Challenges in setting up Green logistics networks

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Today’s agenda

- Introduction
- Green logistics & Supply chain management
- Greening each link of the supply chain (practices)
- The Green Paradoxes of Logistics in Transport Systems
- The concept of Green Transport Corridors
- Conclusions
Introduction

• Over the last decade there has seen a tremendous increase in the public and government concern for the environment. As a result, on a business level there has been a considerable amount of pressure on major firms to reduce the environmental impact of their logistics operations.

• This has risen to a varied impact, in terms of the range of externalities and the distances over which their undesirable effects are felt. Transportation of goods has a negative impact on the local air quality, generates noise pollution, leads to accidents and, in totality, makes a noteworthy input to global warming.

• The impact of logistics on climate change has called for increasing attention in recent years, partially because increasing controls on pollution and road safety improvements have alleviated the other environmental problems. Also, new scientific research has exposed that global warming presents a much greater and more instantaneous threat than earlier thought.

• It is estimated that goods transportation accounts for around 8% of energy-related Carbon Dioxide emissions worldwide. While the inclusions of warehousing and freight management are likely to add another 3% to this total.

• Making logistics sustainable, in the longer term will involve more than cutting carbon emissions. Despite recent improvements, the potential still exists to cut the other environmental costs of logistics by a significant margin.
# Externalities of Freight Transportation

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Green Logistics

• What is Green Logistics:

- The study of the environmental consequences of all the activities involved in the transportation, storage and handling of physical products as they move along supply chains in both forward and reverse directions. It takes into account the nature and scale of these effects and examines the various ways in which they can be reduced in order to develop a sustainable balance between economic, environmental and social objectives.

- The main objective of logistics is to co-ordinate these activities in a way that it meets customer requirements at minimum cost. In the past this cost has been defined in purely monetary terms. As concern for the environment rises, companies must take more account of the external costs of logistics associated mainly with climate change, air pollution, noise, vibration and accidents.
Key drivers for developing Green transport & logistics initiatives

- Part of a larger Corporate Responsibility Agenda
- Increasing supply chain efficiency
- Decreasing risk
- Decreasing your fuel bill
- Improving investor relations
- Improving public relations
- Improving Customer Relations
- Financial ROI
- Government compliance

% Total
Importance of Green issues to companies’ strategy

The new global trend towards the holistic tackling of supply chain externalities is becoming a top priority practice for many corporations in order to achieve a competitive advantage in an increasingly environmentally sensitive market.
Green Supply chain management

• This raised awareness with regard to logistics negative externalities brings forth the concept of Green (or sustainable) supply chain management. The latter can be defined as the alignments and integration of environmental management within supply chain management.

• It is based on the recognition that an individual firm’s environmental impact extends well beyond its corporate boundaries.

• More specifically it involves considering the impacts of extraction of raw materials, distribution, operation and disposal throughout the chain.

• The origins can be tracked back to two functional areas in which companies’ environmental responsibilities interface with external agencies: green purchasing/supply and reverse logistics.

• Environmental impacts should be considered cumulatively over the stages of the supply chain life cycle of a product or service to avoid shifting adverse environmental effects from one stage of the life cycle to another. Each stage utilizes resources and produces negative externalities that impact the environment, however in the green logistics mentality, these should be minimized.
Green Supply chain management (II)

- The green logistics system must include green management, green information system, green supply, green production, green transportation, green distribution, green packaging, green distribution processing and waste recycling. In other words the whole supply chain needs to be green.

- Within green logistics, successful completion requires the close cooperation of several parts such as government, public, and corporate entities.

- If there is only an emphasis on one or two of these parties in the whole system, green logistics will not be achieved. The system architecture refers to the systems external and internal environment as well as the components in itself.

- There should be a consideration for green logistics that it is not an isolated system, but it needs exchange information and energy with outside parties. So in other words a green logistics system is a large end2end integrated system.
Steps towards the efficient establishment of green supply chains

• Companies should they want to implement a green supply chain, should consider:
  • Use of compliance-based strategies that support the cascading of basic environmental requirements generically across all suppliers.
  • Aligning supply chain goals for both efficiency and pollution-reduction.
  • Transfer of environmentally specific innovations or technologies from customers to suppliers.
  • Collaboration, competition or co-opetition between firms to develop re-manufacturing or closed-loop recycling systems.

