

SEVENTH FRAMEWORK PROGRAMME

SST-2007-TREN-1 SST.2007.2.2.4. Maritime and logistics co-ordination
platform SKEMA Coordination Action
“Sustainable Knowledge Platform for the European Maritime and Logistics
Industry”



SKEMA Consolidation Study

Review of well known logistics concepts adopted during last decade

WP No2 – SKEMA Consolidation Studies

Task T2.4: Technology forecasting and assessment

SKEMA Subject Index: SE211

Responsible partner: VTT

Contributing partner: OL

Planned submission date: Version 1- 31/12/2008; Version 2-15.06.2009

Actual submission date: Ver 1 29/11/2008 Ver 2 22.5.2009

Distribution group: Consortium

Dissemination level: PU (Public)

Contract Number: 218565

Project Start Date: 16th June 2008

End Date: 15th May 2011

Co-ordinator: Athens University of Economics and Business

Document summary information

Version	Authors	Description	Date
1	J Eckhardt, A Permala VTT	Final Draft Ver 1	29.11.2008
2	J Eckhardt, A Permala VTT	Final Draft Ver2	1.6.2009
3	J Eckhardt, A Permala VTT	Final Draft Ver3	29.1.2010

Quality Control

	Who	Date
Checked by Task and WP Leader		
Checked by Peer Review	Prof S. Papadimitriou	1/02/10
Checked by Quality Manager		
Approved by Project Manager	Takis Katsoulakos	2/2/10

SE2.1 Dominant trends in logistics and supply chain management

2.1.1 **Review of well known logistics concepts adopted during last decade**

2.1.2 Guidelines for selecting strategically important logistic concepts

2.1.3 Supply chain integration and intelligent logistics - solutions and benefits

Abstract

The study is based on literature and presents logistics concepts related to inventory and supply chain management trends. In addition, transport chain and general logistics trends are presented. Maritime freight transport, shipping and ports sector trends are included in the study.

Reducing stocks is the main trend in inventory management. The economic order quantity (EOQ) and ABC-analysis are concepts used to avoid excess inventories, optimize inventory cost and take into account product characteristics. Supply chain management trends are related to increasing co-operation, transparency, and efficiency. Concepts supporting these trends include just-in-time (JIT), quick response (QR), efficient consumer response (ECR), continuous replenishment (CR), collaborative planning, forecasting and replenishment (CPFR) and vendor managed inventory (VMI). Push, pull and push-pull systems including postponement are strategies that promote the objectives of supply chain management trends. Also the positioning of order penetration and value offering points are important factors in optimizing supply chain efficiency.

Transport chain trends pursue for efficiency and improved services. Increasing use of logistics service providers (LSP) and the growth of container traffic are characteristic for present transport chains. General logistics trends include the increasing use of information technology (IT) and e-commerce, globalisation and companies increasingly paying attention to sustainability. The trends in sea freight are related for example to growing vessel size, trade imbalance, and increasing cost control and service level.

Review of well known logistics concepts adopted during last decade

Contents

ABSTRACT	3
1. OBJECTIVES	6
2. TARGET STAKEHOLDERS.....	6
3. GLOSSARY TERMS.....	6
4. APPROACH	7
5. SPECIFIC AREAS TO BE ADDRESSED	7
5.1 Business logistics inventory management trends: lower inventories.....	8
5.1.1 EOQ.....	8
5.1.2 ABC-analysis	8
5.2 Business logistic SCM trends: co-operation, transparency, efficiency	10
5.2.1 Push, pull and push-pull systems	10
5.2.2 Postponement	11
5.2.3 Moving order penetration and value offering points.....	11
5.2.4 JIT.....	14
5.2.5 QR, ECR, CR.....	14
5.2.6 CPFR	15
5.2.7 VMI	15
5.3 Transport chain trends: efficiency, additional services	17
5.3.1 Increasing use of logistics service providers	17
5.3.2 Growth of container traffic	18
5.3.3 Trends in maritime freight transport, shipping and ports sector.....	18
5.4 General trends	20
5.4.1 E-commerce and IT	20
5.4.2 Globalization.....	22
5.4.3 Sustainability.....	23

6. CONCLUSIONS.....	24
7. REFERENCES.....	25

1. Objectives

The objective of the study is to give an extensive overview of the business logistics concepts. This study shows the evolution of logistics concepts in companies starting from in-house developments by describing inventory management concepts and ending up to supply chain networks by describing collaborative supply chain management concepts. In addition some concepts related to transportation and logistics service providers are presented. The second objective is to present essential logistics and supply chain trends, and general trends affecting logistical decisions remarkably. Maritime transportation trends are presented separately as well.

