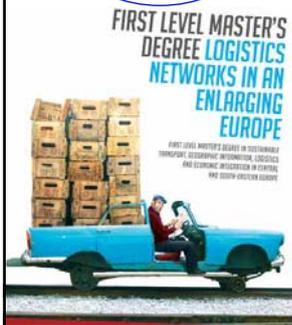## University of Trieste

LOGISTICS NETWORKS IN ENLARGING EUROPE

Improving the Fulfillment Process with closed-loop supply chain

FIRST LEVEL MASTER'S DEGREE LOGISTICS NETWORKS IN AN ENLARGING EUROPE

FIRST LEVEL MASTER'S DEGREE IN SUSTAINABLE TRANSPORT, GEOGRAPHIC INFORMATION, LOGISTICS AND ECONOMIC INTEGRATION IN CENTRAL AND SOUTH-EASTERN EUROPE

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02/02/2007

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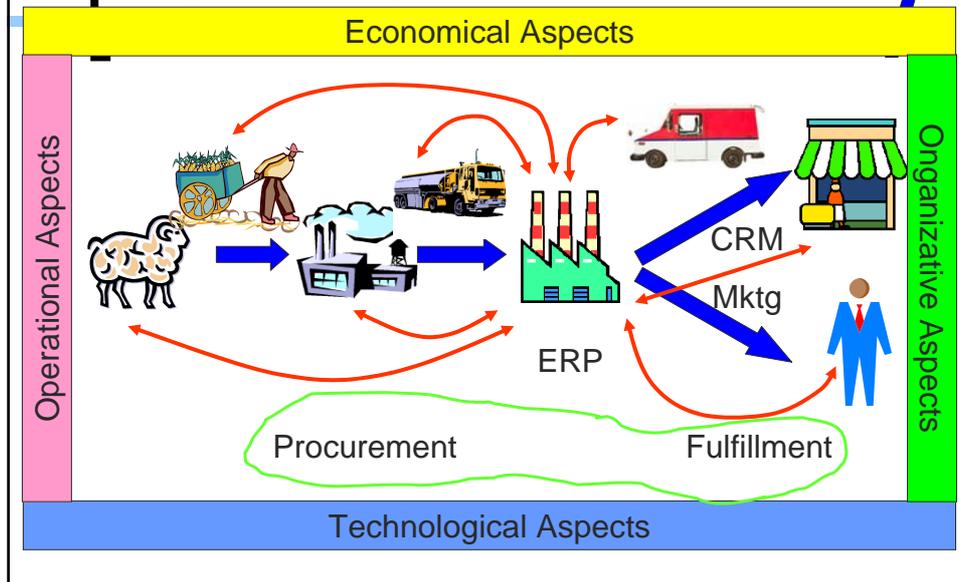- Certified by ELA (European Logistics Association) – Strategic Level

Summary

- The fulfillment process
- Implementation of fulfillment
- Toward the collaborative network
- Extend the customer services with Closed-loop supply chain
- RFID supports reverse logistics

E-business, e-supply chain and more..

- The integration of a supply chain needs Information and Communication Technologies (ICT).
- When a business process is supported by ICT we should speak of e-business
- Inside e-business there is e-logistics …

E-logistics is a part of e-business!

Economical Aspects

Operational Aspects

Onganizative Aspects

CRM

Mktg

ERP

Procurement   Fulfillment
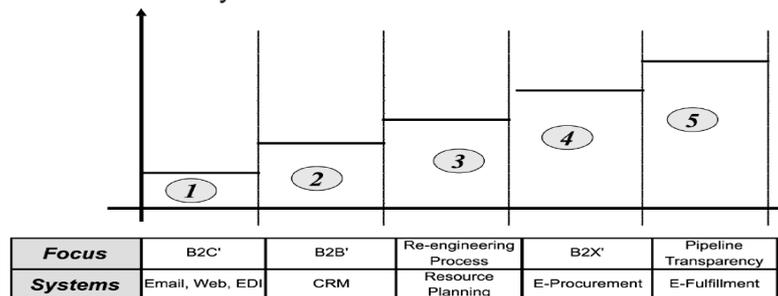
Technological Aspects

E-logistics

- E-Logistics is a dynamic set of communication, computing, and collaborative technologies that transform key logistical processes to be customer centric, by sharing data, knowledge and information with the supply chain partners.
- E-logistics also enables synchronization of events and right decision-making.

Evolution of Supply Chain

- Supply chain literature has been concentrating on key processes in supply and distribution
- Croom (2005) in a recent study proposed an evolutionary model

Focus	B2C'	B2B'	Re-engineering Process	B2X'	Pipeline Transparency
Systems	Email, Web, EDI	CRM	Resource Planning	E-Procurement	E-Fulfillment

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Why Fulfillment

- Hvolby and Trienekens (2002) highlight the difficulty of integrating the supply chain towards demand.
- The market is characterized by the need for increasingly customized products and services.
- Products and services must be ready in an increasingly short time.
- In short
  - Shorter and shorter product life cycles;
  - Demand for greater variety;
  - Increased business risk, due to market volatility.

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4

Strategies customer-centric

- To respond to these issues companies must integrate their supply chain toward customers.
- Companies need a new fulfillment strategy.
- The new e-Supply chain requires business-process and technology synchronization across the entire chain.

The e-Supply Chain

- An e-Supply chain is, in effect, a virtual organization that encompasses a group of trading companies, all working together to slash costs and share profits.

- By optimizing not only their internal processes but also their mutual interactions, they realize the benefits of a truly integrated supply chain.

The forces of e-Supply Chain

- Three forces are converging to create an explosion in consumer-direct business models:

  o technology forces are making it possible,

  o market forces are making it viable, and

  o social forces are making it inevitable.

Fulfillment: the origins

- Fulfillment has evolved from a term to describe distribution for direct marketing organizations to a word that encompasses broader and more customer-centric supply chain processes.
- Supply chains are evolving into "fulfillment networks"—demand-driven e-business networks where participants are linked.

Fulfillment: the goal

- In a perfect e-business fulfillment network, all participants are synchronized to deliver complete customer satisfaction.

