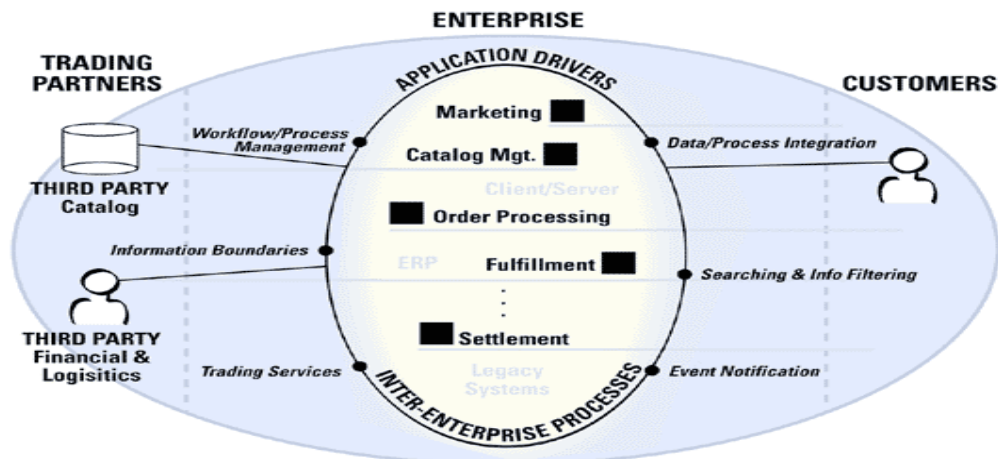


Figure 1: Application Framework More specifically,

In that business model the management of inter-enterprise process is performed by a central business entity which is usually the producer or the retailer who is close to the final consumer (Jarillo 1993, Sydow 1996). This formed network is considered to be a stable and directed to the joint effort for the competitive advantage acquisition (Pfohl and Buse 2000). The rest of the enterprises/ members are closely associated with the central one but they are also able to offer their products to customers who are out of the VA network, their autonomy.

### **Entrusting Model**

In this model the Logistics process execution is assigned to other enterprises. Organizations (external service providers) manage and control these particular processes (Papazoglou et al. 2000).

### **Virtual Model**

The basic characteristic of the virtual model is the fact that for the execution of a project, individual business entities collaborate (Picot et al. 1998). The collaboration and the control of the inter-enterprise process are provisional by with the project materialization. They are supported by the information and telecommunication technologies without simultaneously requiring specified infrastructures from the network members. Every enterprise executes a series of activities in order to materialize Logistics processes. The connection of those activities offers a great opportunity of competitive advantage acquisition either because of the increased synchronization or the differentiation of the offered products. In this case, the inside the enterprise processes have to be planned again because they unify other homogenous or heterogeneous Logistics processes or services of other network enterprises aimed at the achievement of their objectives (Papazoglou et al. 2000).

## **3. Logistics modeling process in Virtual Enterprises environment for the completion of Supply Chain**

Nowadays, the enterprises are forced to create virtual collaborations in order to remain competitive. The conclusion is that they abundantly have data/ information, joint development of products and services, agreed contracts, better market view and analysis, distributed plans products/ services promotion and negotiated prices, terms and demand prediction. These collaborative activities constitute the basic elements of each successful enterprise, are based on information and as it happen in each similar activity, the internet has changed the rules of the game. The enterprises in order to create and manage fast and reliably virtual collaborations, an internet based platform is proposed, which will be able to satisfy the demand for the coordinated inter-enterprise Logistics processes.

The “heart” of the proposed platform is the Logistics processes model for the completion of the supply chain. The model proposes a procedure which is composed of a specific number of levels which are composed of specific steps that their materialization leads to the desirable objective: *the supply chain completion in a virtual enterprise environment*. The model is approached theoretically as well as practically by the development of a software which practically implements the process above.