2. Target stakeholders

- D2D Service Providers, which include ship operators, freight forwarders, logistics providers and Motorways of the Sea (MoS) operators
- Exporters & Importers (shippers)
- European ports, national port bodies and especially small-to-medium ports
- Research organisations, Systems Developers
- The large number of specialised companies that support the Maritime and Logistics industry; this includes bankers, financiers, designers, builders, providers of Single Window (SW), Port Community Systems (PCS) and Cargo Community Systems (CCS)
- The European Commission and national transport ministries

3. Glossary terms

4PL	Fourth Party Logistics
B2B	business-to-business
B2C	business-to-consumer
CMI	Co-Managed Inventory
CPFR	Collaborative Planning, Forecasting and Replenishment
CR	Continuous Replenishment
ECR	Efficient Consumer Response

EDI	Electronic Data Interchange
EOQ	Economic Order Quantity
GPO	Global Port Operator
IT	Information Technology
JIT	Just-In-Time
JMI	Jointly Managed Inventory
LLP	Lead Logistics Provider
MRP	Materials Requirements Planning
OPP	Order Penetration Point
POS	Point-of-Sales
QR	Quick Response
SCM	Supply Chain Management
SMI	Supplier Managed Inventory
TPL	Third Party Logistics
TPLP	Third Party Logistics Provider
VMI	Vendor Managed Inventory
VOP	Value Offering Point

4. Approach

The study surveys key areas of supply chain development, based on literature

- collaboration - sharing and utilization information along the entire supply chain,
- value chain management (organization of the entire supply chain by integrating partners according to their qualifications and capacities in such a way that total supply chain performance reaches its optimum) and
- differentiation of supply chains, recognizing that “one size does not fit all”.

5. Specific areas to be addressed

- Business logistics inventory management trends
 - o Economic order quantity (EOQ)
 - o ABC-analyses

- Business logistic supply chain management (SCM) trends
 - Push, pull and push-pull systems
 - Postponement
 - Moving order penetration and value offering points (OPP and VOP)
 - Just-in-time (JIT)
 - Quick response (QR), efficient consumer response (ECR), continuous replenishment (CR)
 - Collaborative planning, forecasting, and replenishment (CPFR)
 - Vendor managed inventory (VMI)
- Transport chain trends
 - Increasing use of logistics service providers
 - Growth of container traffic
 - Trends in maritime freight transport, shipping and ports sector
- General trends
 - E-commerce and information technology (IT)
 - Globalization
 - Sustainability

5.1 Business logistics inventory management trends: lower inventories

5.1.1 EOQ

The economic order quantity (EOQ) strives to optimal amount of order by balancing the holding cost of inventory against the cost of issuing replenishment orders and/or the costs of production set up (Christopher 1998). According to EOQ rules, higher unit value and higher unit volume leads to smaller economic order quantities and more frequent replenishment orders. (Bowersox et al. 1996 in Eckhardt 2002)

5.1.2 ABC-analysis

A company may need thousands of different items for its operations. It is impossible to equally pay attention to all items in purchasing, production planning, and the sales

department. Items can be divided into groups to concentrate on the most important products. (Sakki 2001 in Eckhardt 2002)

The Pareto or 80/20 rule usually classifies items into three groups with similar characteristics. This facilitates inventory management and the identification of inventory strategies. Classification can be based, for example, on sales, profits, inventory value, usage rate, or nature of the item. *Figure 1* illustrates the most common 80/20 classification, which states that 80 percent of sales are accounted for by 20 percent of the products ("A" items). Equally 80 percent of profits are accounted for by 20 percent of the customers. (Bowersox et al. 1996, Christopher 1998 in Eckhardt 2002)

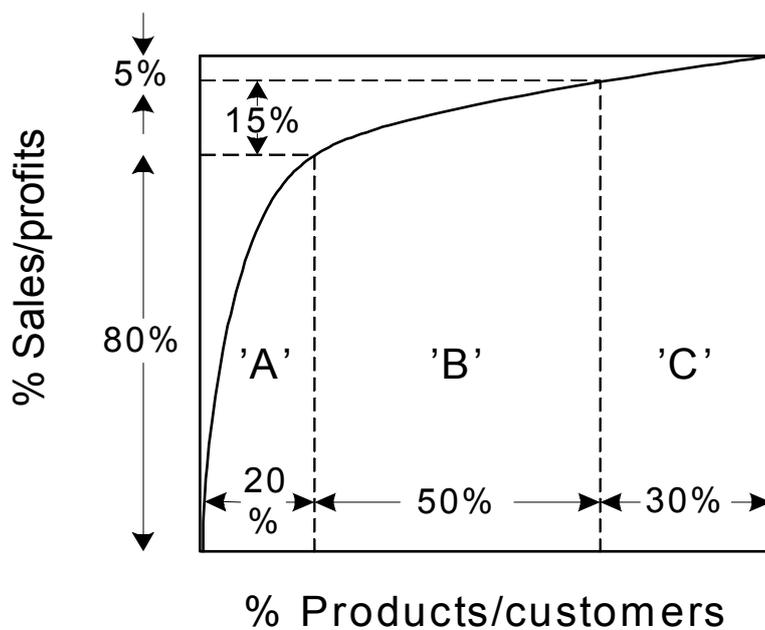


Figure 1. The 80/20 Rule (Christopher 1998)

Each group has its characteristics. The "A" items are described as high-volume fast movers, "B" items are medium movers, and "C" items slow movers. Some companies use "D" and even "E" items. Because "A" group products are the most important for customer service, their stock availability is the highest. Fast moving "A" items require

constant replenishment reviews, but periodic review, such as weekly or biweekly review, is sufficient for other groups. (Bowersox et al. 1996, Rushton et al. 2000 in Eckhardt 2002)

5.2 Business logistic SCM trends: co-operation, transparency, efficiency

5.2.1 Push, pull and push-pull systems

Push-based supply chain makes production and distribution decisions according to long-term forecasts based on orders. Push-based supply chain has a long react time which can lead to the inability to meet changing demand patterns and the product obsolescence or excessive inventories. (Simchi-Levi et al. 2008)

