

St. Petersburg State University
of Engineering and Economics (Russia)

**ICT Best Practices for Sustainable Freight
Transport and Logistics
/Russia, Ukraine, Belarus/**

Valery S. Lukinsky
Vladislav V. Lukinsky
Nina I. Fateeva

SAINT-PETERSBURG STATE UNIVERSITY OF ENGINEERING AND ECONOMICS

- 12 faculties
- 28 000 students (including students at branches)
- All forms of education (Bachelor's programme, Master's programme, specialty, post-graduate center, center for doctoral training)
- Rating: one of the 10 best economic universities in Russia

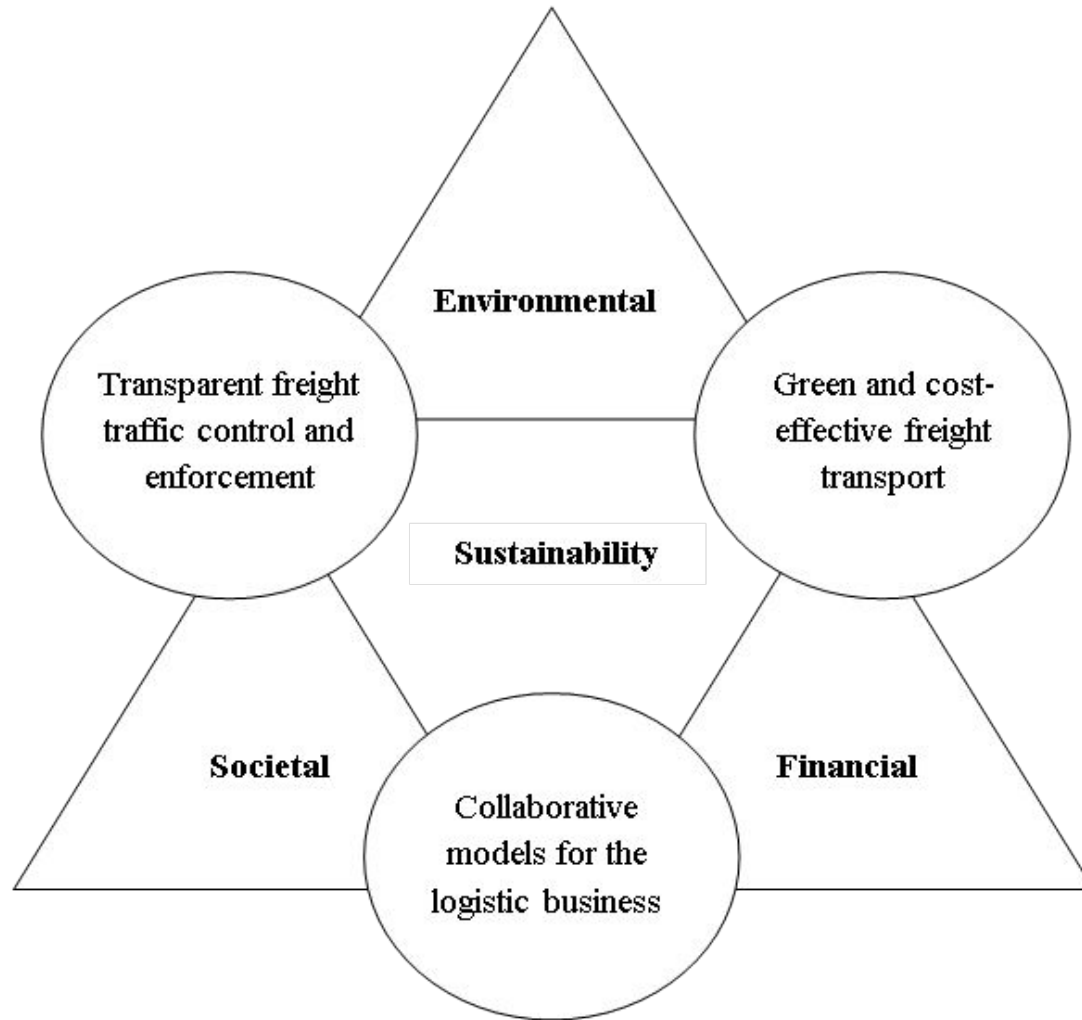
Faculty of Logistics and Transport

Department of

Logistics and Transport Organization

- Lecturers – 32, including Doctors of Science – 8
- Students (total) – 900
- Post-graduate students – 40
- Candidates for a doctor's degree – 4
- Candidates for a master's degree – 30
- Candidates for a bachelor's degree – 82
- New specialty (since 2011) – “Customs”

L4LIFE Framework: three dimensions of sustainability



Source: VTT, Finland

L4LIFE Framework: ICT solutions side

Strategic goals	<i>Environmental:</i>	Manage environmental risks, green supply chain certification, reduce traffic
	<i>Societal:</i>	Reduce fuel costs, increase safety
	<i>Financial:</i>	Differentiating products, efficient co-modality management.
Requirements	<i>Environmental:</i>	Monitor carbon footprint, monitor supply chain efficiency, support intermodal freight
	<i>Societal:</i>	Increase energy efficiency, track shipments, optimize overall cargo traffic
	<i>Financial:</i>	Manage partners, efficient carrier selection, increase load factor
Solutions	<i>Environmental:</i>	“Green” navigation
	<i>Societal:</i>	Cargo mobility information service, freight monitoring & enforcement
	<i>Financial:</i>	Logistic brokers, data infrastructure for logistic efficiency, collaborative & interoperable freight management

Source: VTT, Finland

Research objectives

Collection, organization and analysis of information on the use of ICT in the organization of freight transport (transport logistics).

Sources of getting information about ICT solutions

- **First group:** official sources.
- **Second group:** all possible data published in a variety of information sources.
- **The third group:** promising research and ideas in the form of problems, hypotheses, suggestions, propositions, etc.

The first group of sources: strategies, programs, laws

- National and regional concepts;
- Strategies and transport development programs.

For example:

- the Concept of customs clearance and customs control of goods in areas close to the state boundaries of Russian Federation;
- Development strategy of rail transport in Russian Federation until 2030.

The first group of sources: The Transport strategy of Russian Federation for the period until 2030 (objectives)

The Transport strategy of Russian Federation for the period until 2030 contains the following objectives (among others):

- Decreasing the transport contribution to environmental pollution;
- Decreasing energy intensity;
- Innovative goods and transport technologies satisfying best world achievements;
- Others.

The first group of sources: The Transport strategy of Russian Federation for the period until 2030 (tasks)

The tasks should be solved to implement development objectives of transport system of Russia until 2030 are:

- Generation of common information environment of technology interaction of different modes of transport, members of transportation, customs and other government control structures;
- Using of modern ICT for transport service quality assurance;
- Decreasing transport energy intensity down to the level of leading countries;
- Others.

Growth dynamics of transport logistics tools components

	Logistics Centers	The transport infrastructure of a new type: transport-storage and transport-goods complexes (the combined system of interaction transport and logistics)	<i>Logistics infrastructure</i>
	Systems of electronic logistic support	Transport-logistics infrastructure	
	Urban cargo logistics systems	The integrated system of logistics centers	
	Logistics fleets	The integrated network of the transport-logistics complexes	
	Systems of the transport-logistics centers	The transport-logistic system of the country	
Intermodal transport and logistics systems	Transport-logistics systems	Major logistical and production sites	
Multimodal logistics centers		Multimodal logistics centers and information hubs	
Logistics and information technology	Innovative logistics of commodity-transport technologies		<i>Logistics technology</i>
Logistics technology		Modern transport, logistics and info communication technologies	
Transport and logistics technologies			
	Principles of transport logistics	Efficient logistics	<i>Methodology</i>
	Logistics principles	The integration of transport and logistics process	
Strategy 2010	Strategy 2020	Strategy 2030	

Source: Ministry of Transport of the Russian Federation

The first group of sources: Technical regulation on safety of wheeled vehicles

The document stipulates that the design of vehicles, used to transport passengers or dangerous goods, must provide a possibility for mounting of satellite navigation system GLONASS and GLONASS / GPS.