- The goal in fulfillment strategies is to deliver the right product to the right place at the right time for the right price in the right conditions.
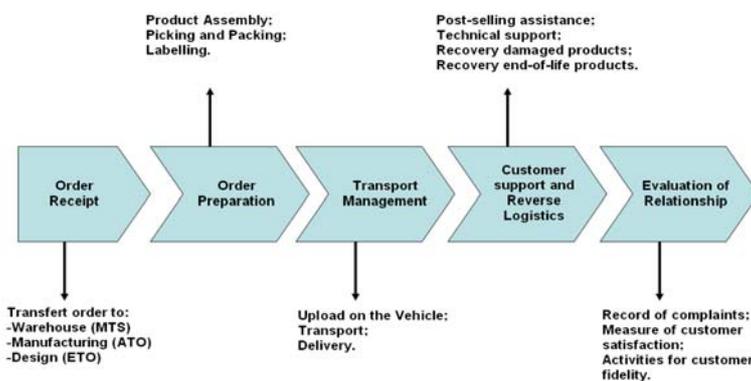
The Key to success

- The key to success is being able to give customers
  - what they want,
  - when they want it,and
  - how they want it,
  - all at the lowest cost.

- This requires "real-time fulfillment " or "e-fulfillment" or fulfillment supported by ICT
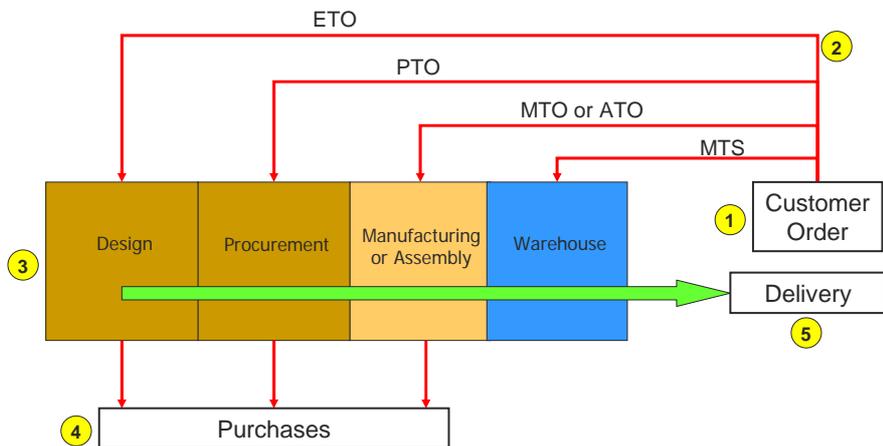
Fulfillment

- fulfillment —what happens after the order is placed.

- It involves rethinking traditional supplier relationships and the role of information driven fulfillment logistics

- The fulfillment merges a customer oriented strategy with a logistics perspective

The Model

Product Assembly;
Picking and Packing;
Labelling.

Post-selling assistance;
Technical support;
Recovery damaged products;
Recovery end-of-life products.

Order Receipt → Order Preparation → Transport Management → Customer support and Reverse Logistics → Evaluation of Relationship

Transfert order to:
-Warehouse (MTS)
-Manufacturing (ATO)
-Design (ETO)

Upload on the Vehicle;
Transport;
Delivery.

Record of complaints;
Measure of customer satisfaction;
Activities for customer fidelity.

8

Order receipt

ETO

PTO

MTO or ATO

MTS

Design	Procurement	Manufacturing or Assembly	Warehouse

Customer Order

Delivery

Purchases

Control the Order receipt

- The metrics used for measuring performance in this phase are:
- Time for confirmation of order: average time between receiving order and sending order confirmation;
- Number of orders arriving electronically to total number of orders.
- Time elapsed between receiving order and starting preparation activity;

9

Order preparation

- This phase covers all the activities necessary to prepare products for dispatch:
  - packaging,
  - labelling and
  - moving products to prepare them for the transportation
- The aim is to prepare the order in the shortest possible time, committing as few errors as possible.

Control the Order Preparation

- Time needed for picking and dispatch preparation;
- Percentage of errors due to picking incorrect products.
- Average picking times.
- Correctly prepared orders to total number of orders.
- Cost of the phase, including staff and vehicles needed for the movement.

Transport management

- This begins with loading the goods onto the vehicle.
- The phase ends when the product reaches the customer.
- Optimal management means getting goods to their destination in the agreed time, in the agreed condition (avoiding damage to the goods), at the lowest cost.
- Usually this phase is outsourced.

Control Transport management

- time for preparing the order;
- time for transferring goods;
- delays on predicted times;
- number of goods damaged during transportation to the total volume of goods transported.

Customer support and reverse logistics

- Customer support is an approach to guarantee an optimal process of supply to the customer

- This phase aims to **increase customer loyalty** and to gain a competitive advantage

YOUR OBJECTIVE

Control Customer Support

- average customer life cycle;
- variation in volume of customer purchases;
- customers lost per year or customers acquired per year;
- number of returned finished products to delivered finished products.
- time to resolve a complaint.
- number of complaints per month or number.
- Number of complaints to number of orders.
- Average time needed to resolve a problem
- Percentage of Finished Products returned (by customers) to total of Finished Products dispatched
- Number of interventions under guarantee / to total number of interventions
- Product repair time
- Average cost of product repair

Reverse Logistics

- The process of planning, implementing and controlling flows of raw materials, in process inventory, and finished goods, from a manufacturing, distribution or use point to a point of recovery or point of proper disposal (Council of Logistics Management) [see Prof. Maggi]

REVERSE LOGISTICS

Evaluation of the relationship

- The aim of evaluation is to collect data from customers following experiences in order to increase market intelligence and to create a loyal relationship.
- It is important to maintain a relationship with customers.
- Companies have to understand the relationship with their customers is very important in terms of:
  - knowledge of their purchasing behaviour;
  - knowledge of how the company's image is perceived;
  - knowledge of the value generated;
  - knowledge of the value the company is able to generate for the customer.

Control the Evaluation of the relationship

- For this final phase some suggested performance indicators are:
- number of satisfied customers to total number of customers;
- percentage of customers who re-purchase;
- variation of average total sales per customer;
- variation of the number of class A customers;
- cost of retaining customers to average cost of acquiring customer;
- Average life-cycle of customer.