In a *pull-based* supply chain production and distribution are coordinated with true customer demand. Efficient information flow about customer demand decreases inventories. Pull system enables lead-time reduction due to better anticipation and decrease in variability. (Simchi-Levi et al. 2008)

Thus, pull system reduces inventories, enhance the ability to manage resources, and reduces system costs compared to equivalent push system. On the other hand, pull system is difficult to implement when lead times are long making reaction to demand information impractical. In pull-based system it is often more difficult to take economic advantage in manufacturing and transportation since they are not planned far ahead in time. (Simchi-Levi et al. 2008)

Push-pull supply chain strategy takes advantages of both push and pull systems. The interface between push-based stages and pull-based stages is called *push-pull boundary* (see Figure 2). (Simchi-Levi et al. 2008)

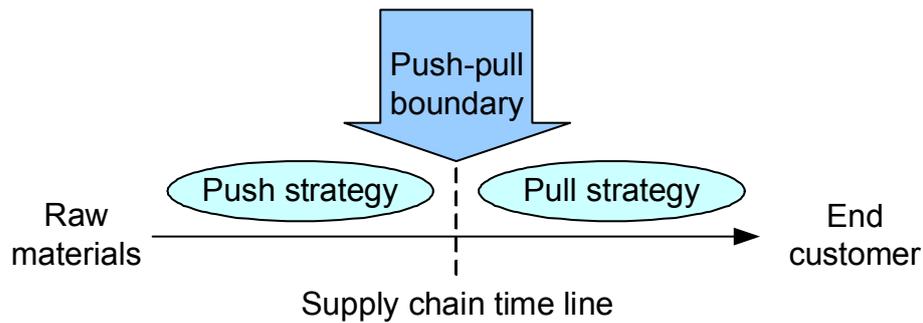


Figure 2. Push-pull supply chains (Simchi-Levi et al. 2008)

5.2.2 Postponement

Postponement is an excellent example of a push-pull strategy. In postponement the product and manufacturing process are designed in a way that decisions about which specific product is being manufactured can be delayed as long as possible or until more accurate demand information is available. Usually the stage until product differentiation is operated using push system. Specific end-product demand has normally high uncertainty and product differentiation is based on individual demand and is thus pull-based. (Simchi-Levi et al. 2008)

5.2.3 Moving order penetration and value offering points

It is essential to understand how the customer's demand chain and supply chain are linked to improve a customer's performance and the company's efficiency. There are two points linking the chains, the order penetration point (OPP) and value offering point (VOP). (Hoover et al. 2001 in Eckhardt 2002)

The *order penetration point* is the point in the supply chain where customer demand or an order is directed to the product (see [Figure 3](#)). Costs and benefits for both parties, supplier and customer, depend on the allocation of the OPP. The order can be allocated from the supplier's warehouse, which means rapid delivery and benefits for the customer. Large inventory involves high costs for a supplier especially if the product range is large. If the OPP is moved back to packaging or assembly, the supplier will benefit from reduced inventory costs, but the customer needs to wait longer for delivery.

One way to shorten delivery time is customization by postponing the process steps that create variants. Moving the OPP back further to manufacturing, a supplier's inventory costs get even lower and makes it possible to meet individual customer needs. This however means longer delivery times that a customer may not be willing to wait for. (Hoover et al. 2001 in Eckhardt 2002)

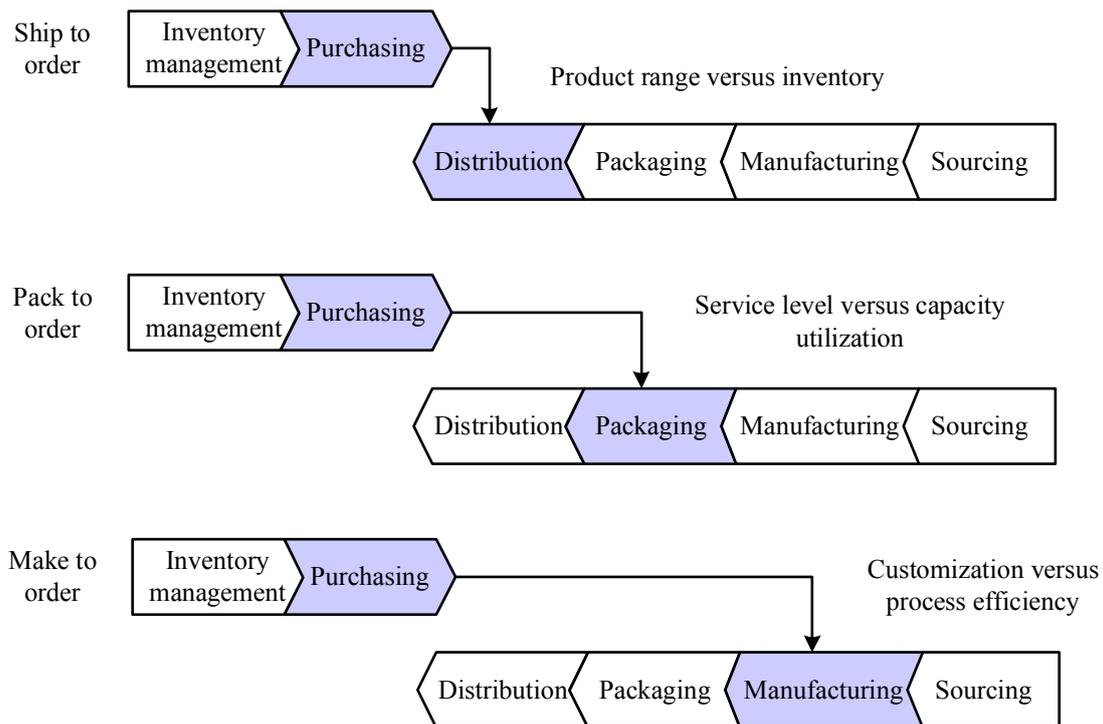


Figure 3. Moving the Order Penetration Point (Hoover et al. 2001 in Eckhardt 2002)

