LogForum

> Scientific Journal of Logistics <

2015, 11 (1), 15-27

DOI:10.17270/J.LOG.2015.1.2

http://www.logforum.net p-ISSN 1895-2038 e-ISSN 1734-459X

LEAN AND RELIABLE DIGITAL SUPPLY CHAINS - CASE STUDY

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ABSTRACT. Background: Existing business model supply chains organisation results in inefficient use of transport resources, high transport costs, increasing congestions and CO_2 emission. This effect has been demonstrated by research conducted by the author as well as by the European Environmental Agency. To change this situation companies are in need of affordable, realisable and trusted data-interchange solutions to take part in international trade and commerce flows. The aim of this paper is to present practical implementation of the developed by the authors concept of global freight management ecosystem and its practical implementation using T-Traco platform.
Methods: Survey, desk research and real case study results were used in the paper.
Reults and conclusions: Real time and global data exchange within the whole supply (including modes of transport and transport units) chain is a backbone of the lean and reliable digital supply chain.

Key words: digital supply chain, global communication, mobile applications, track and trace.

INTRODUCTION

The European economy has been experiencing some radical changes in the last few years. The analysis of the data of the European Statistical Office shows a 5% increase in the sales and turnover in wholesale and retail trade in European Union states. The effects of the global economic recession appeared in 2009, causing the slowdown of the economic progress. Still, companies have remained active and have been adjusting their strategies to the changing market conditions [Hajdul, Golinska, 2012]. Merges of companies take place, new process management concepts are introduced. At the same time, competition gets stiffer and consumers' expectations grow. It should be also noted that regardless of the economic growth rate, the transportation of goods by road increased in the last four years. As an example, on the basis of the latest data made available by the European Statistical Office (Eurostat), the share of road transportation in goods shipping in Europe was 79% in total inland freight tonne-km [Energy, transport and environment indicators, 2012].

These changes forced companies who not only wish to survive, but also to develop and bring the expected profits, to introduce changes to their operation. This is at the same time an opportunity for companies, particularly SMEs, and a challenge. The opportunity lies in the possibilities to participate in large national and international networks and to enlarge market reach. The challenge lies in the complexity of the environment of trade and transport with its complexities of distance and time, language and cultural barriers, and its meriad of national and international rules and regulations.

Citation: Hajdul M., Mindur L., 2015, Lean and reliable digital supply chains - case study. LogForum 11 (1), 15-27. DOI:10.17270/J.LOG.2015.1.2
URL: http://www.logforum.net/vol11/issue1/no2
Accepted: 23.11.2014, on-line: 29.12.2014.

This holds especially for the companies that are active in the facilitation of international trade logistics. Apart from a few very large multinational businesses, this industry consists of SMEs, often playing their role in logistics chains in a very local fashion. Their role is often the local representation of large or international players. This means they hardly communicate with their chain partners overseas or in other parts of Europe, they struggle to follow the innovations in the digital exchange of information. As a conclusion the chains that those SMEs are part of perform well below optimal efficiency.

At the same time, innovation in trade and transport processes is receiving increasing attention from Customs agencies world-wide, including the European Commission (DG Taxud), WCO and UN-Cefact. The European Commission has funded various EU projects such as INTEGRITY, SMART-CM, CASSANDRA, COMCIS and iCargo, looking also at those issues. These projects lead to new solutions for information exchange, such as the data pipeline, and the common framework [Improving sustainability through intelligent cargo and adaptive decision making, 2012].

Therefore, the paper's objective is to present a case study of implementation of low cost and easy to use data exchange tool that support co-competition in the supply chains. Co-opetition in this paper is defined as a business strategy based on a combination of cooperation and competition, derived from an understanding that business competitors can have benefits when they work together [Chieh-Peng, Yi-Ju, Yuan-Hui, Yu-Fang, 2010, Lacoste, 2012, Miriam, 2011]. The implementation has been carrying out within members of ECR Poland.

ECR Poland, member of ECR Europe – a non-profit association focused on optimising value chains in order to deliver better value for consumers/shoppers. ECR Mission is working together to fulfil consumer/shopper needs - better, faster and at less cost in a sustainable way. ECR Poland gathers large, medium and small companies representing:

- retailers and wholesalers,
- manufacturers (mostly supplying all Europe)
- service providers (including logistics and IT services).