• The EU Environmental Protection Agency provided four basic steps to implementing a green supply chain. They are:
  • Identifying costs
  • Determine opportunities (for reducing costs, creating competitive advantages)
  • Calculate benefits, and
  • Decide, implement and monitor
Changes needed in the evolution of green supply chain

- Proactive environmental strategies are required to promote improved performance.
- Studies suggest that environmentally proactive companies have lower regulatory related expenses and being environmentally proactive leads them to new opportunities created by ‘clean products and processes’ and can participate in voluntary international standards.
- There have been identified multiple links of mechanism between environmental performance and firm performance.
- Green = Lean (saves money)
- The scope of actions in the chain has to change from an initial sale to that of the entire product usage life-time, not only because of environmental impact during its use (instead of during production and distribution only) but also because of the future return flow.
- Expand the scope of actions beyond its initial life into a second and third life- more reduce & re-use initiatives than end of the pipeline solutions.
- System View of Environmental Life Cycle
Evaluating the supply chain as a system leads to life cycle optimization.

The life cycle approach views the impacts of a product from the design phase through the disposal phase. This view leads to a greater understanding of the total impact of operating the system and can lead to design decisions that greatly improve long term performance and cost.
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Taxonomy of green logistics practices

• Greening initiatives require measures to be undertaken in every step of the supply chain.

• The main elements could be classified:
  • Green Product development
  • Green Transportation and Distribution
  • Green facilities, and
  • Reverse Logistics issues
1. Green Product issues (I)

- Green product related issues involve: (i) green product design, (ii) green purchasing and (iii) green manufacturing.

- Green product design:
  - Green product design focuses on production processes that adopt environmentally friendly specifications.
  - It involves:
    - products made from, recycled or remanufactured materials
    - products that can be reused and remanufactured
    - products with environmentally friendly packaging,
    - products made from organic components and
    - the identification of the optimum assembly sequence when designing the product in order to be able to follow the regulated recovery rates in an economic manner at the reverse logistics channel

- On this basis, numerous multinational companies have redesigned their production lines, by adding green attributes to their products.
  - Examples: Xerox Europe designed waste free products with a reduced material mix, resulting in easier separation of materials for recycling, and reuse.
  - Sony progresses in reducing the environmental impact of its products by using recycled materials from either exterior packaging or internal components of its products
Green Product issues (II)

• Green purchasing:

• One of the key aspects to green supply chains is to improve both economic and environmental performance simultaneously throughout the chains by establishing long-term buyer–supplier relationships.

• This practice involves the selection of supply chain partners (raw material, components and subassemblies suppliers) based on environmental standards and eco labels.

• It aims in raising consumer awareness in green products, increase their demand and thus motivate the industry to adopt greener production and distribution processes.

• Numerous researchers have observed that collaboration regarding environmental issues between the suppliers and the company (or the customer) in a supply chain has a significant effect in the adoption of environmentally friendly practices by all intermediate counterparties.

  • Examples: Wal-Mart for example uses an MSC eco label on its fish products, certifying third parties to comply on fishery and processing standards through the supply chain from boat to plate
  • Moreover, numerous key supply chain parties have been forced, due to customer demand for environmentally friendly products, to adopt environmental management systems such as ISO 14000
Green Product issues (III)

• Green Manufacturing:

• Green manufacturing incorporates the utilization of environmentally efficient manufacturing hardware and software technologies that minimize energy consumption, and waste.
  
  • For example, a paperboard manufacturing company that prepares products for customers in North America has purchased a new corrugating machine that reduces the amount of paper needed to corrugate boxes while maintaining their strength
  
  • Sony uses Product Data Management software (PDM) with green design as an option, eliminating incorrect product variations induced by improper combination of components and/or modules.

• This in turn minimizes the number of malfunctioned products and thus generated waste.
Green supply chain management is a driver for process improvements.

• In general, pollution and waste represent incomplete, ineffective, or inefficient use of raw material.

• Green supply chain analysis provides an opportunity to review processes, materials, and operational concepts.

• As with continuous improvement programs, green supply chain analysis targets:
  • Wasted material
  • Wasted energy or effort
  • Under-utilized resources

Green Process Improvement Approach

- Identify the waste streams
- Measure or identify the opportunity cost of the waste
- Create innovation vs. treatment bias toward waste reduction
2. Green Transportation and Distribution Issues (I)

- Green transportation and distribution practices involve:
  - green network design
  - utilization of fuel efficient transport fleets and equipments as also, the application of improved aerodynamics in vehicles
  - increase of vehicle utilization rates and reduction of empty returns
  - application of vehicle routing and scheduling software and
  - fuel-efficient driving.
Green Transportation and Distribution Issues (II)

• Green network design:

• Green network design examines the effects of location decisions related to distribution centers and production facilities on the systems transportation emissions performance.

• To be more specific, by operating one distribution center next to each demand point, the supply chain planner minimizes the distances travelled with the environmentally inefficient delivery truck. This in turn minimizes the amount of various emissions generated in the system.

