Role of Information and Communications Technology (ICT) for Multi Modal Transport

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We will discuss

• Existing applications for core operations
• Technology Trend
• Future of things
Historical Application of ICT

Historically, the use of ICT in transport and logistics started in the 1960s.

Typical examples are

- inventory management systems,
- transport routing,
- scheduling, also known as Distribution Requirement Planning, and
- billing systems
Historical Application of ICT..2

Material Requirements Planning (MRP)

and

Manufacturing Resource Planning (MRP II)

And then EMERGED

Enterprise Resource Planning (ERP)
ENABLING TECHNOLOGIES

Cloud Computing

Wireless communication technologies (such as smart mobile phones, QR code, RFID and telematics tracking).

Switching from dyadic one-to-one communication to simultaneous one-to-many communication changes the way supply chains are structured and information is shared.
Proper categorisation of ICT functions

REF: Giannopoulos (2004) Three functions are described below.

**Transportation resource management** This function is related to the control of transportation resources such as load units, trucks, trains, ships and containers.

**Ports and terminals operations management**: This function enables the control of the flow of material through the ports and terminals.

**Freight and vehicle tracking and tracing**: This function enables the monitoring and control of the location of vehicles and freight in the transportation network.
“eFreight” Present day problems
Complexity of freight transport information exchange in the context of multimodal transport:

Problems
- lack of interoperability along the supply chain
- operators provide information several times for different purposes
- lack of information on intermodal availabilities

Result
inefficiencies, costs, reduced visibility of freight
administrative costs + perceived complexity for multimodal transport
no full exploitation of multimodal transport / non-optimization of use of existing transport infrastructure

Thus there is need for interoperable interfaces for information on freight in the various transport modes
“eFreight”: The vision of EU

- Interoperability between paperless freight information systems
- Zero paper documents needed for planning, executing and completing any transport operation within the EU
- Reduced waiting time at hubs related to administrative procedures
- Standard framework for intermodal information exchange
- Harmonised border crossings
ICT in transport planning

Projects/ Demos:
- SONORA, BELOGIC,…
- eFreight, SPIN-ALP,…
- GET Service platform etc.

ICT services:
- IT-based intermodal route planning,
- Intermodal transport scheduling,
- Future: Integration into existing ERP systems

Sources: SONORA project, BE LOGIC project
ICT in transport monitoring

- **Telematic (ITS)**
  - Applications for Freight:
    - Rail: TAF-TSI
    - Road: ITS
    - Maritime: VTMIS, SSN
    - Inland water: RIS

- **Tracking and Tracing:**
  - Of cargoes (not vehicles),
  - Cross-mode (multimodal),
  - Cross-border (transnational).

Intelligent Transport Systems (ITS)

ITS in the field of transport
• Providing real-time traffic information,
• Supporting traffic safety and transport operations etc.

EXAMPLES of ITS in the field of transport:
• Road intelligent transport systems (ITS),
• Air traffic management system (SESAR),
• European rail traffic management system (i.e. ERTMS) and rail information systems (i.e. TAF-TSI),
• Maritime surveillance systems (SafeSeaNet et al.), VTMIS (Vessel Traffic Management and Information System and
• Inland navigation (River Information Services [RIS]).
ICT IN INDIAN RAILWAYS
CENTRE FOR RAILWAY INFORMATION SYSTEMS (CRIS)

• The Centre for Railway Information Systems (CRIS), an autonomous Society under the Ministry of Railways set up in 1986, plays the role of the Information Technology arm of the Indian Railways.

• CRIS develops and maintains the major information systems deployed in the Railways, e.g. passenger ticketing, freight and passenger train operations, management of train crews, and management of fixed and rolling railway assets.
Freight/Operations Applications

• Freight Operations Information System (FOIS), Terminal Management System (TMS) and E-Payment- About 2.9 million tonnes of freight are booked daily in FOIS.