LEAN AND SECURE ECOSYSTEM OF COMPANIES

The effects of the currently applied approach to transport organization within existing supply chains lead to heavier traffic, reduced travel safety and increased emission of harmful substances. The growing congestion lowers the average technical speed of vehicles, ultimately increasing delivery time and possibly impacting customer dissatisfaction, which may even cause a part of orders to be cancelled. Hence, in the long run the companies unwittingly work towards worse financial results and reduced competitiveness.

The above situation is confirmed by the research of the European Environment Agency. The research shows that the utilization of the available load capacity of transportation means is poor across UE states. In case of the most popular type of transportation, namely road transportation, the average utilization of the available load capacity of trucks for delivery or distribution purposes is at 54% [Road freight load factors, 2012]. Naturally, the situation varies among specific countries.

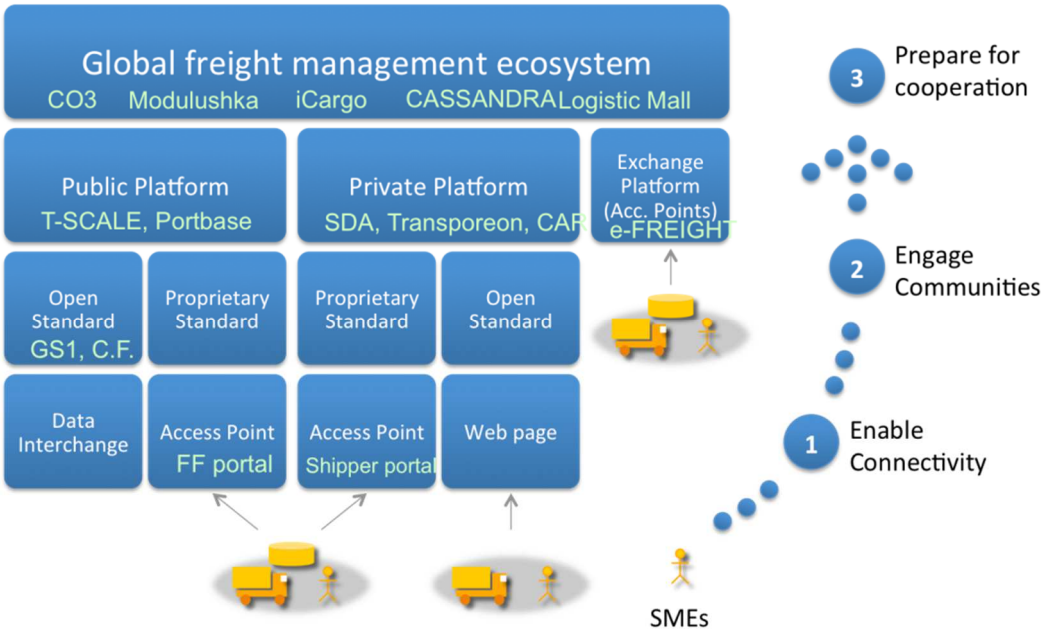
These results were confirmed by research conducted by the European Statistical Office and Professor Alan McKinnon of the Heriot-Watt University. According to his analyses the EU average percentage share of empty runs, as a total number of covered kilometres, for road transportation is at 25% [McKinnon, 2010]. Unfortunately, it often happens that truck owners cannot find return loads and their truck come back empty or only carrying minor loads.

The analysis of presented results leads to a conclusion that transportation resources are used uneconomically, simply speaking are wasted [Hajdul, 2010]. These activities not only apply to improper use of the available resources, but also confirm that possibilities of completing given actions with reduced outlays are either omitted or intentionally ignored [Road freight load factors, 2012].

This may be eliminated through implementing of new model for collaboration of independent companies, either associated in clusters or functioning in close proximity. The collaboration should apply to common organization of transport processes within supply chains and their proper coordination in order to achieve the effect of synergy [Hajdul 2010, Hajdul, Golinska 2012]. However, collaboration requires secure, reliable and dynamic data exchange within ecosystem of companies.

Taking into consideration market needs described above multimodal transport in Europe is also undergoing a radical innovation. The developments in e-freight solutions enable a further integration between transport mode and supports creation of global freight management ecosystem.

The role of this ecosystem is to manage their data, connect to networks of their partners in an easy, cost effective way, as well as share data with partners around the world securely and efficiently, adopts standards that are commonly used, available or forced upon them by governments or multinationals while still maintaining a profitable business model in the end.