Source: newspaper “Rossiiskaya Gazeta”, September, 2009

The second group of sources: major solutions available on the ICT market for transport companies

Currently, ICTs are implemented on the basis of:

- cellular transmission GSM (GPRS / SMS),
- satellite communication Inmarsat, Iridium, GlobalStar,
- satellite navigation (GLONASS / GPS),
- positioning in cellular networks (MPS / LBS),
- warehouse management systems (WMS) and container terminal management systems (CMS),
- corporate information systems (SAP R3, Microsoft Dynamics AX).

The declared purposes are :

- reduction of transportation costs,
- improving of decision-making,
- automation of the transport companies.

The second group of sources: the functionality of ICT solutions for transport companies

1. Control of the location (speed and direction) and the condition of the car, cargo, container in real time.
2. Securing the vehicle and the cargo (container).
3. Analysis of the transport work performed.

The second group of sources: the functionality of ICT solutions for transport companies - control of the location and the condition of moving objects

1. Control of the location (speed and direction) and the condition of the car, cargo, container in real time, including:

- Mapping the location of moving objects on an electronic map;
- Basic parameters of the engine (oil pressure, battery charge, fuel level, coolant temperature) and temperature in the car body (container) - the refrigerator;
- Weight control of delivered goods;
- Taking into account the fuel consumption up to 99% and misuse of vehicle (a reduction of up to 30% on fuel costs);
- Writing data into memory if connection with the server is not available and automatic transfer of information when you log into the network;
- Ability to obtain additional information (gas stations, service centers);
- Ability for customers to keep track of their cargo status through the Internet.

The second group of sources: the functionality of ICT solutions for transport companies - securing the vehicle and the cargo

2. Securing the vehicle and the cargo (container):

- Automatic information in real time of any emergency situations (emergency button, the output of the zone, opening the door);
- The ability to lock remotely the car's engine;
- Control the behavior of drivers and their driving habits;
- Keeping control (opening doors).

**The second group of sources:
the functionality of ICT solutions for transport
companies - analysis of the transport work
performed**

3. Analysis of the transport work performed:

- The formation of various reports (mileage vehicle, operating time, charging);
- Forecasting the arrival of the vehicle to the destination;
- Calculation of optimal routes;
- Automate processing of shipping documents, electronic documents.

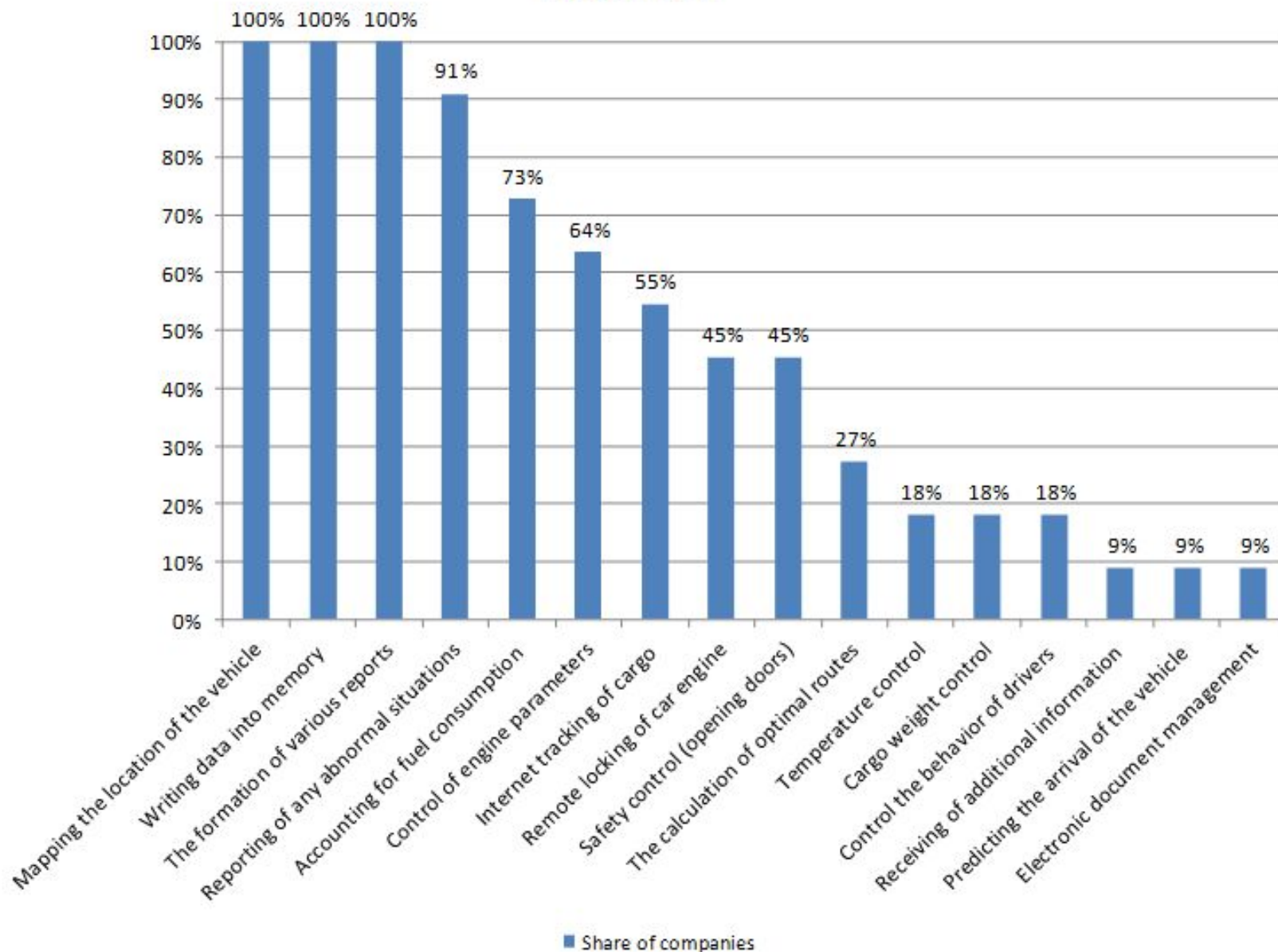
Major developers / manufacturers / suppliers, offering a complete ICT solutions for transport companies:

- 1) SPF "GEYSER"
- 2) CJSC "Russian Navigation Technologies"
- 3) LLC "NTKF" Si-Nord"
- 4) Group of Companies "Scout"
- 5) LLC "Unicom Telematics"
- 6) JSC "Russian Space Systems"
- 7) LLC "ON Socrates"
- 8) LLC "Heaton"
- 9) Group of Companies "M2M telematics"
- 10) CJSC "ITS-Soft"
- 11) Unified National Movement Control System of Russia
and others