### **3.1 Presentation of the proposed Logistics Processes Model**

The models play a significant role in the open enterprise co-ordination, since they define the form of interpretation of messages, documents, activities and services which go through the enterprises. In this way, coordination and management requirements are decreased. More specifically, in order to examine the management of processes and Logistics systems in a e-commerce environment, should first the technological models (techniques and telecommunication infrastructures) should be determined as well as the organizing structures (models) which are to be applied. Moreover, the determination of the e-commerce network participants and their roles in relation with the three basic streams- natural, information and financial – which are added value to the customers are required. On the one hand, it is imperative the business objectives of the participants members/ *entities* concerned (suppliers customers or intermediates) who have a common comprehension of market environment, produce the same products or services and maintain a common total of business processes and on the other hand the relationships which are reported to the transaction which are executed by two or more players (Timmers 1999).

Besides, for the creation of a more massive and stable environment for the model development the modeling and the unification of the information which are exchanged and the processes which are commonly executed by the network members, the comprehension of management issues of their relationships and knowledge are essential. The above

model has to be based on an open and fast mechanism which allows to the candidate collaborators / members of e-commerce network to participate in the supply chain activities and in particular in prediction, planning, development, coordination and distribution of products/ services with the aim of coping with the customer's requirements.

It includes the necessary levels so that the network members can achieve strategic and regular developments as it concerns their particular abilities and Logistics systems which they maintain. Specifically it constitutes by four levels that are estimated to be achieved:

1. the activities and transactions coordination from which the inter-enterprise Logistics processes are constituted.,
2. the regular and efficient stream of products/ services and information which are moved through the supply chain network by reducing the cost, the time and improving the quality, the provided services and their quality and
3. the correspondence of the market offer and demand based on the relationships management among the collaborators and the knowledge.

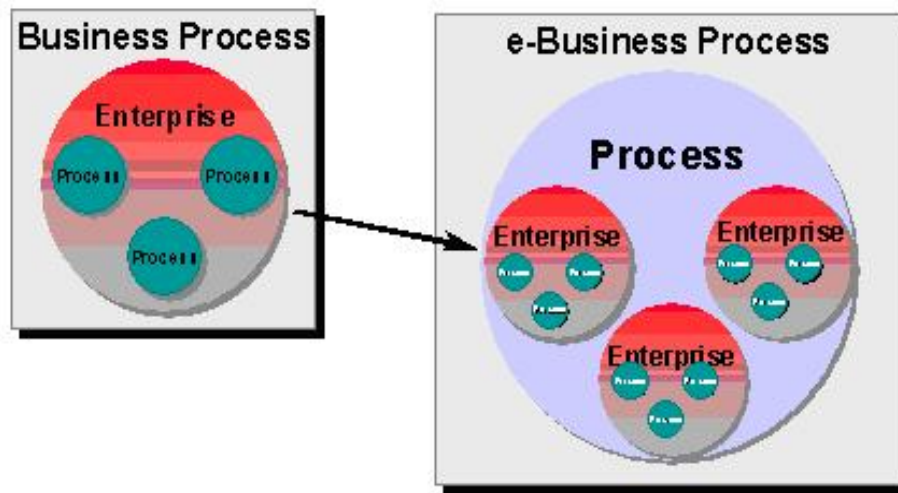


Figure 2: Processes expanding beyond enterprise The four levels of the proposed model

### 1.Mod-L:1

Management of technological infrastructure and Logistics processes of e-commerce network, which will determine the architecture of information/ telecommunication technology as well as the basic factors which are related with the virtual network management and the co-ordination (duration, structure, co-ordination and management of virtual network circle of life). An estimation of this project constitutes the fact that a business entity and especially the Logistics Service Provider (LSP) is able to undertake a significant role and cope with the cooperative problems and interoperability matters which are created in the virtual network (Folinas et al. 2001). More specifically, the Logistics Service Provider firstly receives the offer from the customer, chooses the network members and maintains a central role in the network function.

### 2.Mod-L:2

Classification of the main participated entities, recognition of their roles and comprehension of the services that they are able to provide(that is to say, the competence/ responsibility of participated institutions). As main entities of the e-commerce the following can be considered: each participating member/ business collaborator and the network coordinator. A network member/ business collaborator can function as a supplier, customer or intermediate. The network coordinator is the enterprise or the institution which undertakes the processes of the completion, the cooperative relationships and knowledge management, as well as the negotiation of the agreements of provided services level.

