ICT in Transport Logistics Workshop

CURRENT EUROPEAN RESEARCH AND PROSPECTS, IN ICT IN FREIGHT TRANSPORT AND LOGISTICS

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FREIGHT ICT RESEARCH IN THE 90s AND EARLY 00s

• **Commercial Operations**, applications mainly related to the vehicle, the cargo, or the company (operator), and were related in their great majority to systems for the collection and sending of information and data.

• **Fleet Management Systems**
  
  dedicated to the fleet management operations of a particular firm (or group of firms) including transport planning.

**Focus on**:

development of a number of enabling technologies, that later evolved in system-wide applications as well as the various e-business activities of the firms.
KEY DEVELOPMENTS TO DATE (1/7)

Key technological drivers:

- Mobile transmission technologies
- GPS (Global Positioning System) for Automatic Vehicle Location (AVL) and Computer-Aided Dispatch (CAD).
- GPS or GSM transmission networks
- 'mobile Internet' via high speed multimedia mobile communications, document exchange, and access to other ICT services
- the XML standard, (meta-language for the definition of non-proprietary data exchange standards).
- Route guidance and navigation systems conventional or traffic “actuated”
- Onboard sensors for vehicle mechanical condition, monitoring of the state of the loaded goods, automatic payment for toll roads, vehicle or load unit identification at terminals, etc.
- Smart cards for electronic tachograph, electronic driver licence, storage of load-related information, etc.
KEY DEVELOPMENTS TO DATE (2/7)

**Interoperability and standardization of messages**

- **UN/EDIFACT** - *EDI*

- **XML** *(eXtensible Markup Language)* standard XML has become the most important data interchange format for e-business

- **SOAP** *(Simple Object Access Protocol)* (for remote procedure calls between applications in a distributed environment)

- **ebXML**, *(United Nations Centre for Trade Facilitation and Electronic Business (UN/CEFACT) and the Organization for the Advancement of Structured Information Standards (OASIS))*

- **TransportXML**, *(an XML based standard for electronic collaboration within and/or with the transport and forwarding industry in the period from 2001/2002)*

- **Shortsea XML** a message standard designed to streamline the administration processes within a short sea based logistics chain for scheduling, booking, operations and invoicing.
KEY DEVELOPMENTS TO DATE (3/7)

Creating a European Architecture for ICT based Freight and logistics operations

✓ Reference point for transport management system development, with generic data models, process specifications and message schemes

✓ Project FREIGHTWISE - a standardized platform for freight transport (in terms of roles, functions, processes and messages). The project also intends to integrate and demonstrate practical ICT-solutions to the stakeholders in order to enhance the use of ICT and to support the Commission in developing policies and directives related to this area.
Three domains governing intermodal transport management. (Source: FREIGHTWISE project)
KEY DEVELOPMENTS TO DATE (4/7)

Linking Traffic Management to Freight Transport management

✓ Traffic conditions, closures of streets, traffic restrictions, etc.
✓ waiting hours at specific congestion “hotspots” such as entry to ports, or railways, or borders to third countries
✓ schedules of ferry links
✓ parking areas and service stations for freight transport
✓ the height of bridges (services still being developed)
✓ permits for freight transport
✓ freight transport related associations
✓ general information on ports
✓ customs (in the port or freight centers) including their location, opening hours, etc.
✓ terminals (locations, etc).
The integration concept of THEMIS

Integration between TMS and FTMS

Integration between Traffic Management Systems

Integration between Freight Transport Management Systems

Waterborne
Air
Rail
Road

Shared Information

Door-to-door Transport Management System

Transport Chain Company 1

Transport Chain Company 2

Door-to-door Transport Management System

Road Traffic Management System

Shared Information

Transport Chain Company 1

Transport Chain Company 2

KEY DEVELOPMENTS TO DATE (5/7)

Freight operations

- Advanced ICT systems simplifying and automating freight operations
- Increase the efficiency of commercial vehicle activities through seamless operations based on electronic vehicle and cargo identification, location and tracking, pre-clearance and in-motion verifications.
- Trend towards integrating the basic and enabling technologies into data "platforms" for presenting information to both the vehicle and the control center at the office, or even at the roadside. Information combined into internet based "platforms", allows a commercial vehicle to share urgent information with nearby vehicles, and to dialogue with its control center, or with infrastructure operators and service providers.
**Advanced Fleet management**

- Focus to produce systems that enable communications between dispatchers in control centers and vehicle operators in the field, for timely and correct fleet management (through data delivery to the planning and monitoring systems of the firm).