• By adopting the practice of near-shoring, the practice that involves the allocation of a portion of production processes close to the serving markets, minimizes the amount of transportation emissions generated compared to the practice of off shoring that involves production in distant locations and thus lengthier distances travelled.
Green Transportation and Distribution Issues (III)

• Energy efficient transport fleet and equipment:

• Mode choice – which mode is most environmentally friendly?
  • Transport modes: truck, rail, barge, ship or airplane
  ship, barge and rail are somewhat more environmentally friendly than truck and plane

• There are no exact emission figures: depends on which type of equipment is
  used under which circumstances.

• Main EU governmental action: improve rail, next barge and reduce trucks
  Yet for trucks there have been set the most stringent norms (EURO 5 and 6)

• The utilization of advanced Euro norm and hybrid heavy duty and delivery trucks
  minimize significantly the amount of Particulate Matters (PMs), Hydrocarbon
  (HC), and Nitric Oxide emissions (NOx) produced through technologically
  advanced combustion and therefore reduced energy consumption.
  • For example: Wall-mart procured hybrid diesel-electric and refrigerated trucks that
    required less energy for cooling, so the engine could be turned off when the truck
    stopped.
  • Additionally, reduction in fuel consumption could be also achieved through aerodynamic
    vehicle design. A report presented by the International Energy Agency in 2007 shows an
    impressive 10-20% improvement in fuel consumption compared to conventional vehicles.
Energy efficient transport fleet and equipment examples:

- Large container ships use less fuel per container than smaller ones when fully loaded.

  • Utilization of waste heat "One of the things that really makes a difference is the Waste Heat Recovery System," says Tim Krarup Sørensen, Head of Technical Operation at A.P. Moller - Maersk.
  
  • The system reuses excess heat from the exhaust and thus generates energy that can be used to propel the vessel via the shaft engine or as general energy supply on-board.
  
  • In that way fuel consumption is reduced by approximately 10%, resulting in a corresponding reduction of the emission of harmful particles as well as CO2, SOx and NOx gases. “The system actually makes the vessel capable of functioning without auxiliary engines for longer periods”.

- Electric vehicles do not emit themselves, and have a limited range. Yet could be ideal for city transport logistics.
Green Transportation and Distribution Issues (V)

• Energy efficient transport fleet and equipment: Equipment fuel choice
  • The impetus to produce alternative fuels has contributed to the green logistics movement.
  • One example is bio-fuel. Some of the advantages of biofuel include: tax incentives, lower cost, less reliance on petroleum-producing cartels, less environmental damage (since they burn more cleanly) and fewer public health risks.

• Alternative Fuels — Pros and Cons
  • Although many fuels may in time become viable alternatives, complicated/expensive hurdles paved the way, including the cost of designing/creating vehicles that will utilize them.
  • Secondly, a balancing game will have to be played, carefully considering feasibility, pollution and technological requirements.
  • For logistics businesses, the three most realistic and practical alternative fuels are probably biodiesel and natural gas & electricity. All are renewable, cost effective and already tried. But there are other upcoming options as well (Ethanol, fuel shells, Hydrogen, Propane etc.)
Energy use and Emissions per mode of transport

<table>
<thead>
<tr>
<th>Energy Use</th>
<th>PS-Type container vessel (11,000 TEU)</th>
<th>S-Type container vessel (6,600 TEU)</th>
<th>Rail - Electric*</th>
<th>Rail - Diesel*</th>
<th>Heavy Truck*</th>
<th>Boeing 747-400*</th>
</tr>
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<tbody>
<tr>
<td>kWh/tkm</td>
<td>0.014</td>
<td>0.018</td>
<td>0.043</td>
<td>0.067</td>
<td>0.18</td>
<td>2.00</td>
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<tr>
<th>Emissions (g/tkm)</th>
<th>PS-Type container vessel (11,000 TEU)</th>
<th>S-Type container vessel (6,600 TEU)</th>
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<th>Heavy Truck*</th>
<th>Boeing 747-400*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon dioxide (CO₂)</td>
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<td>8.36</td>
<td>18</td>
<td>17</td>
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<td>Sulphur oxides (SOₓ)</td>
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<td>5.69</td>
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<tr>
<td>Nitrogen oxides (NOₓ)</td>
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<td>0.10</td>
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<td>0.17</td>
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<tr>
<td>Particulate matters (PM)</td>
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<td>n/a</td>
<td>0.008</td>
<td>0.005</td>
<td>n/a</td>
</tr>
</tbody>
</table>

*Source: Network for Transport and the Environment

(NTM) kWh/tkm – kilowatt hours per tonne-kilometres

g/tkm – grams per tonne-kilometres
Green Transportation and Distribution Issues (VI)