Organize the fulfillment process

- The implementation of fulfillment process is not easy.
- The company must select:
  - The communication system (EDI, Web EDI, Web)
  - The partners
  - The collaborative network

Communication systems

- The e-Business has evolved by 3 generations (or waves).
- The first wave is lead by the widely use of ERP systems to improve productivities and EDI for transactions efficiency between enterprises. EDI is very expensive.
- The emergence of Internet let the industry into the second generation, represented by the web-presence (including using internal web-based productivity tools, and external web-based catalogs) and e-commerce exchanges (B2C or B2B). Internet is open ant it's very cheap.
- The third wave will adopt the Web EDI, a new system that merge the safety of EDI with the simplicity of use and the inexpensiveness typical of Internet. The 3rd wave will be the virtual organization.
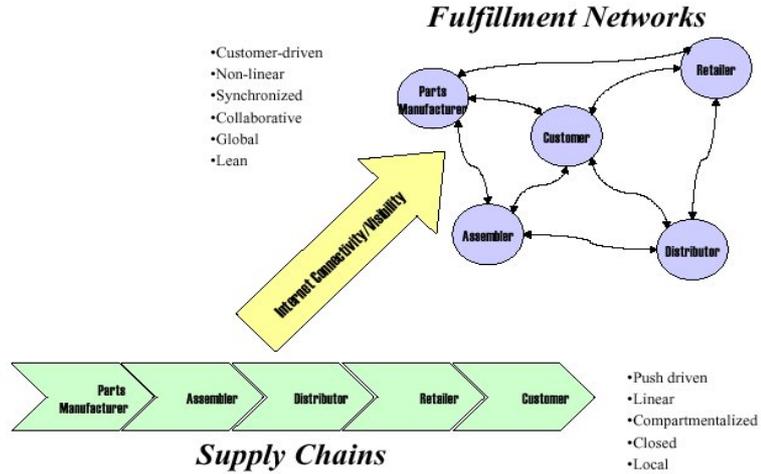
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Organize the fulfillment process

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How to make a Partnership

- Selection of partners is very critical.
- Usually, companies adopt this model:
  - Definition of critical parameters of partnership
    - Loyalty
    - Profits
  - Customer Analysis (Pareto distribution)
  - Preliminary Contact with customers
  - Selection of customers
  - Regulation of relationship

Customer Analysis

	C	B	A
A			Best Customers Class A-A
B			
C	Worst Customers Class C-C		

Loyalty (vertical axis) — Profits (horizontal axis)

Project developed in
breton

16

Customer Analysis

Parameters	Weight	Customer AAAA		Customer BBBB		Customer CCCC	
		rel val	abs val	rel val	abs val	rel val	abs val
Profits	4	5	20	5	20	2	8
Cost of Customer	2	5	10	4	8	2	4
Payments	5	5	25	3	15	1	5
Loyalty	3	5	15	3	9	3	9
Vision	1	5	5	2	2	2	2
RATING			75		54		28

17

Organize the fulfillment process

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- The company must select:
  - The communication system (EDI, Web EDI, Web)
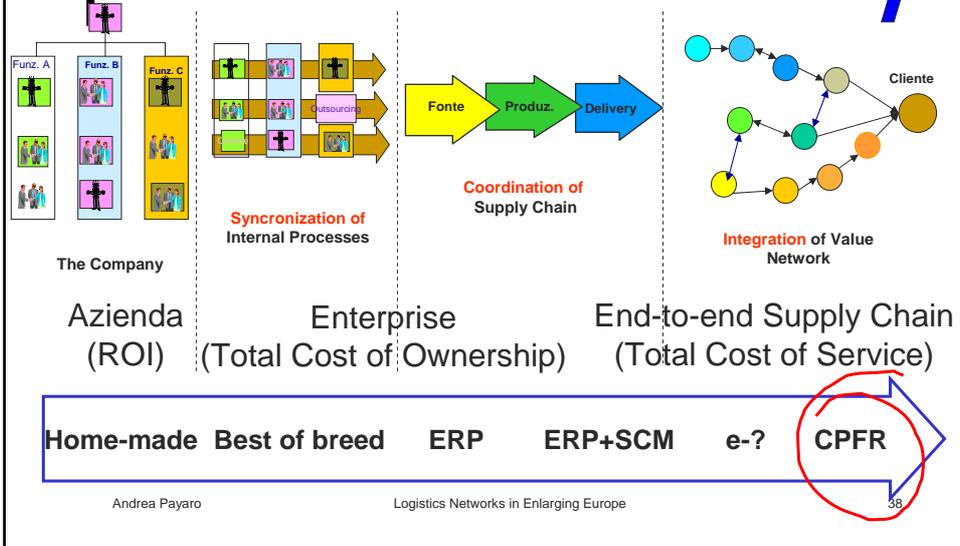 - The partners
  - The collaborative network

Fulfillment Networks

Fulfillment Networks

- Customer-driven
- Non-linear
- Synchronized
- Collaborative
- Global
- Lean

Internet Connectivity/Visibility

Parts Manufacturer → Assembler → Distributor → Retailer → Customer

Supply Chains

- Push driven
- Linear
- Compartmentalized
- Closed
- Local
- Bloated

Adapted from: fischer

From factory to end-to-end Supply Chain

Funz. A   Funz. B   Funz. C

The Company

Syncronization of Internal Processes

Outsourcing

Fonte   Produz.   Delivery

Coordination of Supply Chain

Cliente

Integration of Value Network

| Azienda (ROI) | Enterprise (Total Cost of Ownership) | End-to-end Supply Chain (Total Cost of Service) |

Home-made   Best of breed   ERP   ERP+SCM   e-?   CPFR

19

What is CPFR

- Collaborative planning, forecasting and replenishment (CPFR) is one new collaborative commerce model to enable collaborative relationships between buyers and sellers through co-managed processes and shared information.
- The early adopters of CPFR are retailers and their suppliers who want to increase their visibility to each other and let suppliers replenish goods at the right time and in accurate quantities.
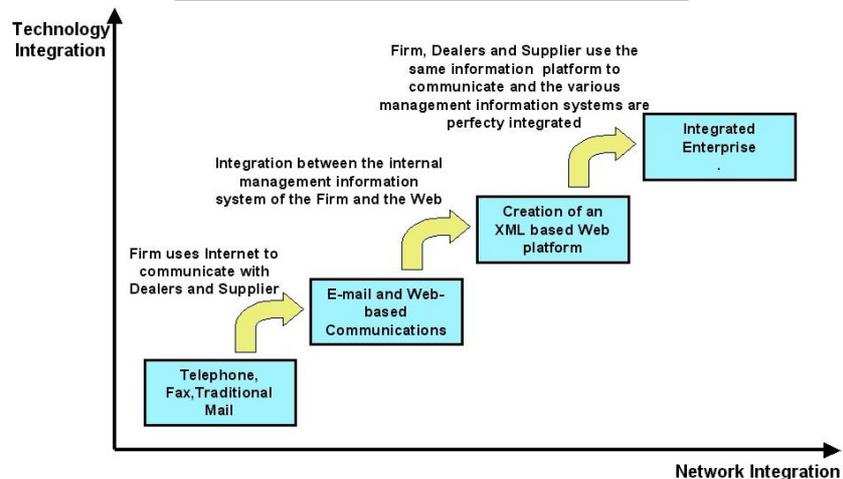
Virtual Enterprise