- Trend is towards use of ICT (and the appropriate planning and operating management methods and instruments), to support virtual business-to-business communities of interest. (Examples are the European Cooperative Resource Management of Unit Loads – project COREM, and the Trident - Transport Intermodality Data Sharing and Exchange Network of ERTICO).
KEY DEVELOPMENTS TO DATE (7/7)

Data analysis and modeling

- “Poor relative” of the EU funded freight transport research
- Data for modeling freight transport operations are scarce
- Dynamic traffic simulation valuable tool to studying freight transport operations. Simulation can be used to explore and validate operating strategies and predicting travel times for Advanced Fleet Management and Travel Information
- ICT location and communication technologies offer possibilities to enhance the quantity and quality of data for the forecast and planning processes.
- Current examples: ETIS reference database and models, and project WORLDNET.
E-Business-oriented systems

- Convergence between ICT and e-business technologies for full exploitation of Internet-based operations, electronic commerce, etc (business-to-consumer and business-to-business sides of the freight transport operation)
- Internet-based community of interests and electronic auction mechanisms.
- Internet-based transport exchanges (business models from mere brokerage to full transport responsibility) - various interfaces (web/internet, mobile phone/handheld, roadside kiosks, etc).
- "Customer-focused" ICT systems (to help shippers find appropriate transport connections and modes, simplify transport-related tasks, or track bookings and shipments)
- Ancillary transport functions such as customs brokerage, insurance or warehousing
**A TYPOLOGY OF FREIGHT ICT APPLICATIONS AND SYSTEMS (2/7)**

**Freight Operation** (mainly proprietary) traditional logistics systems operating on the level of one large and usually globally operating forwarder or integrator. Functions: resource allocation / fleet management (load units, schedules, transport services), consolidation and sorting of shipments, positioning and navigation, automatic vehicle or load unit identification via RF tags, barcodes, freight management functions (including re-routing and re-scheduling).

*Onboard the vehicle:*
- Information about the vehicle or the load
- Relate vehicle to its “environment” (e.g. establish location information via GSM)
- Link vehicle to the home-base
- Mobile office (e.g. send quotes, confirm bookings or delivery, send electronic documents, etc)

*Home-base systems:*
Transport planning, route planning, fleet management, instructions to vehicles communication from vehicle: receive vehicle parameters or vehicle or load status
Intermodal Transport operation

- Innovative technological concepts (hardware and software) for door-to-door transport chain monitoring and supply chain management.
- Systems that try to provide “intermodal” information on schedules and services using common definitions and solutions for the interoperable and seamless data exchange between all the parties in the intermodal chain irrespective of the technologies they are using for data capture.
- Proprietary systems that aim at integrating subcontractors and fulfilling functions across transport modes.
- “Network operators”, that operate systems for data collection (positioning, etc) that employ roadside or rail side tags to measure traffic flows or provide vehicle or rolling stock positioning information
- Algorithms for the optimization of decision making, scheduling and dynamic re-scheduling along the door-to-door transport or supply chains of the future
Intermediary “Virtual” Terminal
(Project GIFTS)

Diagrammatic representation of the idea of Intermediary “Terminal”, “unifying” data from various sources and presenting them in a user friendly way to the end user.
**Site-specific ICT systems**

- Systems that are usually operated at specific sites such as ports and other Terminals, Terminal gates, Freight distribution centres, border crossings, etc.
- One of the pioneers in this field was project INTERPORT
- Functions include: *Terminal management, automatic vehicle or driver identification, warehouse operation and management and planning functions, loading / unloading operations, etc.*
- Site-specific ICT systems link technologies such as freight scanning (e.g. barcodes) with other transport related tasks such as sorting, inventory systems, or invoicing and deduction.
The Integration of the in-terminal areas (Project INTERPORT)

Central Handling System - GIS

EDI

Port Terminal Management System

Function

Effect

- Parking area control (based on port’s system)
- Parking area monitoring
- Optimisation of guidance
- Optimisation of resources

- Stowage area control (based on port’s system)
- Stowage area monitoring
- Elimination of positioning errors
- Optimisation of resources

- Loading/unloading control (based on EDI)
- Loading/unloading monitoring
- Optimisation of resources
- Faster loading/unloading operations