- Increase of vehicle utilization rates and reduction of empty returns
- Increase in vehicle utilization rates could be achieved through:
  - the application of nominated day delivery systems by suppliers
  - the cooperation between transport users
  - the application of efficient packaging techniques, and
  - the transportation of reverse logistics flows.
- More specifically through nominated day delivery systems customers are informed that a vehicle will be visiting an area on a nominated day and in order to receive a delivery that day they must submit their order a certain period in advance.
- By concentrating deliveries in particular areas on particular days, suppliers can achieve higher vehicle utilization rates. Additionally different retail stores located at a specific area could also cooperate by collecting their demanded cargo in a common area, i.e. a warehouse, and then deliver them with high truck loads to the retail shops.
  - An example of success may be that of Exel LTD, a company that operates a retail consolidation center for shops located in Heathrow airport. It was estimated that by adopting this practice the company managed to reduce the number of cargo delivery vehicles visiting the Airport by 75% and increase the vehicle loading rate to 90%
  - Additionally, packaging techniques may also have significant effects in increasing the capacity utilization of a vehicle. For example a large order mail company managed to improve vehicle utilization and cut vehicles – km’s by 6% by loading parcels loose than in bags.
- Finally the continuously increasing proportion of products travelling back for reuse, recycling and remanufacturing, along with the growth in the recovery of waste packaging and life expired products may provide an opportunity of increasing return loadings.
Green Transportation and Distribution Issues (VII)

• Vehicle routing and scheduling:

• A large proportion of freight distribution is carried out by road vehicles. The problem of organizing and routing a fleet in a way that reduces transportation costs and improves the level of service provided, is called the vehicle routing and scheduling problem.

• There is a variety of software packages providing routes and schedules, while managing substantial cost savings (from 5 to 20%) of the global transportation costs.

• These cost savings are mainly due to the reduction of unnecessary distances traveled which may lead in the reduction of fuel consumption and thus green house gasses.

• Additionally difficult journeys (through for example a congested city centre) are scheduled for a time of day where the environmental impact will be minimized. The reduction of commercial vehicle emissions is a key concern for numerous companies, which try to find ways for reducing their carbon footprint and therefore improve their green credentials.
  
  • For example Wallmart, is aiming to make its vehicles 25% more efficient within 3 years and 50% within 10 years while Tesko and J Sainsbury supermarket chains intend to reduce their transport emissions for a category of goods by 50% in five years and 5% in three years, through the application of vehicle routing software.
• Fuel –efficient driving (eco-driving):
  • Driver training programs have shown to improve fuel efficiency by 8-10%.
  • Fuel efficiency may be also affected by other factors. To be more specific:
    • by leaving the engine idling unnecessarily,
    • failing to check tire pressures and
    • not reporting on engine problems or oil leaks, drivers waste a lot of fuel
3. Green facilities issues (I)

- Green facilities incorporate practices that aim to minimize the environmental impact resulting from operations.

- More specifically, it incorporates practices that:
  - maintain the facility’s energy efficiency (temperature and improve its lighting efficiency)
  - improve the energy efficiency of mechanical handling operations

Therefore:

- Airports – reduce noise, energy needs, pollution

- Warehouses / buildings – reduce energy needs and pollution

- Ports – reduce port emissions, reduce dust, noise: e.g. ships use wall current (cold iron) instead of their own engines in ports

- Nature preservation (industrial park and road development)
  - take endangered species into account (badgers in industrial parks)
  - create compensation nature areas.
Green facilities issues (II)

• Energy Savings:

• Fuel, oil or gas is the primary source for heating a facility while electricity for cooling. The extend of which energy is consumed is primarily determined by:
  • the temperature required to maintain the stored products in a satisfactory condition. This may require efforts for maintaining maximum or minimum temperature levels as well as to control the humidity,
  • the background temperature of the internal space of the facility for the employees to perform their work in comfort and in relation to the extent of the physical requirements and the location of the task undertaken.

• For example in warehouses, significant savings in energy can be achieved through:
  • the use of close fitting door locks, close fitting barriers or fast-acting doors in areas where fork lifts entry and exit frequently
  • the segregation of intake and or dispatch areas from other areas of activity and
  • the use of zoned or time controlled thermostats
Green facilities issues (III)

• Energy Efficiency of handling equipment:

• In order to achieve rapid and intensive movement of goods all facilities use a range of various mechanical equipment such as (i) fork lifts or RTG’s, for unloading the container or transportation mode and (ii) reach trucks for storing cargo in the distribution center, at different heights.

• This increases substantially energy requirements in petrol or LPG gas (for fork lifts) as also in electricity (for recharging the batteries of the reach trucks).