Source: own study

Fig. 1. Concept of the global freight management system
Rys. 1. Koncepcja system globalnego zarządzania transportem

RESULTS OF RESEARCH ON THE USE OF THE STATUSES FOR EVENT MANAGEMENT

One of the crucial issues of the data sharing is to precisely know what type of information is essential for the companies (small, medium and large ones) in the freight management. Institute of Logistics and Warehousing, as one of the actors developing global freight management ecosystem in Poland, carried out a survey on 40 companies from ECR Poland (http://ecr-all.org/poland/ecrpolsk/czlonkowie/) and GS1 Poland. The aim of this survey was to define list of statuses that are essential for monitoring of transport order execution in the group of cooperating independent transport users and transport service providers.

From the list of 90 pre-defined statuses, according to the Pareto analysis, the most

important ones, representing 80% of the analysed population, were selected.

Table 1. Key Dates
Tabela 1. Dane kluczowe

Status	% share of responses
Delivered	100,0%
Arrival	97,5%
Delivered, irregularity occurred	95,0%
Refusal to accept delivery - goods not ordered	95,0%
Refusal to accept - delivery doubled	95,0%
Refusal to accept - delivery damaged	92,5%
Not delivered - receiver not available	92,5%
Unloading starts	90,0%
Unloading ends	87,5%
Loading ends	87,5%
Not delivered - wrong address	85,0%
Not delivered - another reason	85,0%
Car breakdown	82,5%
Loading starts	82,5%
Accident	80,0%

Identified statuses were used in the T-Traco platform, a dedicated communication platform developed by the CallFreedom company and the Institute of Logistics and Warehousing, during its implementation in member companies of ECR Poland. The truck driver has an access to the mobile version of the T-Traco platform (on Android platform) and can easily and low cost update in real time statuses concerning concrete transport order. Updated statuses are visible to all other actors involved in the process. Details about T-Traco platform and its implementation are presented in chapter "Innovative monitoring of transport assets".

A REVIEW OF EXISTING SOLUTIONS THAT ENABLE MONITORING OF ROLLING STOCK IN REAL TIME

A key element that enables efficient and effective management of transport assets is access to credible information in real time on the current status of specific cars and locomotives.

There are solutions, based on the Global Positioning System (GPS) and the General Packet Radio Service system (GPRS), which enable monitoring means of transport and, occasionally, cargo units (mostly shipping containers). In order to enable real time monitoring of rolling stock, cars and locomotives must be fitted with monitoring equipment. Monitoring devices consist of three basic components [Szymczak, 2001]:

- a GPS module which enables determination of the location of the monitored means of transport,
- a GSM module with a SIM card of a mobile telephony operator which enables sending information to the server over the GPRS channel with current location of the monitored means of transport,
- a battery which supplies the energy required to support the operation of the rolling stock monitoring device.

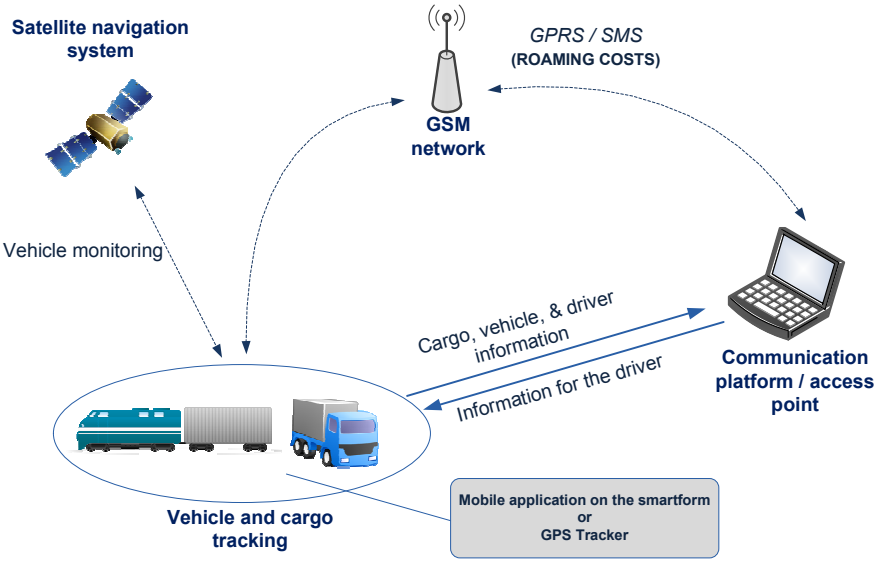
The GPS module enables using the Global Positioning System. The GPS system is a satellite navigation system developed by the United States Department of Defence that covers the entire globe. The system consists of three segments [GPS. 2014]:

- the space segment: 31 satellites that orbit the Earth on the Medium Earth Orbit,
- the ground segment: control and monitoring stations on the ground; and
- the user segment: signal receivers, i.e. the monitored devices installed, e.g. on a railroad car.