- Virtual Enterprise: a group of independent companies operating in concert within formalized guidelines to achieve mutually aligned business goals – such as increased revenue, lower costs, and more efficient business processes.

The Benefits of Virtual Enterprise

- Connecting supply chain partners via shared Virtual Enterprise software creates
  - process integration,
  - improves forecasting and product planning and
  - provides real-time access to order and shipment status
  - reducing manufacturing, distribution and sales costs.
- In a collaborative Virtual Enterprise environment, information must be shared among many companies; with participants adding, using and updating data, as needed for the many roles they play within a value chain.

Levels of Integration

Technology Integration

Firm, Dealers and Supplier use the same information platform to communicate and the various management information systems are perfecty integrated

Integration between the internal management information system of the Firm and the Web

Firm uses Internet to communicate with Dealers and Supplier

Telephone, Fax, Traditional Mail

E-mail and Web-based Communications

Creation of an XML based Web platform

Integrated Enterprise

Network Integration

Web-Based Communication

- First the Web-based communication, which focuses on creating and maximizing the potential of internal supply chains, where distributors,suppliers,customers,and others are linked but not fully integrated.

Xml-based Platform

- These communities then become the XML-based platform, which requires business-process and technology synchronization across the entire chain.

The Optimal e-ful. Model: CPFR

- The CPFR roadmap is divided into five steps as follows:

  - Step 1: Evaluate current conditions
  - Step 2: Define scope and objectives
  - Step 3: Prepare for collaboration
  - Step 4: Execute: Performing the pilot
  - Step 5: Assess results and identify improvements

Some Examples

- Customer centric: For instance, Fiat involved a group of key customers in the conceptual design of the next generation Fiat Punto. Through a Web-based survey, 3,000 customers effectively co-designed a car on-screen by selecting from various styles and features. Same strategy with the Nuova 500, in this case the co-designer are more than 17000.

Some Examples

- One of the first successful build-to-order (BTO) companies was Dell Computers, which gained market share by building customized computers using the Internet as an order fulfillment vehicle.
- Dell generated a 160% return on its invested capital by allowing customers to build their own computers online, then successfully manufacturing and delivering these computers with a lead time of 5 days for the delivery of the products
- BMW also allows customers to make changes to their vehicle within 6 days of final assembly (including a complete change in color, etc.). This allowed BMW to build up to 550,000 permutations of the Z3 vehicle.
- Designing to defer product differentiation is a strategy whereby the final configuration of a product is postponed as much as possible, usually until a customer''s order is received

…customers will no longer tolerate out-of-stock…

In caso di disservizio per la mancanza di prodotto a scaffale, il Consumatore/ Acquirente cambia prodotto o cambia negozio

REAZIONE AL DISSERVIZIO

QUANTI LASCIANO IL PdV?
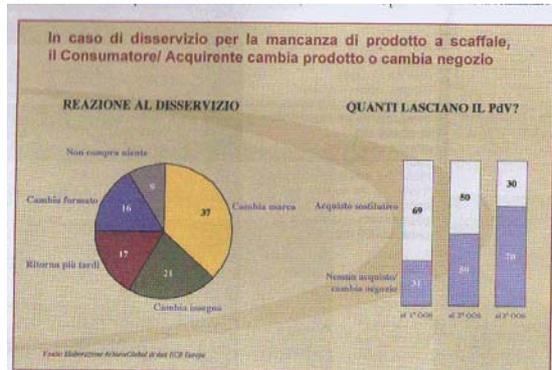
Un consumatore su tre alla mancanza della marca desiderata reagisce acquistando un'altra marca. Ma una percentuale simile rinuncia all'acquisto e addirittura il 21% cambia insegna. Le percentuali di abbandono si innalzano con l'aumento delle mancanze

From: Pietro Pedone, La logistica dell'ultimo metro, Il giornale della logistica, 2005

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L'80% dei casi viene risolto in 24 ore — 95% di clienti recuperati — 15

Il 20% si lamenta — 5% di clienti persi — 1

100 clienti insoddisfatti

46% di clienti recuperati — 2

Il 20% dei casi non viene risolto — 54% di clienti persi — 2

39% di clienti recuperati — 31

L'80% non si lamenta — 61% di clienti persi — 49

100
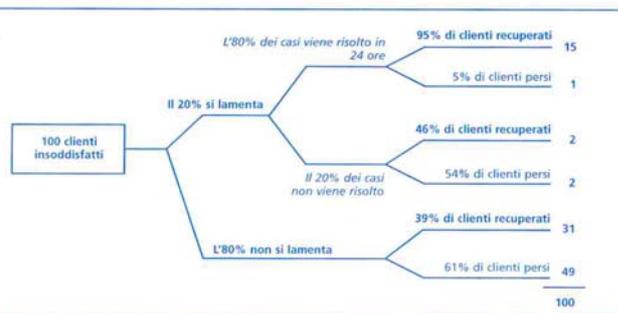
Figura 3.14 Strategie di miglioramento del tasso di ritenzione dei clienti

Source: J.J. Lambin, Marketing Strategico e Operativo, McGraw Hill

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Some Italian Examples

- CHL
- Ducati
- Aprilia

CHL

- Centro HL is an Italian company selling computers and related products.
- In 1996, CHL (www.chl.it) opened its first store to provide assistance with on-line purchasing