### 3.Mod-L:3

Completion of a general frame and Logistics processes for a inter-enterprise interoperability. For this reason a completion of Logistics services platform is proposed that will be based on four levels architecture. The first level

determines the technological and telecommunication models, as well as the safety mechanisms in order to facilitate the transaction coordination among the participated members and avoid the non-permitted data access. In the directly next level the application completion methodologies are determined and materialized in a data as well as a contact level. The last level defines the business and cooperative rules for the collaborators who are involved in the modeling form of shared Logistics processes/ services in a virtual environment. The step process that is proposed in this level constitutes the base for an application development which automates the modeling and completion process of Logistics information and processes.

#### **4.Mod-L:4**

Collaborator relationships management in the frames of transactions/ common processes of supply chain network. Specifically an e-management of collaborators relationship network system is presented which manages the relationships among the collaborators and provides possibilities management of information, knowledge and criteria of the provided service level. The proposed model aims at joint management and supervision of the geographically scattered enterprises in the new digital environment. More specifically, it is estimated that the system is able to support the creation, the management and the optimization of the collaborative relationships in a supply chain which aims at the optimization of the supply chain and the completion of Logistics processes as well as the requirements correspondence of the final customers with offered faculties and resources of each provider. Specifically, the acceptance of the criteria for the agreements of the provided service level, constitute the mean which tries to correspond the customer service attribution expectations, by recognizing both the provider and the customer's responsibilities of the service. The provider and the customer should beforehand determine which specific services and which attribution levels will be provided or required, as well as the mechanisms of calculation by which those abilities will be calculated, with specific criteria, as the cost, the response time, the applied credit policy, the reliability, the quality as well as various legal matters.

The model proposed for the Logistics services management in a virtual business environment can be used as an action guide for the creation and function of a virtual network and the potential collaborators processes completion. In the following chapters of this thesis each of the above levels are further analyzed

### **3.2 Application areas (Mod-L)**

The proposed model (Mod-L), is estimated that can be applied in the following general business sectors for the completion of their corresponding supply chain:

- 1. Agricultural sector (Agricultural Supply Chain).**
- 2. Constructional sector (Technical-Constructional Supply Chain).**
- 3. Tourist sector (Tourist Supply Chain).**

The choice of the sectors above has not only be made based on the technical and functional frame and the requirements of the participated institutions but also by taking into account the following:

- Those sectors constitute the highest income resources of our national economy.
- Applying new and innovative technologies of Information and Telecommunications on these will ensure not only their viability but their competitiveness increase in the new global market as well.
- These particular supply chain in our country are "complete" because they include all the intermediate stages of which they are composed in the national limits. For example, the chain of the olive oil production and packing is entirely materialized by Greek enterprises or institutions (farmers/ cultivators, suppliers, rural associations, financial institutions, national olive oil organizations, olive oil producers, processors, wholesalers, retailers and final consumers).
- To those sectors the Logistics processes and practices have not been greatly applied.
- The implementation and the announcement of a lot of national or European programs in these sectors for the finding of axes of their strengthening actions prove the interest of the government and international institution for their optimization.

Of course, it is likely to apply the proposed model to other sectors like the sector of enterprises that are activated in the field of new technologies of Information technology (such as planning and production of material and software), Electronic Government and broadly in the industries of production (such as car industries, pharmaceutical industries, textile industries, industries of foods and fresh products etc).

In the following units we present the particular characteristics of the three proposed for the application of model

supply chains, the problems that have been observed as well as the possibilities of application of network of virtual enterprise and modern applications of internet for the improvement of their effectiveness and their efficiency.

### 3.2.1 Agricultural Supply Chain

The **Agricultural Supply Chain** refers to the activities of supplies, reception of order, planning and growth of products, distributions and service of customers from two or more enterprises in the rural industry for the implementation of orders of final customers. The agricultural supply chain is composed of small or intermediate enterprises such as the farmers and the producers of raw material, the suppliers of essential matters for transformation, the agricultural cooperatives, the distributors, the wholesalers and retailers.