The second point linking the demand and supply chains, the *value offering point*, describes the point in the demand chain where the supplier receives the customer's purchase decision (see [Figure 4](#)). An offer to purchase is the traditional buyer / seller relationship where the customer's buying department decides who supplies and when. Both the buyer and seller try to optimize their own operations. An offer for inventory management moves the VOP back in the demand chain meaning that the supplier controls the customer's inventory levels and can respond better to their needs. But now the supplier has to separately control each customer's inventory. An offer for planning moves the VOP to production or to sales promotion in retailing. The supplier

and retailer collaborate, for example in a way that the supplier gets information on consumer demand. The VOP can also be an offer to the end-user. This model is still unknown, but there is an example in the PC industry. Dell delivers customized PCs directly to the end customer with the necessary network configuration and software. (Hoover et al. 2001 in Eckhardt 2002)

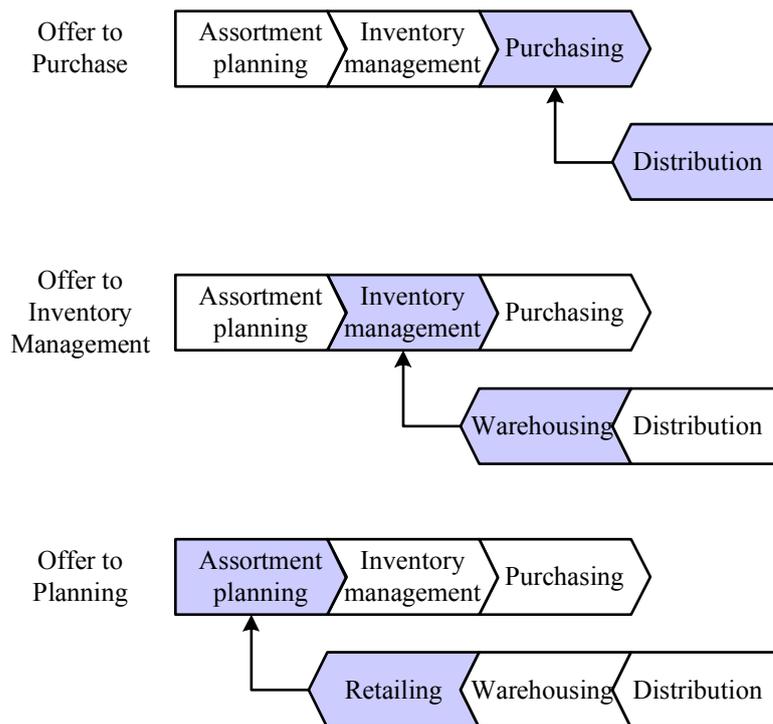


Figure 4. Three Major Value Offering Points (Hoover et al. 2001)

Placing the order penetration point is balancing between supplier costs and customer benefits. Moving the value offering point largely back in the demand chain benefits the customer and causes more work for the supplier. To find a win-win situation the interaction of both links has to be understood. Moving both the OPP and VOP back simultaneously increases the time needed to respond to customer demand, but also the time available to respond. The time advantage makes this a win-win configuration. The supplier can respond to demand earlier, because of better information and more time to act and the customer receives products reliably. The supplier can also reduce its inventory costs. (Hoover et al. 2001 in Eckhardt 2002)

5.2.4 JIT

The idea of Just-in-Time (JIT) is that no activity should take place in a system until there is need for it. This requires synchronization of all elements in the chain and the highest level of planning discipline. JIT logistics avoids excessive inventory holding by the supplier making the management of inbound materials flow a crucial issue. Small JIT deliveries are often combined into a single delivery of several suppliers. Thus, it is not a surprise that JIT philosophy has coincided with the growth of third-party distribution. (Christopher 1998)

JIT deliveries are not always appropriate. JIT deliveries are typically justified when the demand for variety and the value of the product are higher. (Christopher 1998)

5.2.5 QR, ECR, CR

There are many supply chain initiatives for time-based purchasing strategies inspired by JIT philosophy such as quick response (QR), efficient consumer response (ECR), and continuous replenishment (CR). All these inventory techniques use pull philosophy and information to minimize buffers. (Christopher 1998, James et al. 2000, Simchi-Levi et al. 2000 in Eckhardt 2002)

The idea of QR is to capture demand as close to real-time as possible and as close to the final consumer as possible (Christopher 1998). In a QR system suppliers receive point-of-sale (POS) data to synchronize production and inventory activities with actual sales at the retailer. The retailer still places individual orders but POS data is used to improve forecasting and scheduling, and to reduce lead time. (Simchi-Levi et al. 2008)

QR logistics has become a basis for collaborative working in the supply chain. In the grocery sector this development is called ECR. The principle of ECR is to reduce costs significantly by collaborating in new product introduction, trade and consumer promotions, range and assortment, and product replenishment. (Christopher 1998)

In a CR system the resupply of products is automatic due to electronic interface and computer-aided communication (Owens et al. 1998). The system should be so efficient and flexible that stocks are replenished continuously without placing orders (Bowersox et al. 2002). The vendors use POS data to prepare shipments at previously agreed-upon intervals and inventory levels defined by the customers (Simchi-Levi et al. 2008). The CR process works best with high-volume items (Warren 1995).