CHL: Model
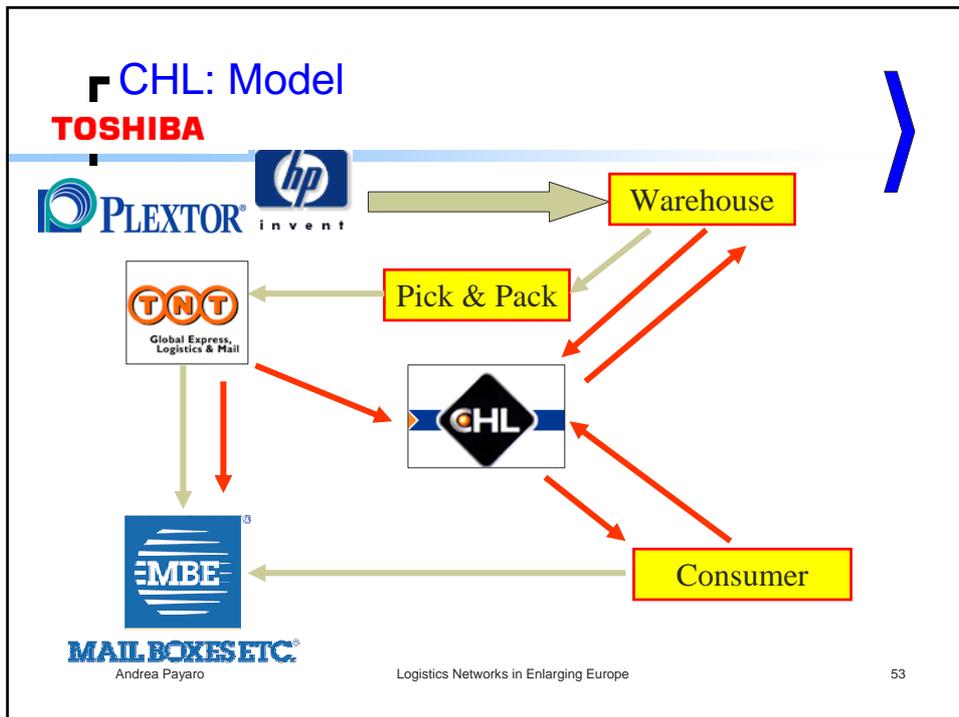
CHL: Fulfillment Model

- CHL Adopts Distributed Delivery Centers strategy
- High levels of Customer service
- Pick up Point is a real physical place and this gives customers a greater sense of security when making purchases
- Tracing of products

Ducati

- Ducati is one of the leading manufacturers of high performance motorcycles.
- Ducati also sells accessories and clothing in more than 40 countries world wide, especially in Europe and North America (85% of sales). The remaining 15% is distributed between Asia and Australia.

Ducati: Model

28
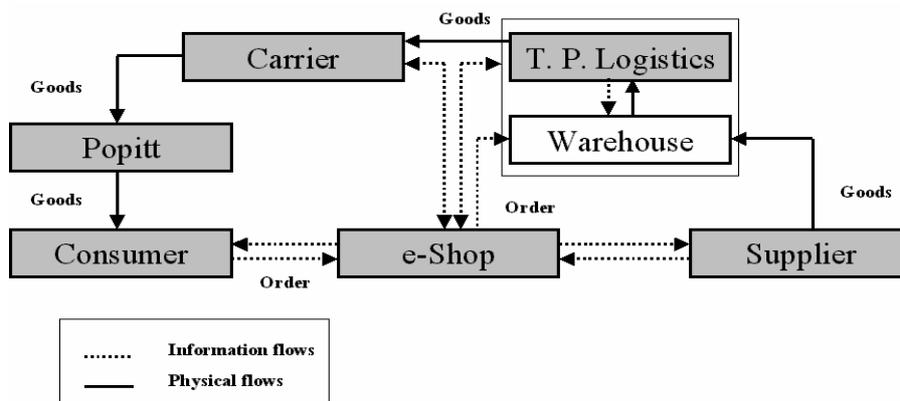
Ducati: Fulfillment Model

- In the B-to-B sector Ducati set up an Extranet called DesmoNet ™ in order to have greater control over managing customer orders, to facilitate the exchange of information between dealers and the headquarters and to offer better customer service
- Ducati adopts Dedicated Fulfillment Center and Build-to-Order strategies

Aprilia

- Aprilia was founded following the Second World War as a bicycle manufacturer.
- Today it is the second largest manufacturer of motorcycles and scooters in Europe and offers a complete range of two-wheel vehicles.
- In 2000, Aprilia manufactured 240,000 scooters and motorcycles ranging from 50 cc to 1000 cc.

## Aprilia: Fulfillment Model

- Aprilia has about 300 dealers, most of which sell several brands of vehicles.
- Aprilia has offered its dealers the opportunity to create and manage a virtual warehouse.
- The purpose of this type of network is to allow a company to gather and manage all of the information regarding a particular product.

Aprilia: Future Projects

- The e-procurement and e-fulfillment projects were carried out by creating a platform which could work in client-server mode. In this way, the suppliers and dealers accessing the network don't have to install the applications in their own system and thus investments in Information and Communications Technologies are kept low and the skills required are limited.