- Entry/exit control (based on EDI)
- Speed up of access control

- Stowage area control (based on port’s system)
- Stowage area monitoring
- Elimination of positioning errors
- Optimisation of resources

- Loading/unloading control (based on EDI)
- Loading/unloading monitoring
- Optimisation of resources
- Faster loading/unloading operations

- Parking area control (based on EDI)
- Parking area monitoring
- Optimisation of guidance
- Optimisation of resources
THE 90s AND EARLY 00s

Public Administration related systems

- They implement safety, security or revenue mechanisms
- Run by public, or private, administrations such as customs or port authorities
- Outsourced to private operators or PPPs (Public-Private-Partnerships). E.g. systems for: *dangerous goods declaration or customs clearance systems*, *electronic fee collection systems for toll roads*, or *smart card based functions such as the electronic tachograph*, etc.

- *Example*, the CDM (Collaborative Decision-Making) system for pooling flight data and make them available to air cargo operators as well as operators in other transport modes connecting to air transport

- Special emphasis on systems that connect transport related data and information for Customs clearance (e.g. for containers green lanes).
City logistics

- Coordination of shippers and carriers
- Consolidation of different shipments of various shippers, carriers, and customers in the same (energy efficient and environmentally friendly) vehicle.
- Central concept the City Distribution Center (the facility where shipments are consolidated prior to distribution).
- Individual routing and control depending on the individual vehicle profile, type of cargo and traffic situation.
- Access to real travel time and traffic status information.
- The “City Logistik” concept developed in Germany – fine example for “spontaneous” groupings of carriers for coordination and consolidation activities.
E- Freight

- Concepts, technological solutions and business models to establish information services platforms centered on the context of **individual cargo** items and their interaction with the surrounding environment and the types of users.
- Possibility to dynamically combining services at different levels.
- Possibility for services associated to any specific cargo item, context and user request.
- Prime example the EURIDICE project.
Vision of a system materializing the four “I”s:

- **Integrated**, 
- **Intermodal**, 
- **Internet** based, and 
- **Intelligence**

**Freight Intelligent Transport System, - Freight ITS:**

Globally integrated framework for freight movement realizing a synergy between previously isolated systems

- Main challenge to drastically increase the **intelligence of freight transport operations** and make it available to all players in the field irrespective of their size
FUTURE NEEDS AND PROSPECTS (2/4)

Three main, parallel but complementary, **directions**:

- ICT for vehicular and infrastructure **intelligence**.
- New hardware and software systems for advanced **integrated** electronics, location, tracking, and communication, as well as the associated information-technology systems.
- New intelligent **models and algorithms** to process the data and information gathered with the systems developed so far, and transform this information into timely and meaningful **advice** for advanced system and fleet planning, management, operations and control. Answer questions such as:
  - Are all of the data collected, transformed into **useful information**?
  - Is this information **properly (i.e. intelligently) exploited**?
Other areas of future work:

- Real-time allocation of resources, decision making, and management of operations.
- Real-time decision support systems that take into account congestion and dynamic demand conditions and coordinate with other agents (e.g., Customs or port players).
- Planning and management of integrated logistics networks (chains) in real-time.
- Trade-offs between accuracy of results and response time in real-time settings.
- Development of the next generation of planning models and methods for carrier or shipper operations that integrate the stochastic and dynamic aspects of ITS.
FUTURE NEEDS AND PROSPECTS (4/4)

- Development of the next generation of urban/regional planning systems that reflect the utilization of CVO and AFMS technologies.
- New intelligence systems for dynamic scheduling and re-scheduling of vehicles and operations.
- City Logistics
- *e-business* in Freight transport (e.g. combinatorial auctions and the development of efficient and comprehensive “advisors”). Need to reach to the SMEs
- Outsourcing in the transportation sector.
- New or improved freight transportation services in terms of:
  - enhanced customer value,
  - reduction of transportation and distribution costs,
  - delivery time reliability.
In conclusion....

- The main challenge for ICT in Freight Transport research remains to provide all actors dynamic and accurate information about schedules, the status of the shipment, and the entire transport process. Today such information exists, but it may be contained in proprietary systems, which do not conform to data exchange standards.

- The ultimate trend is that shipment information will move from the level of the transport means (e.g. ship, or train, or container) to that of load unit or even the individual load item.