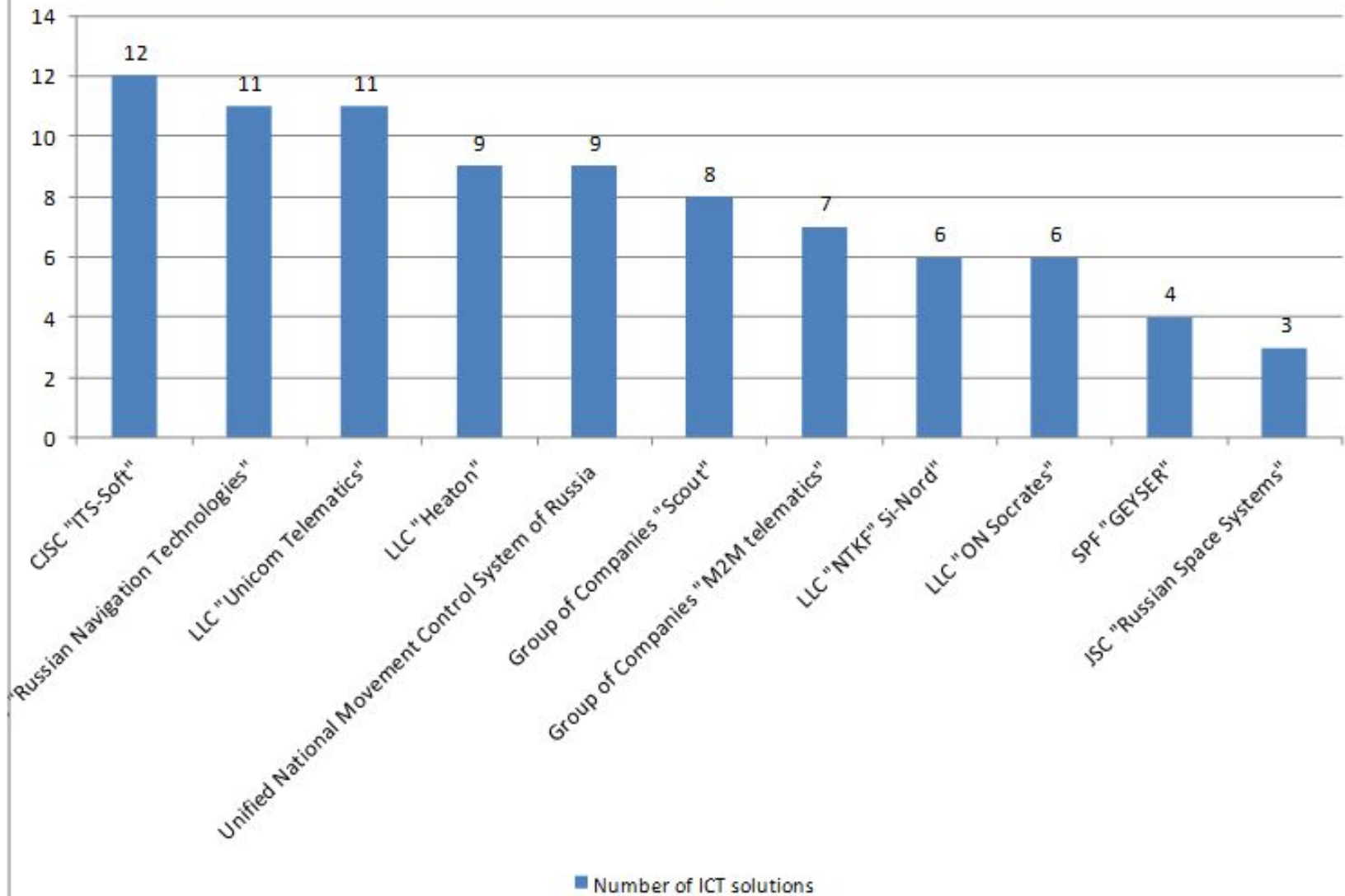
Survey results

№	The functionality of ICT solutions for transport companies	1	2	3	4	5	6	7	8	9	10	11
1	Mapping the location of the vehicle on an electronic map	+	+	+	+	+	+	+	+	+	+	+
2	Control of engine parameters		+	+	+	+			+		+	+
3	Temperature control		+								+	
4	Cargo weight control								+		+	
5	Accounting for fuel consumption and misuse (run) of vehicle		+	+		+		+	+	+	+	+
6	Writing data into memory if connection with the server isn't available	+	+	+	+	+	+	+	+	+	+	+
7	Additional information (gas stations, service centers, etc.)										+	
8	Internet tracking of cargo by customers		+		+	+			+	+	+	
9	Reporting of any abnormal situations	+	+	+	+	+		+	+	+	+	+
10	Remote locking of car engine		+			+		+	+			+
11	Control the behavior of drivers and their driving style		+			+						
12	Safety control (opening doors)		+			+				+	+	+
13	The formation of various reports	+	+	+	+	+	+	+	+	+	+	+
14	Predicting the arrival of the vehicle to the destination					+						
15	The calculation of optimal routes				+						+	+
16	Electronic document management				+							

Percentage of companies offering one of the ICT solutions



The surveyed companies offer between 3 and 12 ICT solutions



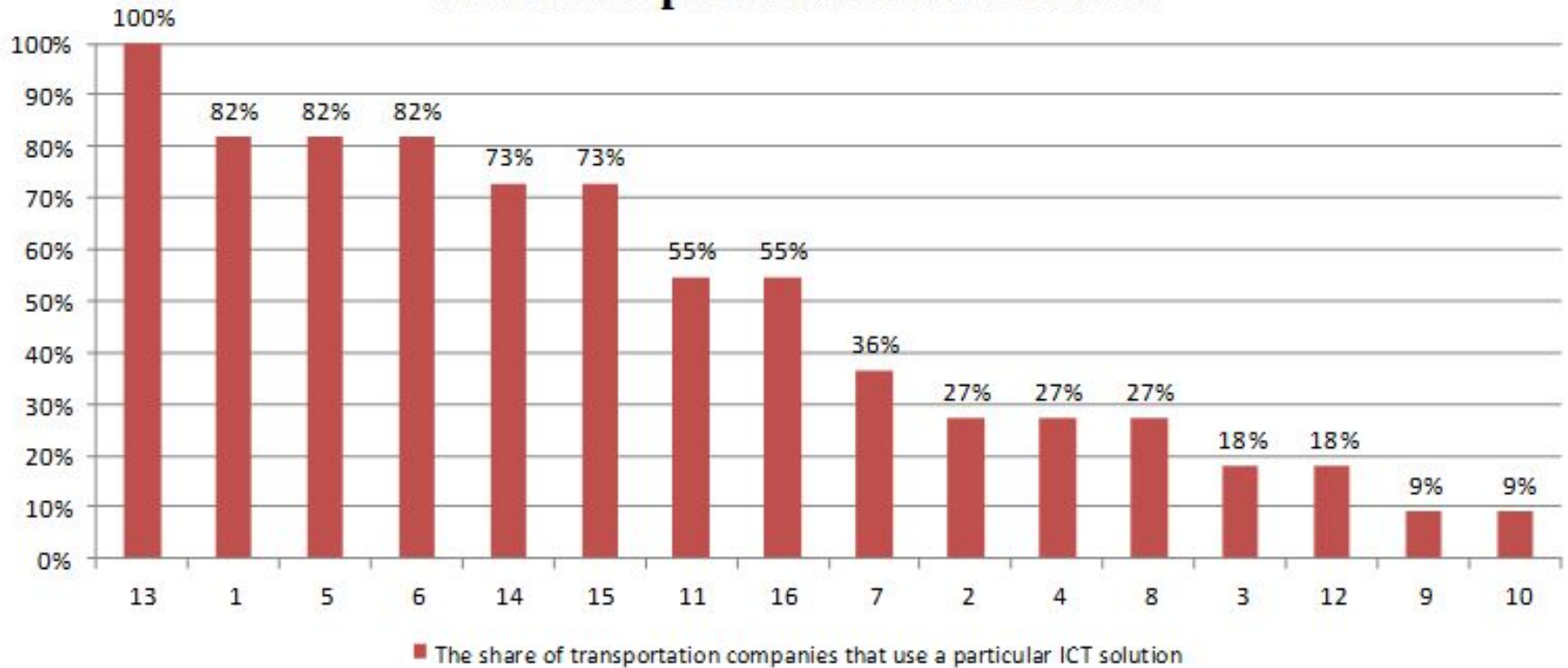
Major solutions on the ICT market, used by transport companies (information is presented without the company names)