Results of an analysis: Positioning

Results of an analysis: Future Trends
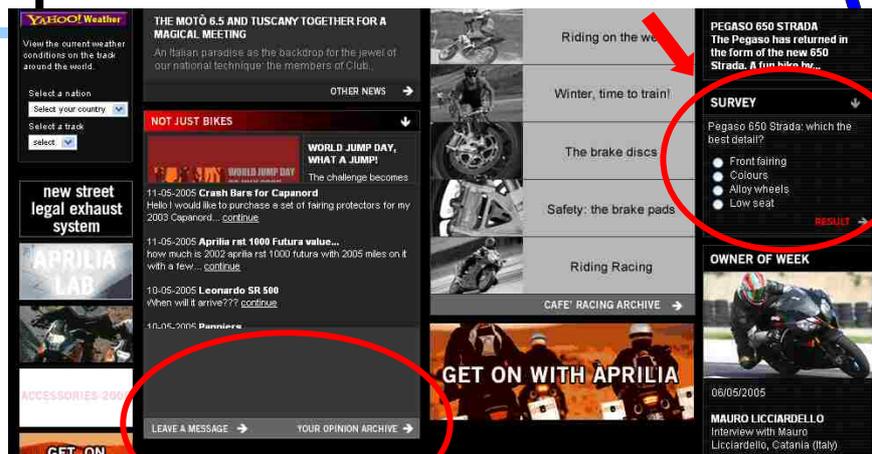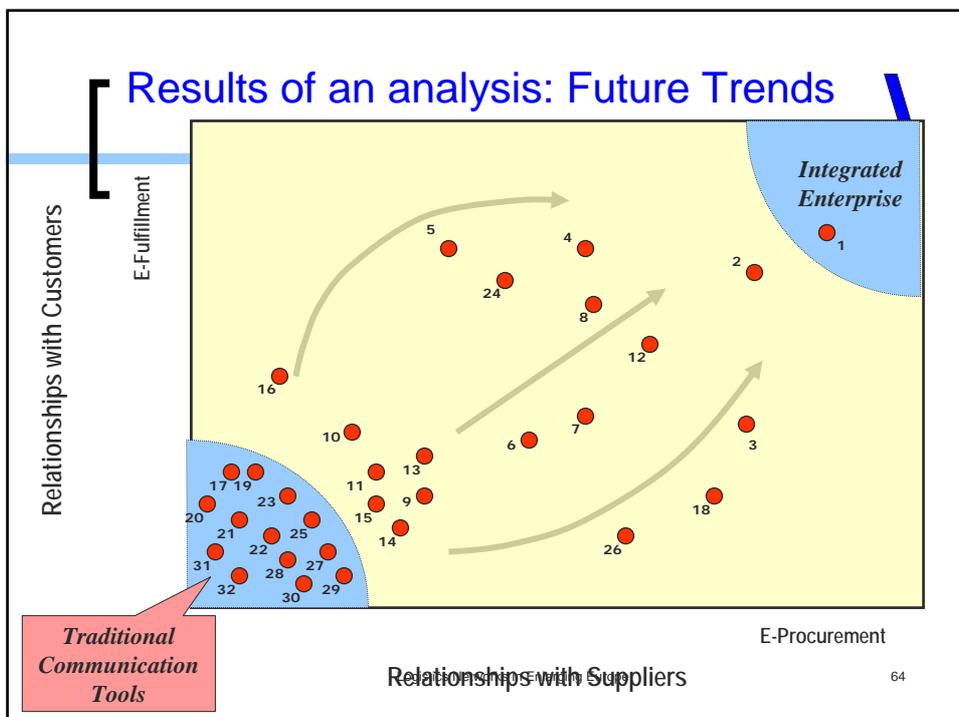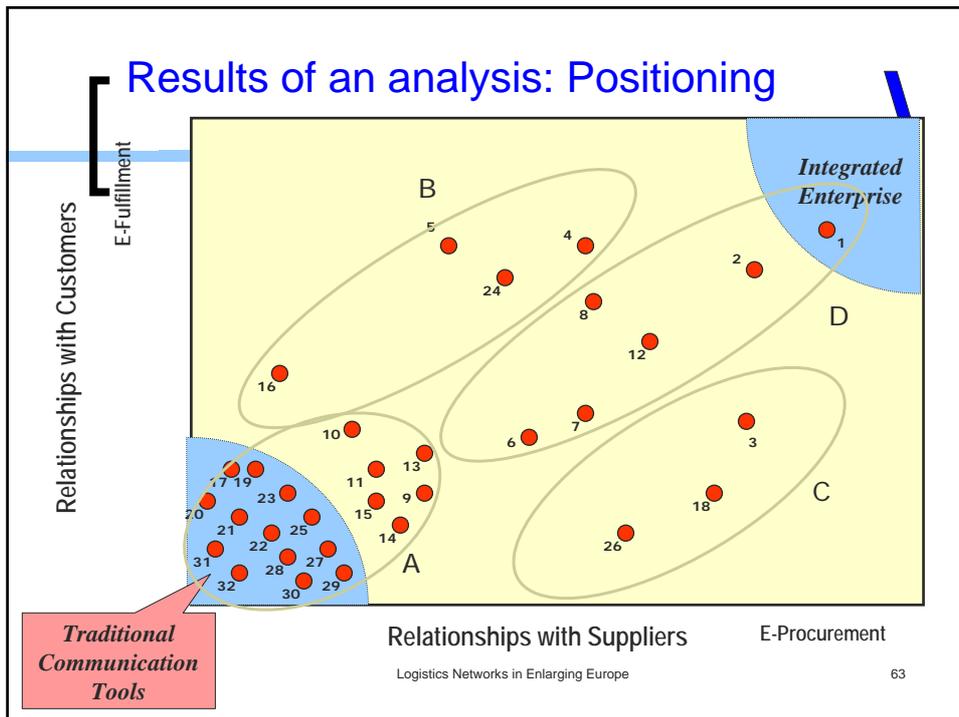
Not only for large companies

- CPFR is not dedicated only to large companies.
- Small and medium enterprises should realize integration and improve their supply chain.
- But…
- The lack of a common strategy among all chain members makes difficult the implementation of collaboration.
- The resistance to the organizational changes is a real weakness.
- The lack of trust in chain members hampers the information sharing.

Case Study: Pe-Ma Group

- A CPFR project with SME
- The situation before the project

All documents are in paper format and they are trasmitted by Fax

PeMa head office Piazzola s.B. - Padova	Khunkhe KPC head office Limena - Padova	Khunkhe head office Malente (Germany)
Raw material WH. / Manufacturing / S.F. WH.	S.F. WH. / Manufacturing and Assembly / S.F. WH.	S.F. WH. / Assembly / S.F. WH.
30 employees	**50 employees**	**Over 250 employees**