5.2.6 CPFR

Collaborative planning, forecasting, and replenishment (CPFR) is a concept of collaborative processes towards overall efficiency in the supply chain. CPFR emphasizes the importance of directly obtaining customer POS, inventory, and marketing plans. End-customer demand information is carried as far up in the supply chain as possible. All the supply chain partners should have common expectations and objectives about growth and profitability plans, marketing plans, category plans, and volume requirements. Companies develop strategic joint plans with key customers to improve their success. Companies also perform the operations jointly and their goal is an effective supply chain without delays or duplicate efforts. (Bowersox et al. 1999, Kaipia et al. 2001 in Eckhardt 2002)

5.2.7 VMI

One time-based method is vendor managed inventory (VMI), which is maybe the most successful supplier collaboration concept. The VMI principle is sometimes called supplier managed inventory (SMI), jointly managed inventory (JMI), or co-managed inventory (CMI). The idea of VMI is that customers do not place orders to suppliers. The supplier takes the responsibility for replenishment of the customer's inventory on the basis of demand and inventory information. (Christopher 1998, Hoover et al. 2001 in Eckhardt 2002)

Even though the VMI system can be realized in different ways, there is a common characteristic that differentiates VMI from other techniques — the supplier's responsibility. The supplier determines the replenishment quantity, frequency, and

regularity. This means that a supplier's performance can be measured in terms of availability and inventory turnover instead of delivery time and accuracy. (James et al. 2000, Kaipia et al. 2002 in Eckhardt 2002)

The most essential dimensions of VMI are ownership and physical location. Inventory management responsibility and direct cost are related to inventory location. In theory, the party offering the lowest real cost of ownership should be responsible for inventory management. The arrangement where the stock is owned by the supplier but held at the purchaser's site of use is sometimes called consignment stocking. (Hughes et al. 1998, James et al. 2000 in Eckhardt 2002)

A well-engineered VMI system offers several benefits for both the supplier and customer. It also benefits the entire demand-supply chain by reducing costs and improving responsiveness. Table 1 summarizes the benefits. (James et al. 2000)

Table 1. Possible VMI Benefits

Supplier	Customer
<ul style="list-style-type: none"> • Greater transparency • No need to forecast • Smooth demand • Better flexibility in deciding timing and quantity • Better resource utilization for production and transportation • Reduced need of buffers and inventories • Customer retention (higher switching cost) • Becoming more reliable supplier for all customers 	<ul style="list-style-type: none"> • Reduced administration cost • Improved service level and availability • Less stock-outs • Assured for critical needs • Lower inventories • Lower need of storage space • Improved cashflow • Supplier's specialist expertise
The supply chain	
<ul style="list-style-type: none"> • Smooth demand • Reduced bullwhip effect • Reduced need of double buffering • Competitive advantage through lower cost and lower consumer price 	

5.3 Transport chain trends: efficiency, additional services

5.3.1 Increasing use of logistics service providers

In the global economy, logistics service providers optimize transport chains around the world in order to quickly, flexibly and cost-efficiently fulfil customer needs. Bask (1999) defines third party logistics (TPL) as “relationship between buyer and seller (interfaces in the supply chains) and Third Party Logistics companies, where logistics services are offered basic to customized ones with shorter or longer term relationship, with the aim of efficiency”. According to Berglund (2000) third party logistics provider (TPLP) is an organization that manages, controls, and delivers third-party logistics. This definition does not prescribe who designs the logistics solution nor restrict TPLP from using other organizations for the execution of operations.

Transportation, warehousing, forwarding and stevedoring activities constitute a major part of TPL services (Bask 1999). Newer logistics services include emergency deliveries, packaging, labelling, pricing, postponement, order, and information processing. Emerging services include:

- cross-docking, which is a strategy to reduce the time inventory spends in the supply chain. When products are received at an inbound dock they are immediately moved “crossdock” for outbound shipment for customer. (Galbreth et al. 2008)
- merge-in-transit, which is a process where goods from several locations are consolidated into one final customer delivery (Kärkkäinen et al. 2003)
- allocation-in transit,
- call-centers and
- e-commerce applications.

The turnover of information based and value-added activities is low despite of the increased extent of these services. TPLPs are still adding the most value to their customers by traditional transportation and warehousing. (Laarhoven et al. 2000)

The forth party logisticsTM (4PLTM) or Lead Logistics Provider (LLP) solution incorporates the advantages of outsourcing and insourcing to maximize overall benefit. 4PLTM is typically established as a joint venture or long-term contract and is responsible

for management and operation of entire supply chain. 4PLTM acts as the only interface between the client and several logistics service providers. (Gattorna 1998)

5.3.2 Growth of container traffic

The introduction of containerization caused accommodation in the geography and design of ports and container terminals (Panayides & Song 2008). Containerization has improved the performance of general cargo at ports and terminals. It has also transformed freight transport systems servicing international supply chains. The demand for multimodalism has increased and the multimodal transport network has expanded and become more effective. The transition from containerization to multimodalism involves an integrated systems approach until interoperability is achieved. (Islam et al. 2005)

5.3.45.3.3 Trends in maritime freight transport, shipping and ports sector

Nearly 82% of the global transportation volume is by sea freight. However, as one of the cheapest transport modes the share of sea freight in logistics value is only around 12%. Container shipping has a dominant share, 34.5%, of the global sea freight market. (Datamonitor 2009). In the European Union ports handle more than 90 percent of the EU's trade with third countries and around one third of intra-EU trade. Thus, ports and maritime transport has a significant role in global commerce (Mangan 2008).