Solutions	Transport companies (data within brackets indicate the ratio of the number of trucks that use ICT to the total number of trucks)										
	№ 1 (13/13)	№ 2 (4/15)	№ 3 (13/13)	№ 4 (300/300)	№ 5 (312/312)	№ 6 (47/47)	№ 7 (12/12)	№ 8 (3/3)	№ 9 (35/35)	№ 10 (6/12)	№ 11 (7/18)
1	+	+	+	+	+	+	-	-	+	+	+
2	+	-	-	-	-	-	+	-	+	-	-
3	-	-	-	-	-	-	+	-	-	+	-
4	-	-	-	+	-	-	+	-	-	+	-
5	+	+	+	+	+	+	+	-	+	-	+
6	+	+	+	+	+	+	-	+	+	+	-
7	-	-	-	+	+	-	-	-	-	+	+
8	+	-	-	-	+	-	-	-	-	+	-
9	-	-	-	-	+	-	-	-	-	-	-
10	-	-	-	-	+	-	-	-	-	-	-
11	-	+	+	-	+	+	+	-	-	+	-
12	-	-	-	+	+	-	-	-	-	-	-
13	+	+	+	+	+	+	+	+	+	+	+
14	+	-	+	+	+	+	+	-	+	+	-
15	-	+	+	+	+	+	+	-	+	+	-
16	-	-	-	+	+	+	+	+	-	+	-

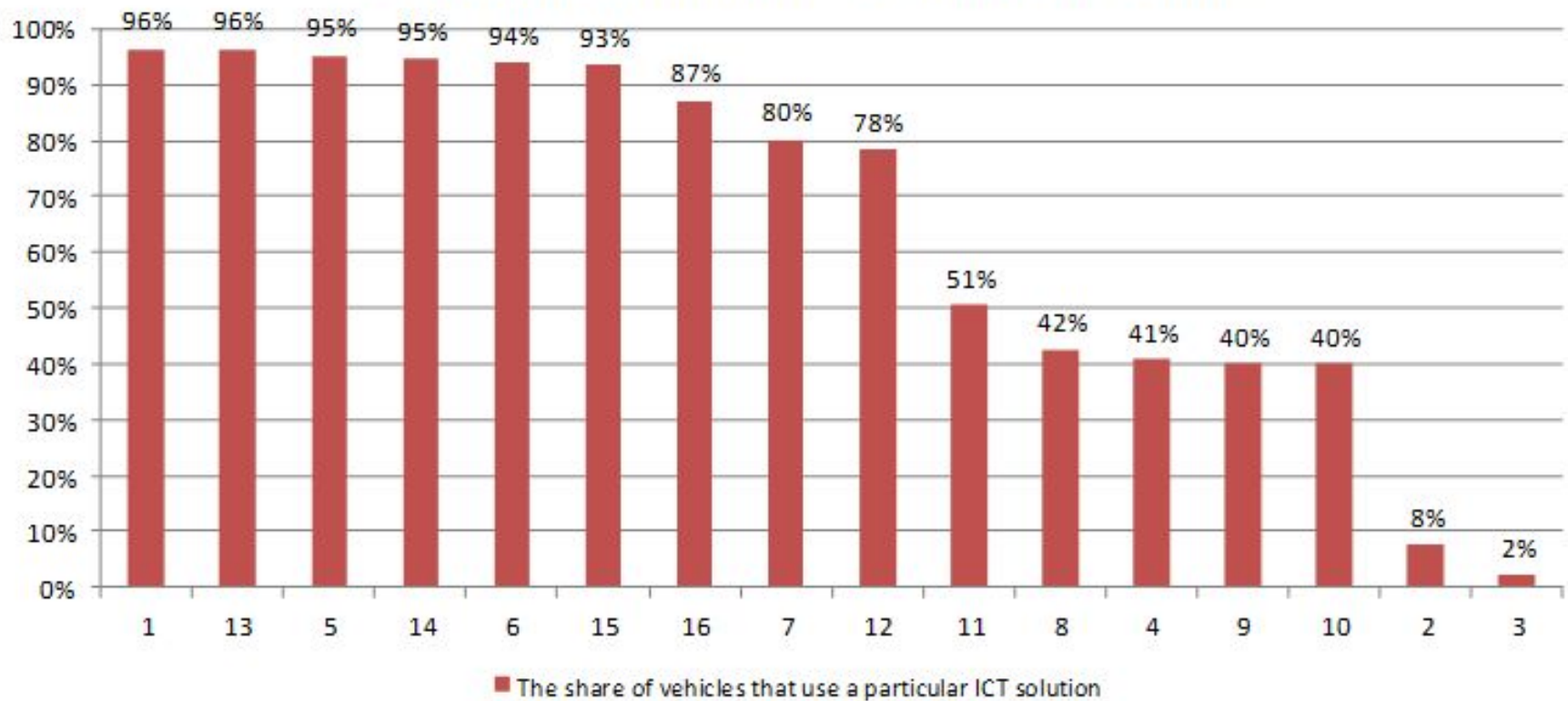
Note to the previous table

Some transport companies (3, 4, 7, 10, 25 trucks) do not use ICT for different reasons (customers are not ready for the additional costs; while we monitor the market of ICT for over 5 years, to sidestep unprofitability proposals are being rejected; in case of transportation of more than three SKUs, preliminary informing of customs does not work (only through a broker in customs office)).

The share of transportation companies that use a particular ICT solution



The share of vehicles for which a particular ICT solution is used



The results of the use of ICT by transport companies

- 1) Mapping the location of the vehicle on an electronic map (solution number 1) gives a reduction in the number and duration of the conversations by the mobile, thus reducing transportation costs and increasing safety (the driver is not distracted while driving);
- 2) Allowance for fuel consumption (solution number 5) gives a reduction in average fuel consumption (due to control of filling and plums in real time);
- 3) Online tracking of cargo by customers (solution number 8) allows receiving information in the office of the transport company directly through the transport manager;
- 4) Electronic document management (solution number 16) allows the company to introduce a program to monitor the traffic that is integrated with accounting (from receipt of the request for transportation prior to payment for work performed).

“Actually the container from St. Petersburg to Moscow moves during one day, but participants of the carriage exchange paper documents for 5-6 days” says Boris Kunin, general director of “Trans Telecom Business”.

An example № 1 of the use of ICT while carrying out international transport

Customs clearance	Since 1 January 2014 it is planned a full transition to paperless technology circulation and the technology of filling of electronic customs declaration and the documents on the base of which it is filled
	To achieve this it is necessary to introduce: <ol style="list-style-type: none">1. preliminary informing of customs authorities.2. Declaration of goods in electronic form.3. Technology for remote goods release by customs authorities.