• The environmental impact of the mechanical handling equipment utilized in a facility could be minimized through

  • the utilization of internal combustion power units using bio-diesel or hybrid fuel combinations along with hydrogen fuel cell technologies for the forklifts and
  • the use of high-frequency, fast-charging systems and opportunity-charge batteries. Opportunity charging can take a form of rapid charging during coffee brakes and short operational breaks or direct charging by onboard regenerating motors, linked to returning energy produced during breaking or the lowering the forklifts via the hydraulic system directly at the battery.
  • Trials reported by Toyota Material Handling suggest that using recovery energy reduces battery power consumption by between 15% to 25%. On this basis, software technologies such as Enterprise resource planning (ERP), Warehouse Management Systems (WMS) provide interconnectivity and coordination between the facility operator and its sources of demand, minimizing therefore unnecessary cargo handling and thus the amount of emissions generated.
Taxonomy of green logistics practices

• Greening initiatives require measures to be undertaken in every step of the supply chain.

• The main elements could be classified:
  • Green Product development
  • Green Transportation and Distribution
  • Green facilities,
  • Reverse Logistics issues
4. Reverse logistics issues (I)

- **Definition:** All logistic activities related to the recovery of value in discarded or returned products.
- **Reverse logistics** can represent a significant chunk of supply chain cost—and it’s typically not very well managed. However, many researchers suggest that it’s time for adjust logistics operations to manage reverse flows as an integral part of supply chain management to improve efficiency and reduce cost.
- The movement of product invariably results in the unintended consequences typically referred to as “over, short and damaged” (OS&D) along with the simple need to deal with unsold and returned items. However, the opportunity to improve overall cost efficiencies has pushed companies to begin looking at the flip side of logistics as the “new frontier” in the continuous improvement of supply chain performance.
- Several logistic service providers now offer good solutions and best practices. Particularly for e-commerce companies it is essential (no physical purchase).
- Recycling or re-using end-of-life products can yield valuable material shortages, esp. in case of scarce precious metals.
Reverse logistics issues (II)

Why returns occur?? - the reasons vary among each stage of the supply chain:

• within manufacturing
  - due to rework, surplus materials, leftover products,
• within distribution
  - due to stock readjustments, wrong deliveries (inaccurate counting, miss-loaded)
  - distribution items as packaging, containers, etc
  - damaged goods in transit
  - product recalls
  - commercial returns
  - unused spares from service engineers
• from customers
  - reimbursement guarantees
  - warranty returns
  - repairs
  - end-of-use returns (leased items, trade-ins)
  - end-of-life returns

Drivers for recovery??

• economics
  - recover value of returned items
  - manage to acquire difficult to obtain parts, raw materials
  - cheaper production (glass, paper)
• Marketing
  - raise the corporate responsibility profile of the company,
  - increase customer awareness and improve customer relations
  - diversification, offer clients total life-cycle solution
  - prevent competitors to enter market
• extended producer responsibility
  - green image, concerns about environmental pollution
• Legal: comply proactively with regulations, avoid (hazardous) waste
Reverse Logistics process

THE REVERSE LOGISTICS PROCESS

RETURN GOODS AUTHORIZATION

PICK UP

SORT & CONSOLIDATION

RETURN TO MANUFACTURER

DESTRUCTION

RECYCLE
Reverse logistics issues (III)

• Traditional handling of returns in warehouses...is not always efficient

• Often forgotten and mistreated category. There’s an inherent disorganization and messiness revolving around reverse logistics that makes it more challenging than conventional “forward” logistics management.

• Characteristically, handling of returns may be 5-10 more expensive than traditional goods (de Koster 2000)

• several categories of returns need to be separated (duty to be reimbursed, damaged, valid return, invalid return)

• value may go down quickly in time

HENCE PROFESSIONAL HANDLING is NECESSARY
• **How: recovery options??**

• **Product recovery:** Product recovery management involves the management of all used and discarded products, components and materials in order to recover as much of the products ecological and economical value, and therefore reduce the quantities of generated waste.

• It incorporates five product recovery options namely (i) repair, (ii) refurbishing, (iii) remanufacturing, (iv) cannibalization and (v) recycling

• **Waste management:** Waste management involves pre treatment of waste.

• Based on the producer Pre-Treatment Requirement of the Landfill directive implemented in October 2007, Pre-treatment is undertaken when the waste has passed by a three point test in which all three points have been satisfied. To be more specific: (i) It must be a physical, thermal, chemical, or biological process, including sorting. (ii) It must alter the characteristics of waste (iii) It must reduce its volume, or its hazardous nature, or facilitate its handling or enhance its recovery.
• **How: recovery options??**  

• **Reuse:** is a strategy that eliminates waste, reduces waste disposal costs, and conserves energy and materials. It involves taking useful products, such as furniture, books and appliances, discarded by those who no longer want or need them and redistributing them to those who do.

• In contrast to recycling, which recovers materials for processing, reuse recovers the original product. Reuse, therefore, primarily involves collection and redistribution of goods. Product returns are an increasing concern to industry. Large retailers can have return rates in excess of 10% of sales, and manufacturers such as Hewlett-Packard report product return costs that exceed 2% of total outbound sales.