MTS MTS

Products Flow

Information Flow

33
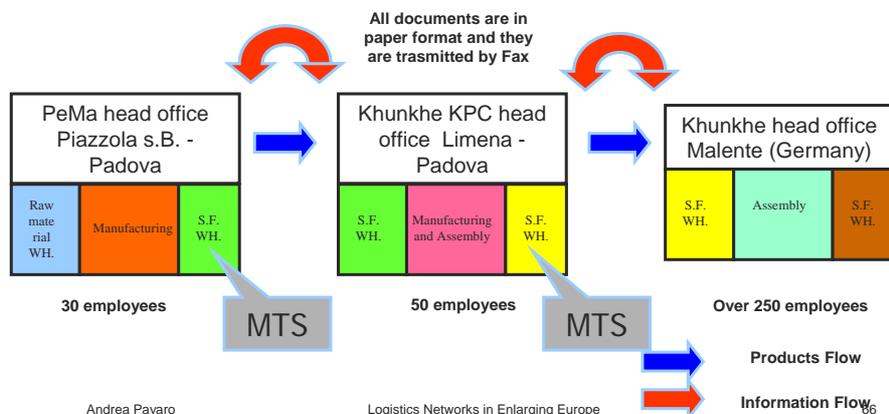
Case Study: Pe-Ma Group

- The situation after the project

All documents are in digital format and they are trasmitted by Web

| PeMa head office Piazzola s.B. - Padova | Khunkhe KPC head office Limena - Padova | Khunkhe head office Malente (Germany) |

Raw material WH. | Manufacturing | S.F. WH. | JIT | Manufacturing and Assembly | S.F. WH. | JIT | Assembly | S.F. WH.

30 employees   50 employees   Over 250 employees

BTO   BTO

Products Flow

Information Flow

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## Case Study: Pe-Ma Group

- This new model of work:
    - improves forecasting and product planning
    - provides real-time access to order and shipment status
    - reduces level of stock and the requirement of warehouses
    - reduces the order cycle time (from 5 to 2 days)

34

Closed loop supply chain

- Companies should offer new services to their customers if they will consider the point of end of life of products.

- The product reaches the point of end of life when the product consumes its value

- This strategy becomes the realization of closed loop supply chain.

- The denomination closed-loop supply chains emphasizes the importance of coordinating the forward with the reverse streams.
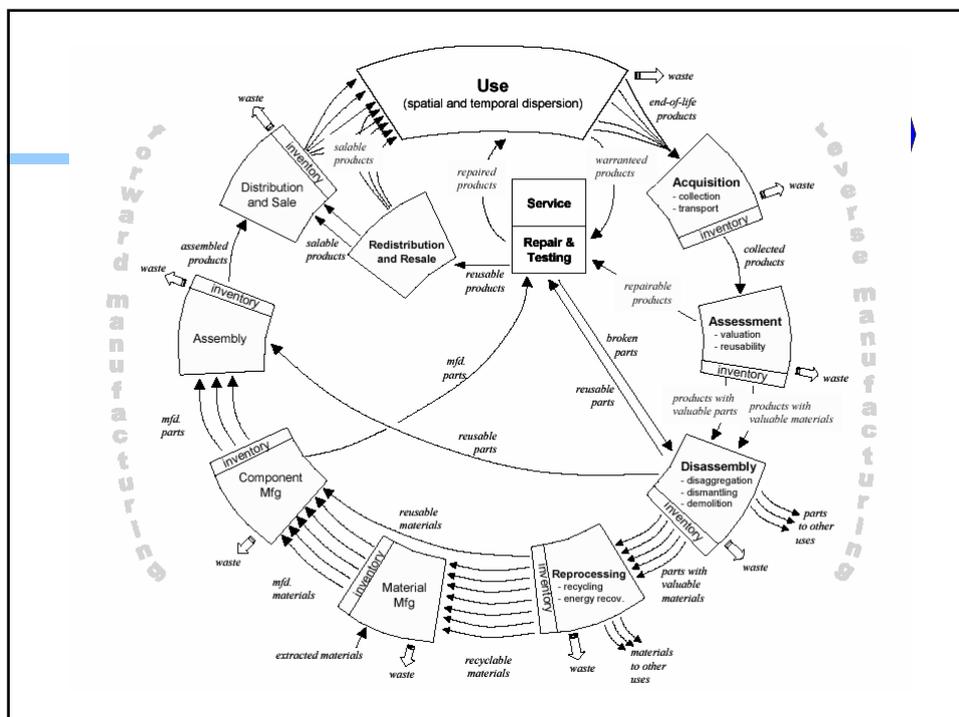
Reverse Logistics in Fulfillment

- It becomes strategic for the manufacturers to manage in an opportune way all the phases that follow the sale of the product to the final customer.
- To follow the goods during their life will involve many advantages:
  o to increase the services to the customer;
  o to trace the life of the product and to gather information related to the life of the product (use behaviours, malfunctions, etc.) ;
  o to maintain the contact with the customer, and increase the fidelity to the brand;
  o to manage the activities of recovery in definite periods;
  o to stimulate the up-selling;
  o to check the defectiveness of the product;
  o to check the state of the sales in real time

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What we should recover?

- Which products are suitable for reverse logistics?
- Literature proposes several characteristics that identify the "level" of recovery of a product
- The model we propose define the product characteristics for the recovery as a group of six parameters.
  o The product size
  o Volume of sale of products
  o Hazardous components
  o Design cycle and product life cycle
  o Product traceability
  o Product modularity

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Product size

- The size is the approximate dimensions of the product and its weight. Large dimensions are a bound in the recovery processes. Consumer can not transport the product to the collection center and the handling is very difficult. A product with small size is suitable for the recovery process.

Product traceability

- The traceability systems are record keeping procedures that show the path of a particular unit or batch of product or component from supplier(s), through all the intermediate steps which process and assemble components into new products and through the supply chain to customers and perhaps ultimately to consumers. A high-level of traceability allows to identify the consumer and to stimulate him to the updating of its product. This type of control allows to increase the services of marketing and create an high level of fidelity through up-selling activities.

Hazardous components

- A product contain hazardous components when it has a large environmental impact at end-of-life. Computers and other electronics are comprised of a large number of different materials, which makes disassembly and recycling difficult. Additionally, there are considerable amounts of toxic and potentially hazardous waste material in electronics [9]. The hazardous elements found in electronics require that the processing of recovered electronics be responsibly managed in order to protect the health and safety of the workers and to protect the environment where the processing occurs. A product with a high percentage of hazardous components must be recovered.

Product modularity (1)

- Modularity is an approach for organizing complex products and processes efficiently, by decomposing complex tasks into simpler portions so they can be managed independently and yet operate together as a whole.