According to Mangan et al. (2008), following trends exist in maritime freight transport, shipping and ports sector:

- *“Gigantism” and traffic concentration.* Vessel size has increased dramatically in recent years (“gigantism”) and only certain ports can handle such vessels. This has led to a traffic concentration at these ports. As hub and spoke networks have increased, many mid-size ports are playing a feeder role.
- *Trade imbalance.* A supply-demand mismatch occurs along the same corridor causing directional imbalances and large numbers of empty

containers. The situation is the worst in the corridor between Asia and USA. There is almost three times more maritime freight going from Asia to USA than the other way around.

- *Capacity constraints.* Increasing demand leads to capacity constraints, especially in container traffic, and demand for new ships is outstripping supply.
- *Increased regulation.* Environmental and security issues are growing features in the sector.
- *Short sea shipping.* Especially in Europe, the rise in short sea shipping is apparent due to congestion and other issues affecting land transport.
- *Changes in the ownership and management of the ports sector.* The relationship between ports and government has changed profoundly over the past quarter of century. Many governments have stopped operating in port business and concentrate only on monitoring and oversight responsibilities. The most of the world's top container ports are PUBLIC/private. The different models of port administration are presented in Table 2.

Table 2. Port administration models

Models	Land ownership	Port function/ Regulation	Cargo Handling
Pure PUBLIC sector	Public	Public	Public
PUBLIC/private	Public	Public	Private
PRIVATE/public	Private	Public	Private
Pure PRIVATE sector	Private	Private	Private

- *Global port operators (GPOs).* Mega shippers of freight are seeking single supplier contracts with carriers who are able to provide efficient and cost effective services. Also carriers are seeking cost reduction and efficiency at ports. To fulfill these requirements and to integrate global

supply chains a number of GPOs have emerged managing increasing number of the world's ports.

- *Inter-port competition.* The competition between ports has intensified. It can be recognized in different forms between:
 - whole ranges of ports or coastlines,
 - ports in different countries,
 - individual ports in the same country,
 - the operators or providers of facilities in the same port, and
 - different modes of transport.
- *Ports and economic growth.* Ports are critical links in supply chains and their efficiency and performance are recognized to determine a country's competitiveness.

Datamonitor (2009) has identified following trends regarding container lines:

- *Increasing cost control*
 - 'slow steaming', where lines operate at a low engine load allowing lines to sail at half speed, which in addition to cost saving reduces CO2 emissions remarkably
 - revised transit routes to avoid transit fees, for example going around the Cape of Good Hope rather than through the Suez canal
- *Improving service level* by introducing new services and entering into new alliances with other lines and redesigning networks to include more around-the-world services
- *Reassessing network plans and rationalizing services* with less direct port calls and more transshipment and feeder services.

5.4 General trends

5.4.1 E-commerce and IT

E-commerce means trading of goods and services over private or public computer-mediated networks. In recent years there has been a massive shift from private networks to 'open' Internet. The Internet provides businesses with a more flexible and

comprehensive means of interaction at a much lower cost than earlier electronic technologies such as electronic data interchange (EDI). A basic document exchange is designed to one-to-one interactions, but the Internet allows one-to-many and many-to-many interactions. (Anderson & Leinbach 2007)

Electronic document exchange requires three special features. Valuable and private information needs to be protected by some form of encryption. Also an audit trail must indicate when parties concerned have received the documents in order to prevent delays or claims not having received the document. Finally, an electronic signature is needed to close deals without face-to-face contact or paper handling. (Anderson & Leinbach 2007)

E-commerce activities are generally divided into business-to-business (B2B) and business-to-consumer (B2C) categories. B2B dominates e-commerce clearly. B2C Internet sales had a share of 4,2 per cent (EU27) year 2007 (Eurostat 2008). [Table 3](#) shows that manufacturing has the highest e-commerce penetration in EU enterprises. It is easier for businesses than for consumers to adopt Internet for completing transactions because businesses have previously used pre-Internet electronics means such as fax and EDI. Thus, the leap from conventional shopping to web-shopping is greater. (Anderson & Leinbach 2007)

Table 3. Per cent of enterprise turnover from e-commerce in 2007. (Eurostat 2008)

	EU15	EU27
Total	12	11
Manufacturing	15	14
Wholesale/retail	11	10
Accommodation	14	13
Transportation/storage/communication	12	11

E-commerce substitutes physical distribution of goods only in some lines of businesses. For example, software, publications, and plane tickets can be downloaded by the customer without the need for freight transportation. B2B and B2C e-commerce have different effect on freight. When a consumer adopts e-commerce a personal transportation is substituted by freight transportation. B2B e-commerce has less influence on freight because goods movement will be the same than always even though orders will be placed and processed through a new medium. (Anderson & Leinbach 2007)

Transport service providers have been early adopters of e-commerce. Client information in electronic form helps in optimizing load consolidations, scheduling and routing. The Internet provides a medium for tracking and tracing using data produced by intelligent transportation systems (ITS) technologies such as scanning technologies. A highly visible freight system locates in transit goods at any point in time within a small margin of error. (Anderson & Leinbach 2007)

Supply chain integration and intelligent logistics will be discussed in study SE 2.1.3.