• In any case the *Choice on the recovery option depends on quality of return and the needs for output*
Green initiatives from supply chain functions’ point of view

<table>
<thead>
<tr>
<th>Function</th>
<th>Initiatives</th>
<th>Outcome</th>
</tr>
</thead>
</table>
| Product Development | • Design for environment  
                       • Redesign packaging  
                       • Identify and use less hazardous or recyclable materials  
                       • Provide waste management solutions for products at the end of their lifecycle | • Offer environmental friendly products and drive competitiveness  
                       • Reduce product size and weight  
                       • Improve waste management and reduce solid waste |
| Procurement       | • Conduct green sourcing for indirect and direct materials  
                       • Collaborate with suppliers for their green initiatives  
                       • Localize sourcing for JIT | • Utilize environmental friendly materials  
                       • Cost reduction benefits from suppliers’ improved efficiency  
                       • Short procurement distance and reduced raw material inventory |
| Production        | • Improve factory layout  
                       • Improve production process from straight push to pull, push-pull, or postponement strategy  
                       • Utilize fuel efficient tools and machines  
                       • Recycle materials | • Reduce in-house traffic movements  
                       • Reduce finished goods inventory and warehouse space  
                       • Improve fuel efficiency |
| Distribution      | • Strategically place warehouse & distribution centers  
                       • Improve warehouse layout  
                       • Utilize fuel efficient tools and machines | • Achieve least total costs, while minimizing carbon footprint  
                       • Improve efficiency and productivity  
                       • Improve fuel efficiency |
| Transportation    | • Consolidate LTL or milk-run for both inbound and outbound  
                       • Use more environmentally friendly logistics providers  
                       • Reroute fleet vehicles  
                       • Optimize truckloads  
                       • Utilize rail or intermodal  
                       • Utilize back-haul | • Reduce waste of empty trailer space  
                       • Incentivize Logistics providers to be "greener"  
                       • Reduce miles and improve fleet utilization  
                       • Reduce carbon emissions caused by transportation |
Effects of greening the supply chain

• Many of those initiatives are day-to-day initiatives and process improvement activities to drive operational efficiency, increase recycling, reduce waste, and enhance communication and visibility in the supply chain.

• Hence, the outcome of the green initiatives not only improves operational effectiveness of balancing costs and service, but also reduces the carbon footprint from movements, spaces and materials in the supply chain.

• A “green” KPI or measurement enables companies to associate the positive financial results to the carbon footprint reduction.

• Once the mystery of “green” is discovered, the cost of green initiatives won’t become an implementation barrier so companies can benefit from quick financial and social return from those initiatives. As a result, the “green” strategy is not just a social responsibility. It becomes the “sustainable” and “desirable” strategy for any company.
Advantages of shifting from logistics to green logistics

- **Environment**
  - Eco-friendly (energy saving and CO2 reduction)
  - Increasing safety (reduction of contaminated waste gases and disasters)

- **Economy**
  - Realizing cost reduction (increasing fuel efficiency and saving resources)
  - Increasing logistics service quality (decreasing damages on goods)
  - Increasing corporate brand image (supports from consumers)

- **Improvement of competitiveness**

- **Customer satisfaction**
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- Conclusions
The logistics industry as a whole is still a long way from being considered green. Reverse logistics has been its major environmental pre-occupation.

While this is an important step, recycling being one of the important elements in sustainability, many other environmentally significant considerations remain largely unaddressed. Are the achievements of transport logistics compatible with the environment?

If the basic characteristics of logistical systems are analyzed, several inconsistencies with regards to environmental compatibility become evident.

Costs:

The purpose of logistics is to reduce costs, notably transport costs. In addition, economies of time and improvements in service reliability, including flexibility, are further objectives. Corporations involved in the physical distribution of freight are highly supportive of strategies that enable them to cut transport costs in the present competitive environment. The cost-saving strategies pursued by logistic operators are often at variance with environmental considerations, however. Environmental costs are often externalized.

This means that the benefits of logistics are realized by the users (and eventually to the consumer if the benefits are shared along the supply chain), but the environment assumes a wide variety of burdens and costs. Society in general, and many individuals in particular, are becoming less willing to accept these costs, and pressure is increasingly being put on governments and corporations to include greater environmental considerations in their activities.
Hub & Spoke Networks:

- The hub-and-spoke structure has characterized the reorganization of transportation networks for the past 20 years, notably for air and rail and maritime freight transportation.

- It has reduced costs and improved efficiently through the consolidation of freight and passengers at hubs. Despite the cost savings in many cases, the flows, modes and terminals that are used by pursuing logistical integration are the least sustainable and environmentally friendly.

- The hub-and-spoke structure concentrates traffic at a relatively small number of terminals. This concentration exacerbates local environmental problems, such as noise, air pollution and traffic congestion.