An example № 2 of the use of ICT while carrying out international transport

Heavy cargo transportation	Existing problems	Promising solution
	<ol style="list-style-type: none"> <li data-bbox="421 461 1103 772">1. The carrier gets the legislation permission 3-4 weeks after sending the application in. (even carriers who carry out transportation in the Far East and Siberia). <li data-bbox="421 803 1103 1043">2. There are few legal acts that establish various limiting parameters of overall weight and dimensions of vehicles in Russia. <li data-bbox="421 1075 1103 1315">3. Russia has not implemented the international agreement involving the use of international vehicle weight certificates. 	<p data-bbox="1130 461 1812 701">In Tver region the ultramodern item weight-checking point, which has no analogue in Russia, is going to be installed.</p> <p data-bbox="1130 732 1812 972">Under the road surface a special cable with a sensor responsive to the excess weight of the vehicle will be placed.</p> <p data-bbox="1130 1003 1812 1243">Traffic lights will automatically send the truck to the extreme right lane and then to the stationary weight control point.</p>

The third group of sources: proposals of the working group of the INGECON

- 1) Unification of documents on the basis of electronic data carriers** (electronic portfolio of documents accompanying the implementation of international transportation).

We offer to distinguish three data carriers:

- for driver it has to contain passport data with visas, driver's license, data on the mode of work and rest, an ADR certificate, personal information (e.g., blood type), etc.;
- for the vehicle it has to contain the vehicle registration certificate, travel permit, certificate of serviceability, insurance, and others;
- for goods it has to contain invoice CMR, TIR carnet, invoice, the certificate of origin.

The consequences of the transition to paperless data carriers at three levels

First level: transport companies

- Reduce of complexity of obtaining permits and the return, the risk of loss, damage, incomplete filling of the permit forms

Second level: the state (for example, Russia or Finland)

- Reduce of labor costs for the distribution system of permits and monitoring the correctness of their use (including authentication forms)

Third level: Interstate

- The number of permits, which receives the RF Transport Ministry from foreign countries, is about one million forms per year;
- States are free to determine what information (and in which language) should be on the permit. Often there are delays in the start of the year with an exchange of forms between two countries;
- The transition to paperless data carriers will standardize forms of permits, significantly simplify the procedure for their exchange and use;
- Technical upgrades necessary for the transition can be a platform for the transfer of all transport documents in a single information space;
- A separate study has to be carried out to determine the effect of implementing the proposed measures.

The third group of sources: proposals of the working group of the INGECON

2. Electronic directory of international road transportation

- It allows providing the driver in his native language information in real-time about traffic characteristics, the nearest car parks, etc., as well as options for its behavior in extreme situations (road accidents, truck breakdown, a police check).

3. The development of scientific base for evaluation of the effectiveness of ICT in transport logistics

- "Now all the members of transport process have a lot of data, but they are very difficult for understanding. Each mode of transport is developing on its own, and movement toward consolidation is very slow", says Vladimir Voronin, vice general director of "NIIAS".

The structure of logistics costs in different countries

Costs	U.S.		Poland	UK	Russia		Finland	Brazil
	1	2	3		4	5	6	7
Transportation costs	40	62	45 – 50	41	45	54	36	60
Storage costs	26	34	30 – 40	21	25	40	51	36
Inventory carrying costs	29			23				
Administrative costs	5	4	15 – 20	15	30	6	13	4

Sources:

- 1 – Ballou Ronald H., Business Logistics Management, 1999;
- 2 – Willson R., 18th Annual State of Logistics Report, Washington DC, 2007;
- 3 – Skovronek Ch., Sariush-Volsky Z., Logistics in enterprise, 2004;
- 4 – Anikin B.A., Tyapuhin A.P. Commercial Logistics, 2005;
- 5 – Sergeev V.I., Dybskaya V.V., State University – Higher School of Economics, Moscow, 2008;
- 6 – Finland State of Logistics, Helsinki, 2006;
- 7 – Dolgov A.P., materials of Russian-German conference, 2008.

Research interest ranking of topics*

	Topic	The total score of 3 regions**
1.	Information Technologies	3
2.	Performance evaluation	7
3.	Unique distribution strategy	13
4.	Location of reserves	14
5.	Re-engineering of the logistics network	14
6.	Customer relationship management in the unions and associations	14
7.	Logistics strategy	19
8.	Organizational Structure	25
9.	Globalization	28
10.	Environmental problems	28

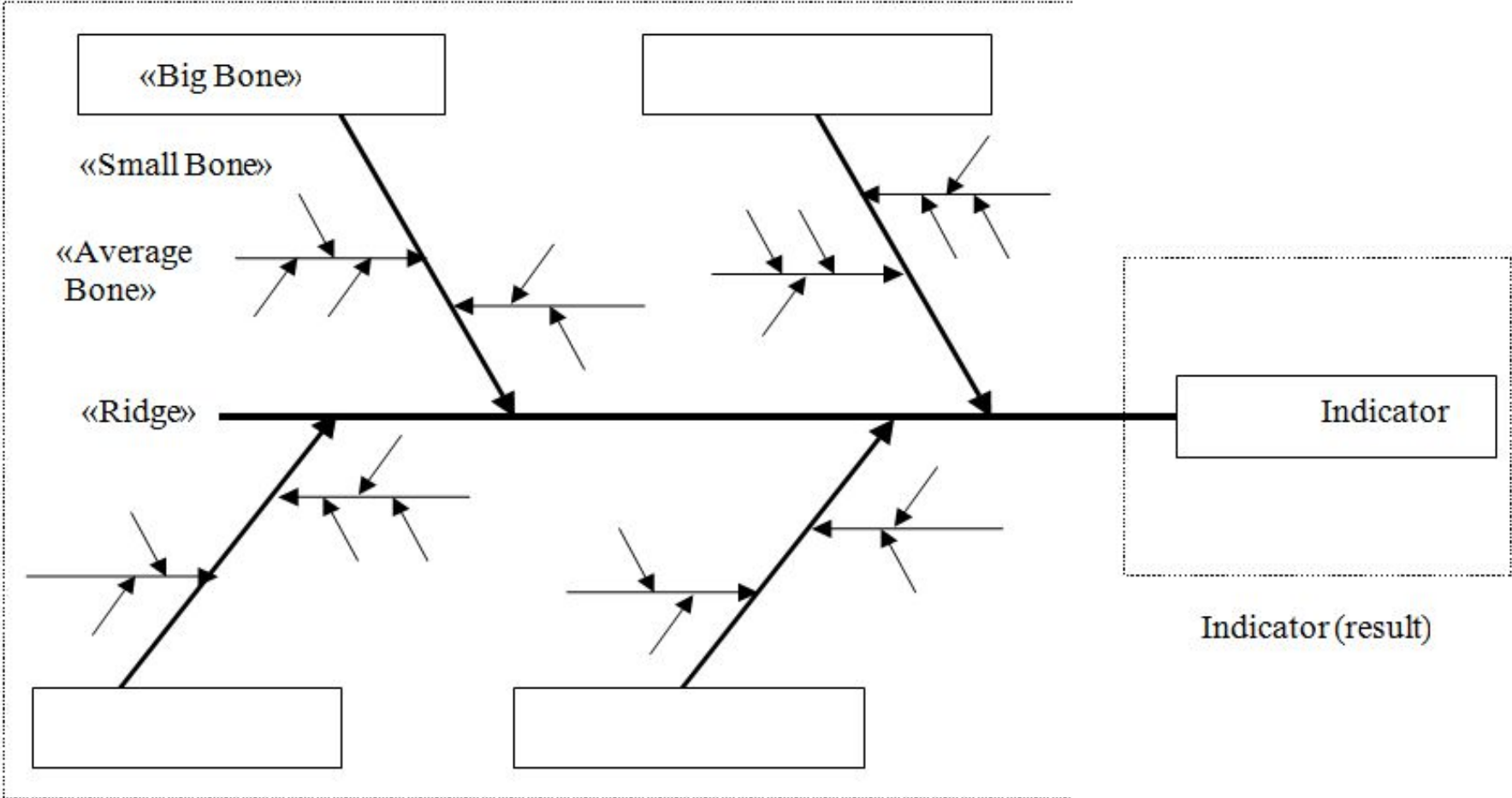
* Compiled from data published by D.J. Bowersox and D.J. Closs with reference to the Center for World Studies, University of Michigan;