5.4.2 Globalization

The international division of labour, a complex set of production factors (e.g. the growth of outsourcing, standardization of production processes) and the utilization of information and communication technologies (ICT) combined with decrease in transport cost have fostered economic globalization which results in significant freight flows worldwide. (Leinbach & Capineri 2007)

The long term goal of globalization is to increase the level of living of all the world's peoples (Black 2007). Globalization makes it possible to buy reasonably priced goods around the world - particularly in Asia (DHL 2008). However, some countries are losing productive activities and many countries are not benefiting from globalization (Black 2007). Globalization increases the average length of shipments which increases emissions, accidents and fuel use (Black 2007). The great distances also pose a challenge to the logistics sector (DHL 2008).

The main trend in global logistics is to reduce energy cost by efficient modal shifts and investment in greener fuels and vehicles. It is expected that emerging markets in Asia Pacific, Middle East & Africa and Latin American will increase their shares in the global logistics market. (Datamonitor 2009)

Sea is the dominant transport mode globally. The trend of modal shift from more expensive modes of transport to less expensive modes, modernization of ports in emerging markets and arrival of big carriers is expected to improve marginally the share of sea freight by 2013. Rail freight is expected to raise its share due to government support in order to reduce emissions from the transport sector. (Datamonitor 2009)

5.4.3 Sustainability

Sustainability consists of the natural environment, society, and economic performance. In the field of supply chain management sustainability refers to following environmental and societal issues (Carter & Rogers 2008):

- development of environmental logistics strategies,
- environmental purchasing,
- carrier selection for and the transportation of hazardous materials,
- improvement of fuel efficiency and emissions reduction from transportation equipment,
- safety in motor carrier, rail, and airline industries,
- diversity hiring and promotion issues concerning logistics personnel, and
- diversity of for-hire motor carriers and other industrial suppliers.

Organizations are increasingly paying attention to sustainability and adopting it in business strategy. Projects aiming at sustainability are increasing as energy costs continue to rise and consumer groups are pressuring due to greater transparency along supply chains. Also organizations are taking a more holistic view of the costs and benefits associated with social and environmental projects. Possible benefits and cost savings are related to (Carter & Rogers 2008):

- reduced packaging waste and the ability to design for reuse and disassembly,
- reduced health and safety costs, and lower recruitment and labour turnover costs resulting from safer warehousing and transportation and better working conditions,
- lower labour costs – better working conditions can increase motivation and productivity, and reduce the absenteeism of supply chain personnel
- companies that proactively address environmental and social concerns can influence government regulation which can lead to competitive advantage for companies and their suppliers
- reduced costs, shorter lead times, and better product quality associated with the implementation of ISO 14000 standards, which provide a framework for environmental management systems, and
- enhanced reputation – engaging in sustainable behaviour can make an organization more attractive to suppliers and customers, to potential employees, and to shareholders.

6. Conclusions

Business logistics' objective is to reduce cost without degrading service level. This can be achieved by efficient procedures and co-operation. Supply chain management aims at lower inventories, higher efficiency, and more co-operation and transparency between partners. This can be achieved by adopting logistics concepts, for example VMI. All the logistics concepts emphasize the importance of information sharing. Transportation in the supply chains aim at better efficiency and new services. The use of LSPs increases efficiency by combining and optimizing transportations and using developed concepts. LSPs also offer several value adding services.

General trends such as e-Commerce, IT, globalisation and sustainability have also a great influence on supply chains. Trends shape the environment where supply chains operate and thus trends are drivers for new supply chain strategies and concepts. For example IT creates new possibilities and increases efficiency. Global markets increase competition and pose challenges for transportation, but opens new possibilities for

logistics service providers. Sustainability improves companies' image and fosters more ecological solutions, but these solutions might be less cost effective requiring more developed solutions.

7. References

Anderson, W.P. & Leinbach, T.R. 2007. E-commerce, logistics and the future of globalized freight. In: Leinbach, T.R. & Capineri, C. (eds.) Globalized Freight Transport: intermodality, e-commerce, logistics and sustainability. UK, Edward Elgar Publishing Limited. pp. 167-188

Bask, A. 1999. Third Party Relationships in Logistics Services, Helsinki School of Economics and Business Administration, Licenciate Thesis, Helsinki. 140 p.

Berglund, M. 2000. Strategic Positioning of the Emerging Third-Party Logistics Providers. Linköping studies in Management and Economics, Dissertations No. 45.

Black, W.R. 2007. Sustainable solutions for freight transport. . In: Leinbach, T.R. & Capineri, C. (eds.) Globalized Freight Transport: intermodality, e-commerce, logistics and sustainability. UK, Edward Elgar Publishing Limited. pp. 189-216

Bowersox, D. J. & Closs, D. J. 1996. Logistical management: The Integrated Supply Chain Process. Singapore, McGraw Hill. 730 p.

Bowersox, D. J., Closs, D. J. & Stank, T. P. 1999. 21st Century Logistics: Making Supply Chain Integration a Reality. Oak Brook, IL, Council of Logistics Management. 264 p.