• Nearly 1,600 Railway Receipts (RRs), amounting to about Rs 255 crore, are generated, constituting 99.9% of freight booked; approximately Rs 191 crore (75% of total) is collected through e-payment every day.
Freight/Operations Applications

FOIS Rake Management System (RMS)-

• About 4,353 rakes are monitored daily through this module. Loads on the run / consignments in transit can be tracked by the customers on FOIS-Web.
• The Rake Allotment System provides optimum allocation of rakes for efficient freight movement.
Freight/Operations Applications..contd

• Control Office Application (COA) and Timetable Management System (Satsang)- About 5,00,000 arrival/ departure events of 14000 trains are recorded each day in 77 control offices through COA.

• Satsang assists in the preparation of train timetables to optimize running of trains.
Freight/Operations Applications..contd

- Crew Management System (CMS)-362 lobbies are provided with CMS.

- The system serves 47,000 calls daily via SMS, enabling train crews to sign on and sign off at CMS kiosks.
Locomotive Management System (LMS for Diesel Locomotives) and SLAM (for Electric Locomotives) (Software for Locomotive Asset Management)

These applications, presently implemented at a few sheds, will ultimately manage the maintenance of over 10,000 locomotives

Coaching/Freight Maintenance Management System (CMM/FMM)

These applications, presently implemented at pilot locations, will manage the maintenance of 60,000 coaching vehicles and 2,50,000 wagons.
Freight/Operations Applications..advantages

• These applications provide convenience and transparency for the Freight Customer.

• They also ease the work of the Railway staff, improving overall efficiency.

• Section controllers – reduced fatigue and stress through COA

• Running staff – optimized crew rotation and automatic mileage calculation through CMS
Freight/Operations Applications..advantages

• Track maintenance staff – easier maintenance of records through Track Mgt System

• Locomotive maintenance staff– information at fingertips through SLAM, LMS

• Planners – Rake Allocation System of FOIS assists in optimal allotment of rakes
FOIS - https://www.fois.indianrail.gov.in/
Advances in interface technologies

• The latest development of augmented reality (AR) technology

• **Augmented reality (AR)** is a live direct or indirect view of a physical, real-world environment whose elements areaugmented (or supplemented) by computer-generated sensory input such as sound, video, graphics or GPS data.
Policing Function
Augmented Reality:
An imminent reality for the logistics arena
Application of Technology
Examples from DHL

• Vision Picking at DHL - Augmented Reality in Logistics -
  https://www.youtube.com/watch?v=l8vYrAUb0BQ

• DHL Supply Chain's Service Logistics innovation-
  https://www.youtube.com/watch?v=kbFbsaLmFrv

• http://www.dhl.com/content/dam/downloads/g0/about_us/logistics_insights/csi_augmented_reality_report_290414.pdf

• http://www.dhl.com/content/dam/downloads/g0/about_us/innovation/CSI_Studie_BIG_DATA.pdf
Monitoring Mechanisms

Some technologies like

• RFID
• NFC
• QR Code
RFID

- **Radio-frequency identification (RFID)** is the wireless non-contact use of radio-frequency electromagnetic fields to transfer data, for the purposes of automatically identifying and tracking tags attached to objects.
NFC

- **Near field communication (NFC)** is a set of standards for Smartphone and similar devices to establish radio communication with each other by touching them together or bringing them into proximity, usually no more than a few centimetres.

- [List of applications of near field communication](#)
QR Code

The QR (Quick Response) Code is a two-dimensional (2-D) matrix code that belongs to a larger set of machine-readable codes, all of which are often referred to as barcodes, regardless of whether they are made up of bars, squares or other-shaped elements.
Example of QR Code
The future
What is IoT?

• The Internet of Things (IoT) has been defined by *International Telecommunication Union* in Recommendation ITU-T Y.2060 (06/2012)

• The IoT is a “network” of ‘things’ that can broadcast data and connect to the internet or to a network.

• Objects, animals or people are given unique identifiers and the capability to transfer data over a network.

• The convergence of wireless technologies, micro-electromechanical systems (MEMS) and the Internet leads to IoT.
Potential of IoT – Internet of Things

• According to Gartner, by the 2020, there will be 26 billion devices connected to the internet, with 10 billion already connected.