** Europe, North America, the Pacific region.

Needs of the logistics sector development (Turku School of Economics, project “LogOnBaltic”)

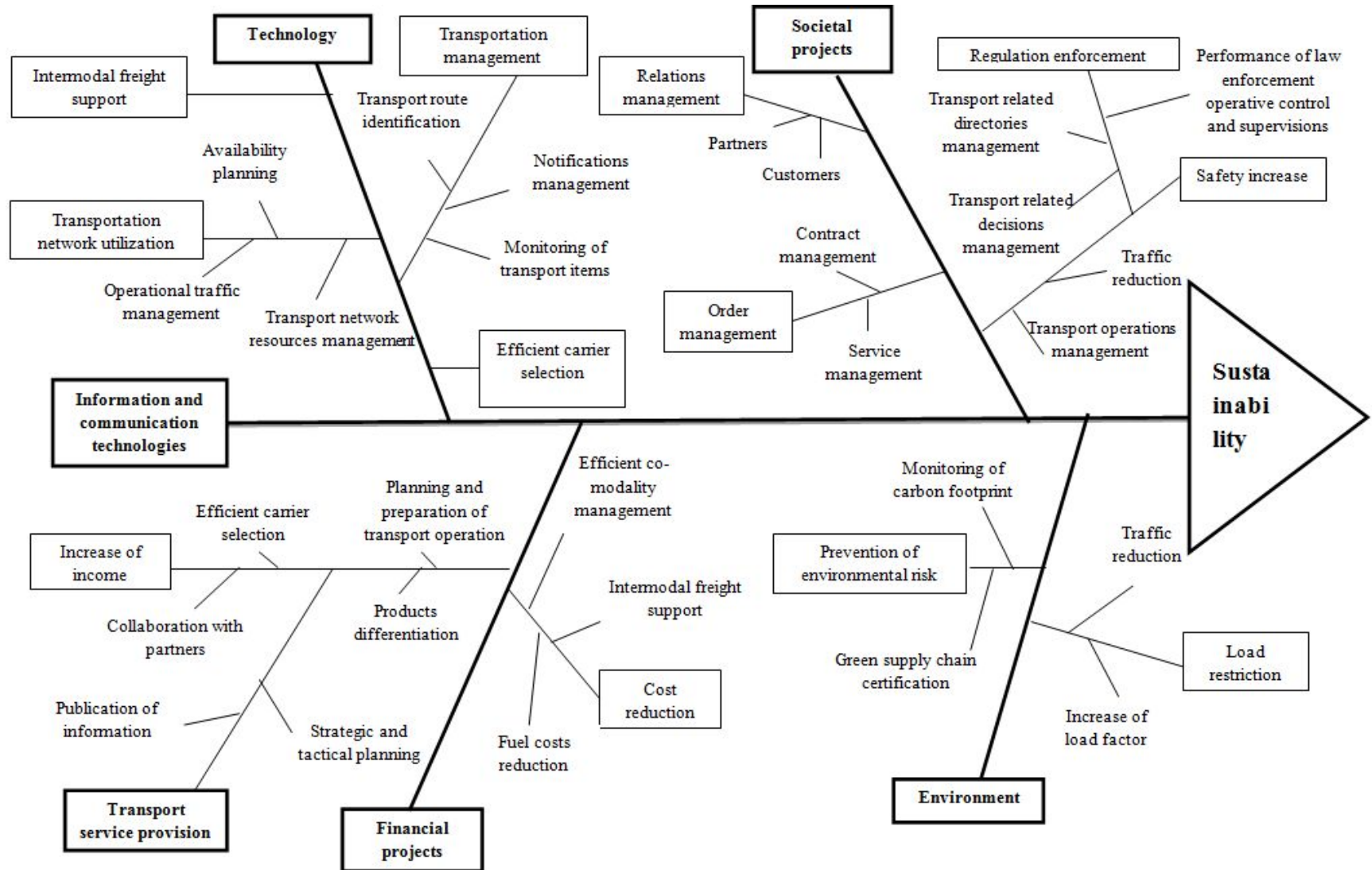
Index	Value, %
1. The development of information systems	18 – 22
2. Customer satisfaction management	21 – 23
3. The reduce of logistics costs	17 – 19
4. The selection of logistics service providers	11 – 12
5. The increase of transparency in the chain of suppliers	9 – 11
6. The development of competency	8 – 9
7. Structural changes in the distribution network	6 – 7
8. The use of mobile technology	3 - 4

Structure diagram of the causes and results (Ishikawa diagram)