- In addition, the hub structures of logistical systems result in a land take that is exceptional. Airports, seaports and rail terminals are among the largest consumers of land in urban areas. For many airports and seaports the costs of development are so large that they require subsidies from local, regional and national governments.

- Therefore we can conclude, that, the trend in logistics towards hub formation is clearly not green.
The Green Paradoxes of Logistics in Transport Systems

Reliability

• At the heart of logistics is the overriding importance of service reliability. Its success is based upon the ability to deliver freight on time with the least threat of breakage or damage.

• Logistics providers often realize these objectives by utilizing the modes that are perceived as being most reliable. The least polluting modes are generally regarded as being the least reliable in terms of on-time delivery, lack of breakage and safety.

• For example ships and railways have inherited a reputation for poor customer satisfaction, and the logistics industry is built around air and truck shipments... the two least environmentally-friendly modes.
The Green Paradoxes of Logistics in Transport Systems

• **Time / Speed**

  In logistics, time is often the essence. By reducing the time of flows, the speed of the distribution system is increased, and consequently, its efficiency. This is achieved mainly by using the most polluting and least energy efficient transportation modes. The significant increase of air freight and trucking is partially the result of time constraints imposed by logistical activities.

  The time constraints are themselves the result of an increasing flexibility of industrial production systems and of the retailing sector. Logistics offers door-to-door (DTD) services, mostly coupled with just-in-time (JIT) strategies. So, other modes cannot satisfy the requirements, such a situation creates as effectively.

  This leads to a vicious circle. The more physical distribution through logistics, the less production, distribution and retailing activities will be constrained by distance. In turn, this structure involves a higher usage of logistics and more ton-km of freight transported.

  There is overwhelming evidence for an increase in truck traffic and a growth in the average length of haul (Cooper et al 1998), and although McKinnon (1998) has suggested that JIT is not greatly increasing road freight volumes (italics added), it cannot be considered a green solution. The more DTD and JIT strategies are applied, the further the negative environmental consequences of the traffic it creates.
Warehousing

• Logistics is an important factor promoting globalization and international flows of commerce. Modern logistics systems economies are based on the reduction of inventories, as the speed and reliability of deliveries removes the need to store and stockpile.

• Consequently, a reduction in warehousing demands is one of the advantages of logistics. This means however, that inventories have been transferred to a certain degree the transport system, especially the roads.

• This has been confirmed empirically. In a survey of 87 large British firms there had been a 39% reduction in the number of warehouses while one third of the firms indicated an increased amount of truck traffic, although the increase was thought to be small in most cases.

• Today inventories are actually in transit, contributing still further to congestion and pollution. Of which the environment and society, not the logistical operators, are assuming the external costs.

• In some industrial sectors, computers for example, there is a growing trend for vertical disintegration of the manufacturing process, in which extra links are added to the logistical chain. Intermediate plants where some assembly is undertaken have been added between the manufacturer and consumer. While facilitating the customizing of the product for the consumer, it adds an additional external movement of products in the production line.
The Green Paradoxes of Logistics in Transport Systems

E-commerce

The explosion of the information highway has led to new dimensions in retailing. One of the most dynamic markets is e-commerce.

This is made possible by an integrated supply chain with seamless data interchange between suppliers, assembly lines and freight forwarders.

Even if for the online customers there is an appearance of a movement-free transaction, the distribution online transactions may consume more energy than other retail activities.

The distribution activities that have benefited the most from e-commerce are parcel-shipping companies such as UPS and Federal Express that rely solely on trucking and air transportation.

Information technologies related to e-commerce applied to logistics can obviously have positive impacts. For instance, the National Transportation Exchange (NTE) is an example where freight distribution resources can be pooled and where users can bid through a Web Site for using capacities that would have otherwise been empty return travel.

- The consequences of e-commerce on Green Logistics are little understood, but some trends can be identified. As e-commerce becomes more accepted and used, it is changing physical distribution systems. The standard retailing supply chain coupled with the process of economies of scale (larger stores; shopping malls) is being challenged by this new structure.

- The new system relies on large warehouses located outside metropolitan areas from where large numbers of small parcels are shipped by vans and trucks to separate online buyers. This disaggregates retailing distribution, and reverses the trend towards consolidation that had characterized retailing earlier.