These companies tend to operate either independently or as a partnership especially in the latter stages of the chain (wholesalers, retailers and final customers). Historically, in the agricultural sector, there are clear boundaries between different roles at each level of the supply chain. Farmers produce agricultural products which are collected and stored initially in cooperatives (or associations of local authorities).

Then they are transferred to production or processing. From that point the final products are distributed through wholesalers and distribution centres to retailers (super markets, retail shops) and final customers. Today, the boundaries between these processes are not so obvious.

The agricultural industry is addressed to customers and final users who require a good balance between quality, service and price. Retailers should be more responsive to market demands by reducing the cost of their internal processes, increasing service levels and reducing the final price. Things that were not previously of great interest such as the level and cost of inventories, planning production, storage, distribution centres and wholesalers, the movement of the respective information, etc., are now critical factors that can lead to cost reductions of final product.

The involved enterprising entities of agricultural supply chain are usually small to medium-sized enterprises that function usually autonomously and with a small capital. The fast pace of changes both globally and locally, the complexity of markets, the great number of products, the small margins of profit, the big number of suppliers producers, the liability of agricultural products and the more and more demanding consumers, lead the agricultural enterprises to the adoption of more flexible models of production.

Furthermore, the dramatic development of the information and telecommunications technology as well as the market demand for healthier products and the demand for production systems emphasizing on the protection of the environment, reinforce the application of similar production models.

Today more than ever, it clears from the agricultural enterprises or organisations that the real competitive advantage can be achieved only through the creation of narrow cooperative relationships, networks and channels of communication for the exchange of enterprising information along the supply chain.

Besides, approaching the above cooperative relationships as far as the processes of Logistics are concerned we can observe the influence in them and the particular nature of agricultural products.

In particular the dependence on the meteorological phenomena, the excessive production that leads to the maintenance of big reserves, the lifespan of products between the production, transformation and consumption require collaboration in the process of decision-making on planning issues, supplies, management of reserves and distributions. Consequently, the application of innovative methodologies Logistics, such as the JIT (just in time) and CPFR for the confrontation of important questions in the rural sector and the exploitation future occasions of market, require an open environment for the support of exchange of information and the materialisation of commercial transactions.

The significance of network of virtual enterprise in the rural industry is relatively news. Theoretically, cooperatively functioning and leaving apart the various adversities both the suppliers and the manufacturers as well as the remaining entities could achieve their final objectives serving their customers with the smaller possible cost.

The virtual enterprise equals to the distribution of dexterities and information. For this reason, a bidirectional communication and exchange of necessary relevant information of rural enterprises are required. A part of this information should be unified so that the compatibility between the calculating systems of various collaborators is ensured. This is achieved by the use of new technologies that allows the automation and acceleration of processes and the reduction of errors.

The application of technologies in a network of virtual enterprise is necessary in each process [Logistics and level of supply chain], from the supply of raw material to the placement of product in the tradesman bookshelf. The key to successful chain is the ability of unification of all these technologies and the networks of virtual enterprise constitute the means of achievement of the above objective. In the past few years they have particularly materialised a lot of work of application of innovative technologies, for the support of processes that they are included between wholesalers or tradesmen and the final customer (applications e-commerce - manufacture and operation of electronic shops). However, there are not many applications in the initial stages of **Agricultural Supply Chain**, such as those ones between the suppliers and the enterprises of processes or transformation of raw materials.

In general, the degree of application of new technologies in the rural sector is characterized by the following: the market is new, traditionally it is not distinguished for the wide use of new technologies because either the technologies are expensive (EDI), or there unwillingness to be adopted by the smaller agricultural enterprises and the employees themselves. Due to the above reasons the software that was developed in the frames of thesis and is described in following section is put into practice into the study of a possible order between the enterprises and the agricultural sector.

To sum up, the objective of creation of the network of the virtual enterprise, is the intensification of their competitiveness and the increase of flexibility of adaptation in the requirements of market, via the application of new technologies. This application will lead to the replanning of enterprising processes and to the rearrangement of organisational structures of enterprises of/members of the network.

### 3.2.2 Constructional Supply Chain

The **Constructional Supply Chain** refers to the connections and the relationship of the customer of/supplier that are created between the all enterprises that participate in the materialisation of the constructional work. General, by the main characteristics of the constructional sector are the partial nature and the refuted objectives. This leads to practices insufficient information and automatically to dysfunctional **Supply Chain** (Love et al. 1999).