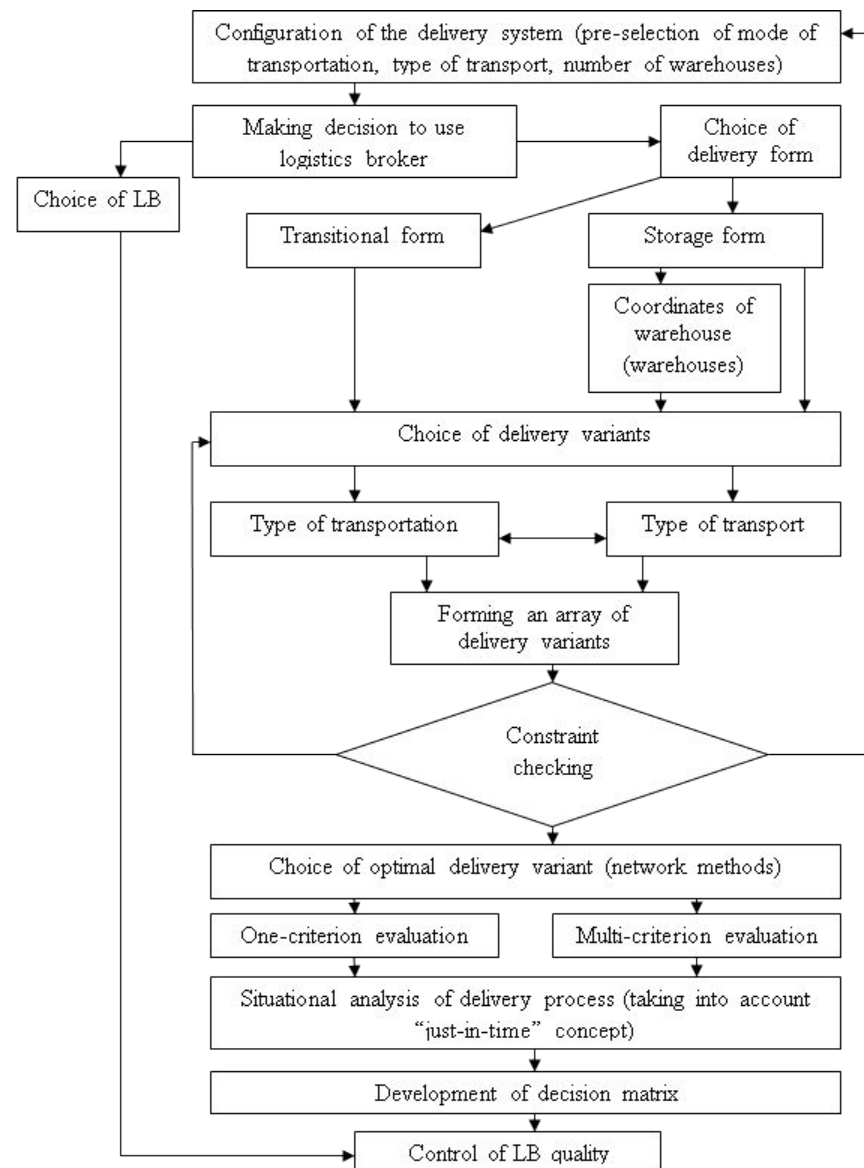


Factors (causes)

Cause-and-effect diagram of impact of ICT solutions on sustainability



Algorithm for designing a cargo's delivery system

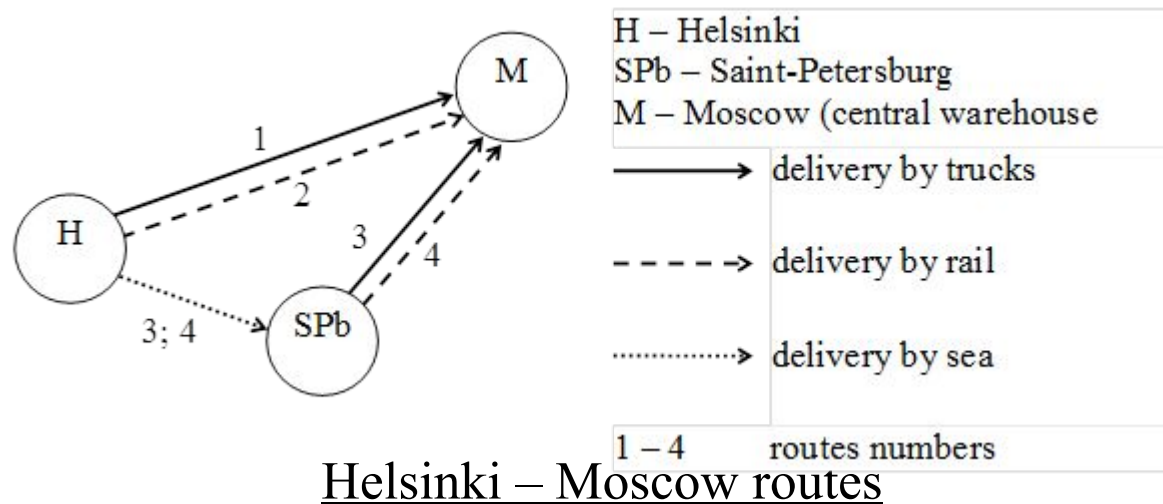


Source: INGECON

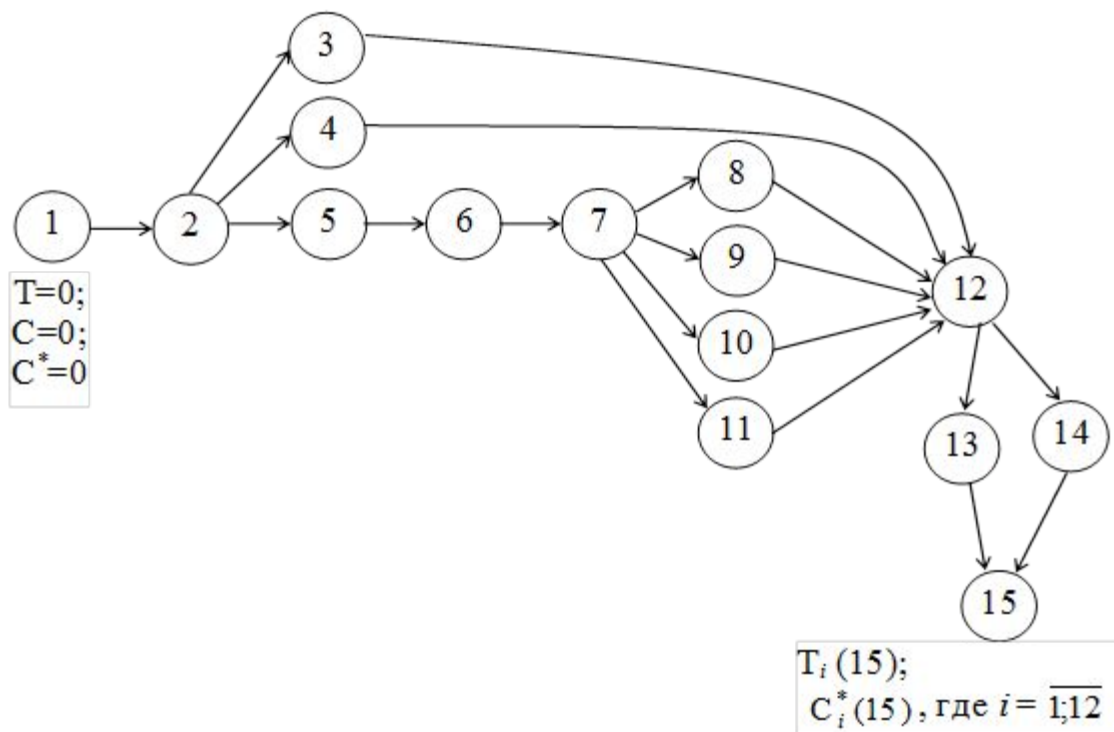
The choice of delivery options in multimodal traffic on the network schedule

Brief description of the delivery options

Route number	Characteristic	Modes of transport
1	Helsinki – Moscow	Car
2	Helsinki – Moscow	R-w + car
3	Via S-P port	Sea + car
4	Via S-P port	Sea + r-w + car



Network diagram of delivery schemes on the Helsinki – Moscow route



Works to deliver goods on the route Helsinki – Moscow

Work's number		Characteristics of works	Cost, \$	Time, days
1	2	Delivering goods to the customs in Helsinki	180	1,0
2	3	Paper work and entrucking	200	1,0
2	4	Paper work and loading into railway carriage	50	3,0
2	5	Paper work and loading of the vessel in Helsinki port	250	2,0
5	6	Delivery by sea to S-P	600	2,0
6	7	Unloading in S-P port	110	1,0
7	8	Release of a container from S-P port on ones own with the guaranteed customs warranty*	50	3,0
7	9	Release of the container by the forwarder from S-P port	300	1,0
7	10	Release of the container from S-P port guaranteed by the customs carrier	-	2,0
7	11	Release of goods on the railway from S-P port	50	4,0
8	12	Delivery by the road transport to Moscow (TSW)	650	1,5
9	12			
10	12	Delivery by rail from S-P port to M (TSW)	850	1,5
11	12	Delivery by the road transport from Helsinki to Moscow (TSW)	389	4,0
3	12	Delivery by rail from Helsinki to Moscow (TSW)	1 500	4,0
4	12	Self-help customs clearing in Moscow	359	7,0
12	13	Customs clearing in Moscow by the customs broker	150	4,0
12	14	Delivery by rail from S-P port to M (TSW)	300	1,5
13	15	Delivery in Moscow by the road transport from TSW to the consignee's terminal	50	0,5
14	15			

* To release the container on his own a freight owner should have his own temporary storage warehouse (TSW) and be able to issue warranty certificate.