- From a system's perspective, modularity can be viewed as a continuum describing the degree to which a system's components can be separated and recombined, and it refers both to the tightness of coupling between components and the degree to which the "rules" of the system architecture enable (or prohibit) the mixing-and-matching of components.
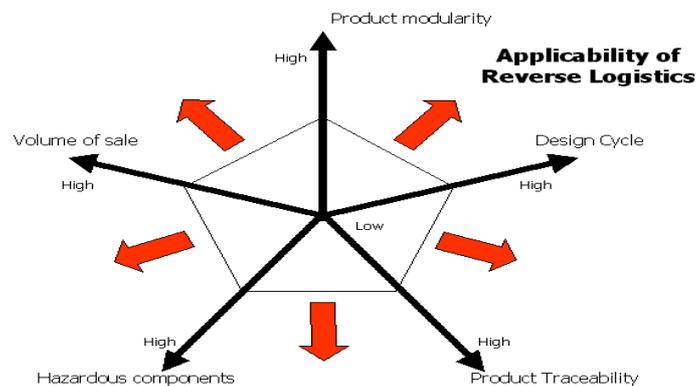
Product modularity (2)

- To enhance component reuse and material recycle, engineers must embed strategic modularity into the product and reduce the cost to the recycling organizations. Such effort will lead to overall improvement of industrial ecology through reduction of raw material use, energy use throughout the product life-cycle, and solid waste

Design Cycle and product life cycle

- The design cycle is the length of time between successive generations of the product. The design cycle is the frequency that a design team redesigns the product or designs a new product thus making the original product obsolete.
- A long life cycle permit to recovery the product, dis-assemble and check the components, and re-insert them in new products.
- If there is a short life cycle, the manufacturer introduces with high frequency in the market new products . This compel to innovate the components and this cause an high obsolescence.

The model for a middle or small size good

Product modularity
High

**Applicability of
Reverse Logistics**

Volume of sale
High

Design Cycle
High

Low

High

High

Hazardous components

Product Traceability

The change

- Development is an excellent time to begin considering the reverse logistics implications of the product's design (design for reverse logistics (DFRL)).

- In recent years, much has been learned about the importance of considering the manufacturing and logistics implications of design decisions, which has given rise to the fields of design for manufacturing (DFM) and design for logistics(DFL).

- Today, automakers are increasingly paying attention to how cars can be disassembled at the end of their life, known as **design for disassembly**. Many decisions made during the development phase of a product will have reverse logistics implications.

The RFID support the recovery process

- The traceability of the product is possible with the radio frequency identification (RFID). In order to handle reverse logistics better, firms will need to improve their reverse logistics information systems

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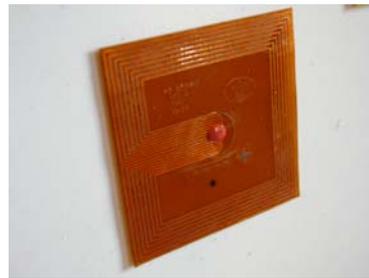
RFID

- Radio Frequency Identification Technology, or RFID, is a technique for electronic labeling and identification of objects using radio waves. Often considered the next stage in the barcode evolution, RFID is the fastest growing segment of the automatic data capture and identification market. It has fairly diverse applications, ranging from marathon races and airline baggage tracking to hazardous material management, electronic security keys, and supply chain management (SCM).

An example

- The case of a large enterprise in the north Italy.
- The company manufacturers more than two million boilers sold in Europe.
- More than 1,700 employees
- An extensive network of service centres.

- The boiler has a long lifecycle and the company is studying a reverse logistics model based on the RFID technology

Treceability

- The information system needs a unique central database that collects the products code and the technical characteristics of goods.
- This database is updated when the product is sold via a Web-portal or using a GSM system.
- During the life, if the product needs assistance, the technicians up-date information in the tag with the Personal Digital Assistant (PDA) endowed with RF transmitter.
- At end-of-life the product is brought to the Collection and Sorting Center (CSC).
- At the CSC the tag is read.

Traceability

- The Center can query the manufacturer database via an Internet application.
- At this time, the center can know the modules that can be remanufactured or refurbished, the demand for remanufacturing of the firm, the toxicity of product and eventually the instruction for disassembly.
- The manufacturer update its database with the information contained in the tag and sent by the CSC.
- Finally, the Collecting and Sorting Center decides if the product will be remanufactured, refurbished or send to landfill on incinerator

The Model

43
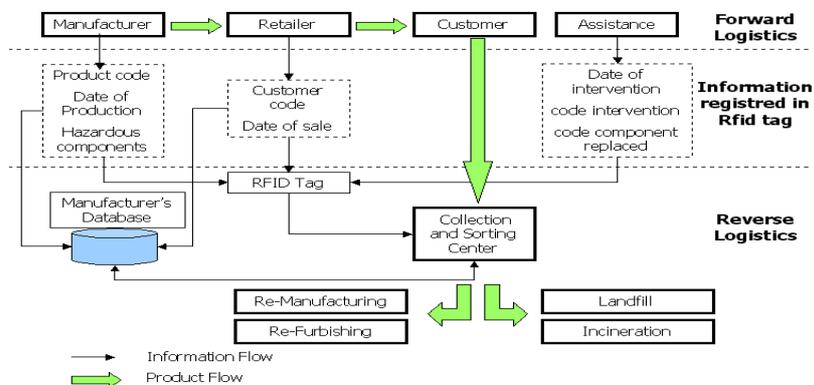
Strenghts

- The strengths of RFID system are:
  - to increase the recovered products;
  - to simplify the operations of collecting and sorting;
  - to simplify the operations of disassembling;
  - to reduce the quantity of toxic components scattered in the environment.

Weakness

- The weakness for RFID system:
  - unique identification system is needed;
  - the system of coding has to be shared among all the manufacturers of a particular good;
  - the firm needs an organizational change;
  - products with an high level of modularity are needed.

Conclusions

- Even if the companies are geared towards different markets, the strategies they should use are quite similar.
- The companies should create platforms which allow suppliers and customers to take part in a private environment where they can access the companies' production plans.
- Fulfillment is the merging of marketing and logistics.
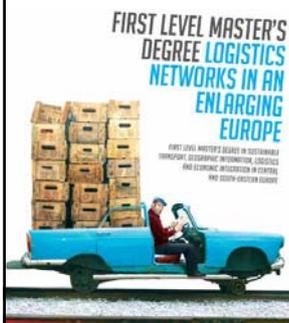- In a competitive environment This is the only way to improve customers satisfaction

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Thaks for Your Attention

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