- In the traditional system, the shopper was bearing the costs of moving the goods from the store to home, but with e-commerce this segment of the supply chain has to be integrated in the freight distribution process. The result potentially involves more packaging and more tons-km of freight transported, especially in urban areas.
# The Paradoxes of Green Logistics

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<th>Dimension</th>
<th>Outcome</th>
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| **Costs**      | Reduction of costs through improvement in packaging and reduction of wastes.  
Benefits are derived by the distributors. | Environmental costs are often externalized.                             |
| **Time / Flexibility** | Integrated supply chains.  
JIT and DTD provide flexible and efficient physical distribution systems. | Extended production, distribution and retailing structures consuming more space, more energy and producing more emissions (CO2, particulates, NOx, etc.). |
| **Network**    | Increasing system-wide efficiency of the distribution system through network changes (Hub-and-spoke structure). | Concentration of environmental impacts next to major hubs and along corridors.  
Pressure on local communities. |
| **Reliability**| Reliable and on-time distribution of freight and passengers.              | Modes used, trucking and air transportation, are the least environmentally efficient. |
| **Warehousing**| Less warehousing per unit of freight.  
Inventory in circulation.                                             | Inventory shifted in part to public roads (or in containers), contributing to congestion and space consumption. |
| **E-commerce** | Increased business opportunities and diversification of the supply chains. | Changes in physical distribution systems towards higher levels of energy consumption. |
Today’s agenda

- Introduction
- Green logistics & Supply chain management
- Greening each link of the supply chain (practices)
- The Green Paradoxes of Logistics in Transport Systems
- The concept of Green Transport Corridors
- Conclusions
The concept of Green Transport Corridors

- Green transport corridors promote the development of a ‘greener-oriented’ transport system. Green Corridors provide the most environmentally-friendly, sustainable, efficient and safest connections for freight transport in Europe.

- The concept of transport corridors is marked by a concentration of freight traffic between major hubs and by relatively long distances of transport. Along these corridors industry will be encouraged to rely on co-modality and on advanced technology in order to accommodate rising traffic volumes while promoting environmental sustainability and energy efficiency.

- Green transport corridors will reflect an integrated transport concept where short sea shipping, rail, inland waterways and road complement each other to enable the choice of environmentally friendly transport.

- They will be equipped with adequate transhipment facilities at strategic locations (such as seaports, inland ports, yards and other relevant logistics terminals and installations) and with supply points initially for bio-fuels and, later, for other forms of green propulsion. Green corridors could be used to experiment with environmentally-friendly, innovative transport units, and with advanced Integrated Transport System applications.

- Account should be taken of the opportunities offered by the TEN-T guidelines on the development and the integration of multimodal transport chains. "Green" transport corridors for freight should allow fair and non-discriminatory access to corridors and transhipment facilities as a requirement for co-modality.

- Restrictions of access to the market for terminal operations, inter alia, in ports can have repercussions to the customers of these facilities. Therefore, open and non-discriminatory access for operators and customers of these facilities should be ensured in accordance with the rules of EU.
Green Corridors: Sustainable green logistics solutions

- Sustainable logistics solutions are economically, ecologically & socially viable transport solutions. Sustainable solutions ensure the applicability of the most economical and environmentally-friendly means of transport, while also respectively logistic systems that are available at present, should also incorporate the social dimension. Continuous improvements of services and efficiency, are strived for, in all parts of the transport chain in the Green Corridors, while keeping the economic efficiency in mind.

- The possibility to document the reductions of environmental and climate impact is very important, as this is how the specific “greening” of a transport service is measured. The emissions need to be quantified and measured. The measurability, through setting up Key Performance Indicators (KPIs) is the manner to prove that it is a green concept.

- Moreover, the quality issue needs to be seen from the perspective of the customers of the logistics system. The customers have a set of conditions that should be fulfilled in the logistic chain and these are described in detail in agreements with the service providers. High quality in the transport chain means expectations on:
  - Efficiency in the logistics chain, whereby large effort is put on maximizing the utilization of vehicles and infrastructure.
  - Punctuality as regards to the agreed time of departure and delivery.
  - Security in the transport chain is an important issue in order to receive the goods without damages at arrival point. Efficiency also relates to the fast handling of all kinds of cargo throughout the whole transport chain in the Green Corridor. All parts of the corridor should be as efficient as possible and strive for continuous improvements. This includes the infrastructure and the nodes, and all the different parts of the transport chain, where different modes and actors are included. This also implies a strong management of the corridor.
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Conclusions

• Green logistics concepts manage environmental impacts where they occur—ideally before they occur.

• Best practices focus on the business, not social, value that green logistics creates.
  • Align green supply chain goals with business goals
  • Evaluate the supply chain as a single life cycle system
  • Use environmental analysis as a catalyst for innovation
  • Focus on source reduction to reduce waste

• The integration of environmental concerns in supply chain network design is now a reality for numerous businesses worldwide. The adoption of green practices will not only affect the business that adopts the policy but also the customers and suppliers.

• The new global trend towards the holistic tackling of supply chain costs and its environmental performance is becoming a top priority practice of corporations in order to achieve a competitive advantage in an increasingly environmentally sensitive market.

• In other words green practices that balance profitability with environmental efficiency will constitute cornerstones of sustainability, viability and thus competitiveness.
End of Session

Thank you for your attention!

Q&A