• Gartner further estimates that IoT products and services will generate revenue exceeding $300 billion in 2020. IDC on the other hand has forecast that the worldwide market for IoT solutions will grow to $7.1 trillion in 2020.
By 2020, the Internet of Things will have achieved “critical mass”. Linking enormous intelligence in the cloud to billions of mobile devices and having extremely inexpensive sensors and tags embedded in and on everything, will deliver an enormous amount of new value to almost every human being. The full benefits—in terms of health, safety and convenience—will be enormous.
REAL LIFE EXAMPLE OF IOT
Cold-Storage and Supply-Chain Management
Key Goals

• Real-time monitoring of Cold-storages
• Regular Performance Feedback
• Business Integration
• Advanced Reporting
• Complete Supply Chain Management System under one single umbrella
Cold-Storage – Technology Specifications

- Very Specialized Temperature Technology
- Completely Digital Temperature sensng Technology
- Measurable Temperature Range: -55°C ~ +125°C (-67°F ~ +257°F)
- Accuracy: ±0.5°C @ -10°C ~ +85°C
- Maximum Resolution: 0.0625°C
- Very Stable Technology: Once installed, does not require any kind of maintenance or services
Cold-Storage - Real-Time View

• Specialized View for monitoring of the Cold-storages.
• You can see your complete supply-chain cold-storages in single view on the map.
Cold-Storage – Preventive Measures

• If units are disconnected or Temperature sensor is disconnected inside the Cold-storage, an alert can be raised on the server with actual time of disconnect.

• Supervisors are immediately notified of any such event.
Cold-Storage – Advanced Supply Chain Management

• For Ex: This screen shows all vehicles in 300 Km. proximity of the ABU ROAD Cold-storage.
IoT Introduction-Potential

https://www.youtube.com/watch?v=RFqIsAh7wqE
Big Data

Big data is a term for data sets that are so large or complex that traditional data processing applications are inadequate. Challenges include analysis, capture, data curation, search, sharing, storage, transfer, visualization, querying and information privacy.
Big Data ... just a little bit more!!!

Volume
- Terabytes
- Records/Arch
- Transactions
- Tables, Files

Velocity
- Batch
- Real/near-time
- Processes
- Streams

Variety
- Structured
- Unstructured
- Multi-factor
- Probabilistic

Value
- Statistical
- Events
- Correlations
- Hypothetical

Veracity
- Trustworthiness
- Authenticity
- Origin, Reputation
- Availability
- Accountability
What is Analytics?

Mathematical or Scientific methods that highlight data for insight

Insight = Competitive Advantage
Used to inform actions and decisions

Data is becoming the world’s new natural resource

With analytics, insights are created to augment the gut feelings and intuition for decisions
Big Data & Analytics

A great example of Visualization
Hans Rosling's 200 Countries, 200 Years, 4 Minutes - The Joy of Stats - BBC Four

Link to Video
https://youtu.be/jbkSRLYSojo
Big Data Potential

In addition to data fusion, there is process fusion—such as standardizing processes and understanding the various interlinked processes.

This provides operations visibility across the entire process chain, which can improve all logistics-related functions, such as:

- Distribution center sort optimization
- Back-haul activities
- Revenue and fuel management
**Cloud computing** is a service provided by IT experts that acts as an alternative to the ongoing high-cost of investment into IT resources and management which minimises technology- and in particular user-related barriers.

**Software as a service (SaaS)** is becoming a popular way of accessing specific software on-demand through an Internet browser via a fixed or per usage subscription fee.
Web 3.0 and Social Networking

The development of social networks should accelerate the development of the business network sector

With social network sites such as Facebook and Twitter bringing revolutionary changes in the way individuals communicate,

The same technological platform could be used in the transport and logistics environment to facilitate instant communications between various stakeholders.