Source: INGECON

Reflection of ICT in the key logistics activities indicators (KPI)

№	The name of KPI*	The number of specific indicators	
		Total	Reflection of ICT
KPI – 1	Total logistics costs	7	–
KPI – 2	The quality of logistics services	7	1**
KPI – 3	Duration logistics cycles	9	–
KPI – 4	Productivity (infrastructure and staff)	7	–
KPI – 5	The use of investment in logistics infrastructure	6	1***
Total		36	2

* Sergeev V.I., Corporative logistics, 2004;

** Information and communication reliability, accuracy and timeliness;

*** Use of investments in information system;

Key indicators of road transport enterprise

Key, resulting fields	The main parameters of the class
Satisfaction of consumers in product quality and logistics service	<ul style="list-style-type: none"> - Ensuring compliance with the order exactly by the deadline; - The accuracy of the parameters of the order; - Information and communications reliability, accuracy and timeliness; - The number of removal orders, raising tariffs; - Customer complaints; - Assessment of users (rating) the degree of satisfaction of logistics services; - Reliability of delivery; - Flexibility - the ability to recognize the special position (or wishes) of clients; - The level of complexity of services provided
Investments using	<ul style="list-style-type: none"> - The use of working capital; - Average inventory level of material resources; - Return on investment in fixed assets; - The accuracy of maintaining the level of stocks of material resources; - The use of investment in transportation; - The use of investment in storage infrastructure; - The use of investment in technological equipment and repair facilities
Operational logistics costs	<ul style="list-style-type: none"> - The cost of transportation of products; - Costs related to product quality; - Costs associated with the procedures of orders; - The cost of materials handling and storage resources; - Administrative costs
Quality	<ul style="list-style-type: none"> - The accuracy and reliability of forecasting; - Execution of production schedules and delivery schemes; - Errors in the execution of orders; - The competitiveness of services; - The quality of cooperative relationships within the supply chain

Key indicators of road transport enterprise: continuation

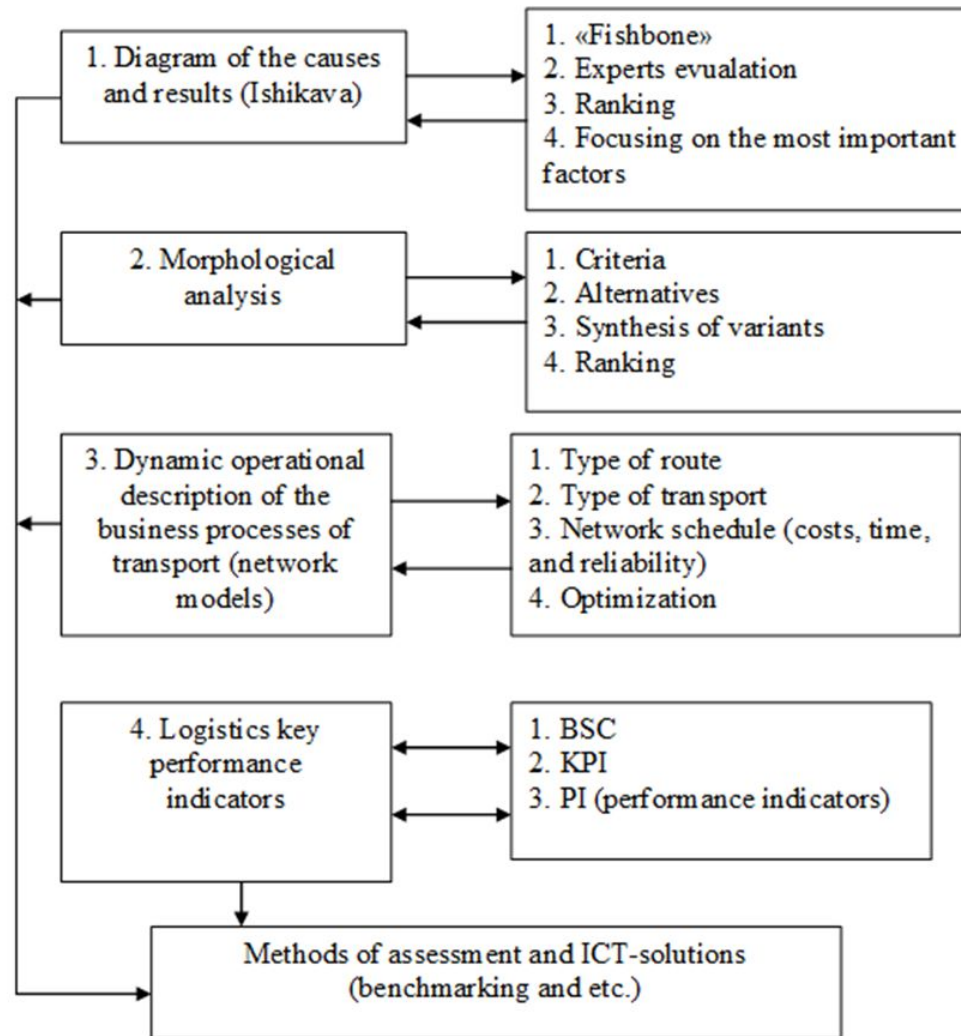
Key, resulting fields	The main parameters of the class
Productiveness	<ul style="list-style-type: none"> - The number of orders processed per unit time; - The use of rolling stock; - Dynamics of documents; - The ratio of operating logistics costs per unit of capital invested; - The ratio of logistics costs per unit of transport products; - The individual components of logistics costs in relation to total costs; - Logistics firm's costs in relation to the standard or the average level in the market; - Logistical resources for the current moment in relation to the projected costs; - The total return on assets; - Turnover of circulating funds
Environmental effectiveness and efficiency of human labor	<ul style="list-style-type: none"> - The level of harm to the environment during the implementation of logistics processes (noise level, the level of harmful substances in exhaust, etc.) - Repeated use of transportable containers; - The ratio of labor productivity growth and average wages; - Saving of human labor; - Increase the share of the transport of products by improving productivity
Cycle times	<ul style="list-style-type: none"> - Cycle time components of the order; - Replenishment time resources; - Order processing time; - Turnaround time; - Cycle time reports; - Total time from order entry to execution

Logistics performance indicators (international shipping)

№	Name of indicator	Benchmarking (foreign carriers)	Russian carriers
1	Average annual mileage of the car (road train): - for shipping between the states (USA); - international shipping (EU)	up to 300000 miles per year up to 170000 miles per year	- 70-100
2	Rate of technical readiness of the park (large motor carriers, USA)	0,95-0,97	0,8-0,9
3	Output rate	0,8-0,85	0,7-0,8
4	Rates of: -capacity utilization; - mileage utilization	0,7-1,1 0,75-1,0	0,6-0,75 0,6-0,7
5	Average weight of load on 1 vehicle, tn import export	19,9 23,7	13,8 18,4
6	Average weight of load on 1 vehicle, tn (carriage)	24,4	21,1

Source: INGECON

Formation of the decision-making model on the use of ICT



Conclusions

1. Improve the accounting in order to highlight the costs associated with ICT operations (functions).
2. Develop a methodology for assessing the impact of ICT solutions on total logistical costs.
3. Develop a methodology for evaluating the use of investments in logistics infrastructure (transport logistics).

Thank you!