Bowersox, D.J., Closs, D.J. & Cooper, M.B. 2002. Supply Chain Logistics Management. New York, McGraw Hill. 656 p.

Carter, C. R. & Rogers, D. S. (2008) A framework of sustainable supply chain management: moving toward new theory. *International Journal of Physical Distribution & Logistics Management*. Vol. 38, No. 5, pp. 360-387.

Christopher, M. 1998. *Logistics and Supply Chain Management: Strategies for Reducing Cost and Improving Service*. 2nd ed. England, Prentice Hall. 294 p.

Datamonitor. 2009. *Global Logistics through the Economic Downturn*. December 2009. 130 p.

DHL. 2008. [www-document]. <www.dhl-discoverlogistics.com>. (Read 30.10.2008)

Eckhardt, J. 2002. *Logistical Solutions for a Vendor Managed Inventory System*. Master's Thesis. University of Oulu. 72 p. + app. 5 p.

Eurostat. 2008. [www-document]. <<http://epp.eurostat.ec.europa.eu>> (Read 26.11.2008)

Galbreth, M.R., Hill, J.A. & Handley, S. 2008. An investigation of the value of cross-docking for supply chain management. *Journal of Business Logistics*. Vol. 29, No. 1, pp. 225-240.

Gattorna, J. 1998. Fourth-party logistics. En route to breakthrough performance in the supply chain. In: Gattorna, J. L. (ed.) *Strategic Supply Chain Alignment: Best practice in supply chain management*. Hampshire, Gower Publishing Limited. pp. 424-445

Hoover, W. E. Jr., Eloranta, E., Holmström, J. & Huttunen K. 2001. *Managing the Demand-Supply Chain: Value Innovations for Customer Satisfaction*. New York, John Wiley & Sons, Inc. 257 p.

Hughes, J., Ralf, M. & Michels, B. 1998. *Transform Your Supply Chain: Releasing Value in Business*. London, International Thomson Business Press. 240 p.

Islam, D.M.Z, Dinwoodie, J. & Roe, M. 2005. Towards Supply Chain Integration through Multimodal Transport in Developing Economies: The Case of Bangladesh. *Maritime Economics & Logistics*; Rotterdam. Vol.7, Iss.4, pp.382-399

James, R., Francis, M. & Rich, N. 2000. Vendor Managed Inventory (VMI): A System Approach. In: Hines, P., Lamming, R., Jones, D., Cousins, P. & Rich, N. (eds.) *Value Stream Management: Strategy and Excellence in the Supply Chain*. Great Britain, Prentice Hall. pp. 335-355

Kaipia, R. & Holmström, J. 2001. On the way to supply chain collaboration — measuring the benefits of information sharing. Working paper. [WWW document]. <http://www.tai.hut.fi/ecomlog/publications/time_profit.html>. (Read 16.10.2001)

Kaipia, R., Holmström, J. & Tanskanen, K. 2002. VMI: what are you losing if you let your customer place orders? *Production Planning & Control*, Vol. 13, No. 1, 13 p.

Kärkkäinen, M. Ala-Risku, T. & Holmström, J. 2003. Increasing customer value and decreasing distribution cost with merge-in-transit. *International Journal of Physical Distribution & Logistics Management*. Vol. 33, No. 2, pp. 132-148.

Laarhoven van, P., Berglund, M & Peters, M. 2000. Third-party logistics in Europe — five years later. *The International Journal of Physical Distribution & Logistics Management*. Vol. 30, No. 5, p. 425

Leinbach, T.R. & Capineri, C. 2007. The global economy and freight transport flows. In: Leinbach, T.R. & Capineri, C. (eds.) *Globalized Freight Transport: intermodality, e-commerce, logistics and sustainability*. UK, Edward Elgar Publishing Limited. pp. 1-14

Mangan, J., Lalwani, C. & Fynes, B. 2008. Port-Centric Logistics. *The International Journal of Logistics Management*, Vol 19 No 1, pp. 29-41

Owens, G., Vidal, O., Toole, R. & Favre, D. 1998. Strategic sourcing: Aligning procurement needs with your business goals. In: Gattorna, J. L. (ed.) *Strategic Supply Chain Alignment: Best practice in supply chain management*. Hampshire, Gower

Publishing Limited. pp. 285-301

Panayides, P.M. & Song, D-W. 2008. Evaluating the integration of seaport container terminals in supply chains. *International Journal of Physical Distribution & Logistics Management*, Vol.38, Iss.7, pp.562-584

Rushton, A., Oxley, J. & Croucher, P. 2000. *The Handbook of Logistics and Distribution Management*. 2nd ed. London, Kogan Page. 571 p.

Sakki, J. 2001. *Tilaus-toimitusketjun hallinta: Logistinen b to b- prosessi*. 5th ed. Espoo, Jouni Sakki Oy. 234 p.

Simchi-Levi, D., Kaminsky, P. & Simchi-Levi, E. 2000. *Designing and Managing the Supply Chain: Concepts, Strategies, and Case Studies*. USA, McGraw Hill. 321 p.

Simchi-Levi, D., Kaminsky, P. & Simchi-Levi, E. 2008. *Designing and managing the supply chain: concepts, strategies, and case studies*. 3rd ed. Mc Graw Hill, New York. 498 p.

Warren, T. 1995. How CRP cut inventory, sped turn & grew sales. *Frozen Food Age*. Vol. 43, No. 8, pp. 1-3.