Yammer - A private social network for business called Yammer has recently gained momentum. Now acquired by Microsoft.
Microsoft & Yammer

Collaboration + Enterprise Social Networking = Social for Getting Work Done Together

Growing like crazy

$1 billion
SharePoint fastest business to reach $1 billion

Fusing a platform to help people get work done

SharePoint

700,000 Developers, building on the platform

Yammer

150 countries

used in 150 countries

23 languages

2012 Leader Foremost Mobile Voice

2012 Leader Foremost Activity Streams Voice

2012 Leader Foremost Mobile Voice

Translated into 23 languages

Together we will deliver
The most complete solution in the marketplace

### Key Enabling Factors for Multimodal Integration

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
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<tbody>
<tr>
<td><strong>Data standards</strong></td>
<td>Development of common global standards such as General Transit Feed Specification (GTFS). GTFS allows transit agencies globally to share information in a standardized format with developers of multimodal trip applications.</td>
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<tr>
<td><strong>Technology advancements</strong></td>
<td>Advancements in technologies for real-time vehicle tracking, and real-time information at transit stations and on mobile phones.</td>
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<td><strong>Role of major technology companies</strong></td>
<td>Investments by companies such as Google, IBM, Siemens, Cisco, and Panasonic to promote smart urban mobility. Google Transit, which provides multimodal transit planning service, has expanded to over 250 cities in 67 countries, since its launch in 2005 in Portland, Oregon.</td>
</tr>
<tr>
<td><strong>Role of application developers</strong></td>
<td>A growing community of start-up application developers, who are developing innovative apps using GTFS data, for multimodal trip planning.</td>
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## Future Outlook

### Ocean Freight
- Maritime Agenda 2010-20 objectives will be a key driver
- Growth of non-major ports, containerisation and east coast ports
- BOT terminals opened for international bidding

### Rail Freight
- Rising investment in the rail will fuel growth in allied industries
- Wagon manufacturing, port handling equipment, railway electrification systems and construction companies key areas

### Air Freight
- Tier-2 cities next cargo centres
- Development of 25 greenfield airports in Tier-2 and Tier-3 cities
- Modernization of 35 non-major airports

### Trucking
- About 110 new logistics parks are expected to be operational
- Spread over approximately 3,500 acres at an estimated cost of USD 1 Billion

### 3PL Services
- Companies currently outsource an estimated 52% of logistics, and 3PL represents only 1% of logistics cost – huge potential
- Revenue expected to increase from USD 1.2 Billion (2010) to USD 4 Billion (2015)
Barriers to Adoption of Technology

- **User-related**
  - Enterprise Size
  - Economic and financial reasons
  - Operation-related barriers
  - Management-related barriers

- **Policy-related**
  - Lack of related policies
  - Coordination and harmonisation of related policies
  - Lack of standardisation supported by policies

**Cloud computing**

**Web 3.0**

**Mobile communications**

**AR**

**NFC**

**Technology-related**
- Compatibility and interoperability of systems
- ICT integration and standardisation
- Confidentiality of information

**Barriers**

**Enabling technologies**

Barriers to ICT implementation

- Large investment requirements,
- The implementation costs,
- Managing and maintenance costs
- **Operation-related barriers** include human capital issues such as difficulty in employing qualified personnel,
- Lack of ICT specialists, and personnel skill shortage to operate new applications,
Barriers to ICT implementation

• Management capability has a large impact on how companies perceive the adoption of ICT.
• For example, the uncertainty of commercial success with regard to ICT applications, including a lack of knowledge on payback times and unclear returns on investment, seems to act as an obstacle hindering organisations from investing and implementing ICT applications in multimodal transport.
The technology-related barriers

• Relate to the technological constraints that prevent operators making full utilisation of ICT applications, including the issues such as interoperability of systems, ICT integration, standardisation, security and data protection.

• Low compatibility may exist between these ICT applications thus serving as a key barrier to the interconnectivity between different applications and integration with future applications.

• The interconnectivity of applications used by different actors in multimodal transport is of vital importance for reliable and efficient cargo movement.
References

- BELOGIC EU project: http://www.be-logic.info/
- eFreight EU project: http://www.efreightproject.eu/
- RISING EU project: http://www.rising.eu/web/guest;jsessionid=73E0BFE8488F7FF97C2A0D7334FBFAE3
- SONORA EU project: http://www.sonoraproject.eu/
- WHITE PAPER Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system, Brussels, 28.3.2011, COM(2011) 144 final
- Telematic Applications for Freight - Technical Specification for Interoperability (TAF – TSI)
Discussion