According to Loraine, New και Cox the research on issues **Constructional Supply Chain** should be focused on the growth of cooperative relationship between the involved enterprises (Loraine 1994, New 1997 και Cox 1999). Loraine specifically formulated the opinion that the effective collaborations depend on the creation network structures (Loraine 1994). When the network structures in the **Constructional** sector are supported by innovative technologies of the internet, then each involved enterprise in the materialisation of work can have direct access to the other participants even if they are not bound by a formal and contract collaboration (Love et al. 1999).

A network of virtual enterprise is specifically appreciated that will offer more flexibility and compatibility to a **Constructional Supply Chain**. This due to the fact that in the traditional **Supply Chain**, each involved enterprise executes its own work as they are provided by contract without taking into account the improvement of relations and the total output of the chain.

The enterprises/ organisations that activate in constructional sector appear to be conservative in every change, because the risks that could be hidden. For example, they hesitate because the small time of implementation of various work undertake, they collaborate closely with the other enterprises of the same field and they share knowledge, information and resources

Consequently, in this enterprising sector in which the agreements are binding and obligatory it is not proposed that the virtual networks will replace the traditional organisational structures, they will simply function as tools of value added for more effective and more efficient implementation of the Logistics processes.

For example replacing the traditional systems of exchange of enterprising documents among the members of [techno]-constructional supply chain (paper, fax etc), with what is based on the internet (web-EDI, XML) the problems of misapprehension, bad interpretation and even omission of information from which “suffers” the constructional sector will be solved to a large extent. (Gunasekaran και Love 1999).

### 3.2.3 Tourist Supply Chain

The **Tourist Supply Chain** includes all processes of benefit of services and products that various enterprises should provide in order to meet a particular demand. The basic characteristics of the tourist Supply Chain are the number of



the enterprises that are activated in the tourism industry and their growth all over the planet. For example the offers growth and presentation for a place in Greece as well as the travel arrangements take place in a country except Greece, while means of transportation belongs to a company of the third country. Also The **Tourist Supply Chain** is considerably influenced by various exterior and imponderable factors (such as meteorological, the political and economic instability of the destination, potential phenomena of terrorism etc).

We should also add the change of tourist behavior that travel more often but for smaller periods of time, as well as the increase of their demands for better service and facilitations.

Moreover, they prefer to determine their program and they demand advice that concerns a great variety of subjects. Generally they demand to be served dealing with as few suppliers as possible. (Bloch et al. 1996, Bloch και Segev 1996).

It is obvious that the advantages of a e-commerce network which offers a unified appearance to the customer as well as a high flexibility and correspondence to their requirements (for example last minute program modification) constitute the ideal enterprise model for the automation of the transactions which are executed in the Tourism Supply Chain. Furthermore, the network ability to jump over the time and the place makes it the most reliable means of information exchange and real time transactions implementation. The benefit of the current information, the reservation management without intermediation, the search for the best market opportunities etc, are all the activities which are materialized better and faster by the use of Internet. This results in the functional expenses reduction and the improvement of the provided service level (Wynne et al. 2000).

#### 4. Conclusions

In this article the proposed Logistics Processes model levels were presented. The objective is the development of a Supply Chain completion model which is created by a e-commerce network and presents a coordination frame for the Logistics services management in a virtual enterprise environment.

The Logistics Management Model levels deal with the following:

1. The network Logistics services and technological infrastructure management.
2. The main involved entities classification, their role recognition and the comprehension of the services that they can provide (namely the participants institutions competences/ responsibilities).
3. The general frame and Logistics processes completion inter-enterprise interoperability.
4. The management of coordination relations in the frames of transactions /common Supply Chain network processes. The central role in the model concretisation is estimated to have the entity that is responsible for Logistics processes designing the available resources management, aiming at the creation of a competitive Supply Chain. For this reason in the rest of this thesis the proposed model is examined from the aspect of the Logistics Services Supplier. In the following chapters the levels of the proposed model are analyzed.

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