The purpose of the system is to provide the user with information on his or her location. The information is delivered in a text form with data on the current longitude and latitude of the user. The data is then sent, with the GPS module and the SIM card, to the user's server where it is displayed on a map. Figure 2 contains a diagram showing the operation of the system.

Currently, there are about a dozen solutions that enable monitoring of rolling stock in real time. The analysis covers selected products offered worldwide.

In the table 2 there are presented selected products offered on different continents.



Source: Prepared by the authors based on the information found at www.t-traco.com

Fig. 2. Schematic diagram of operation of systems for real time monitoring of rolling stock
Rys. 2. Schemat operacyjny systemów monitorowania w czasie rzeczywistym przemieszania się ładunku

Table 2. An analysis of selected solutions that enable real time management of rolling stock
Tabela 2. Analiza wybranych rozwiązań monitorowania w czasie rzeczywistym przemieszania się ładunku

Product name and website address	Main functionalities
AFRICA	
Trackntrace http://www.trackntrace.co.ke/index.php	• Information on fuel consumption, theft prevention. • Detailed location on an online map. • Data transfer over the GPRS.
PearTrack Systems Ltd http://www.peartrack.com/	• Access to location without the need to charge the devices for up to 10 years. • Temperature monitoring and reports on opened doors. • Alarms concerning unauthorized movements of the means of transport. • Data transfer over the GPRS.
NORTH AMERICA	
Track Your Truck http://www.trackyourtruck.com/	• Identification of location on a map and route history. • Mobile access from the telephone level. • Reporting of vehicle activity. • Data transfer over the GPRS.
FreightWatch International http://www.freightsecurity.net/	• Access to the location through Google Maps. • Mobile access from the telephone level. • Battery operation for 1 year. • Alarm module and notifications. • Data transfer over the GPRS.
Wireless Matrix http://www.wirelessmatrix.org/	• Access to the location through Google Maps. • Alarms tripped in the case of unauthorized movements of goods. • Battery operation for up to 7 years. • Data transfer over the GPRS.
Safety Track of Michigan http://www.safetytrackofmichigan.com/	• Access to the location through Google Maps. • Battery operation for up to 5 years. • Information on changed location every 15 minutes. • Data transfer over the GPRS.
AUSTRALIA	
Navmann Wireless www.navmanwireless.co.nz	• Access to the location through Google Maps. • Battery operation for up to 7 years.

Product name and website address	Main functionalities
	• Easy installation of the device (using a magnet). • Archiving of the cargo movements history. • Data transfer over the GPRS.
EUROPE	
Visirun http://www.visirun.pl/index.php/pl/	• Location shown on a map in real time. • Reporting. • Mobile access from the telephone level. • Data transfer over the GPRS.
Finder http://www.finder.pl/	• Access to the location through Google Maps. • Reporting. • Mobile access from the telephone level. • Data transfer over the GPRS.
Satis http://satisgps.com.pl/	• Location shown on a map in real time. • Reports and analyses • Data transfer over the GPRS.
Tronik http://tronik.pl/	• Location shown on a map in real time. • Data transfer over the GPRS.
Data System Group http://www.datasystem.pl/	• Location shown on a map in real time. • Mobile access from the telephone level. • Data transfer over the GPRS. A lump-sum fee for data transfer in roaming in the European Union.
Frotcom International http://www.frotcom.com	• Location shown on a map in real time. • Detailed information on the route of the means of transport. • Possible generation of alarms. • Data transfer over the GPRS.
Tracks360 Ltd – Wireless Asset Tracking Specialists http://www.tracks360.com/	• Location shown on a map in real time. • Possibility to select batteries of various capacities/operation periods. • Data transfer over the GPRS.

Source: prepared by the authors

In conclusion of the analysis of different products presented in Table 2, one can identify the following main characteristics of the currently offered systems:

- access over a web browser and visualization of current location of monitored means of transport on a map,
- identification of the location of the means of transport using a mobile device with an integrated GPS module, GPRS module, and battery; and
- access to a module that enables preparation of reports.

The key disadvantage of all the analyzed systems is the fact that all of them use the GPRS system for transfer of information about the location of the means of transport. Moreover, none of the providers of the analyzed systems offers its services globally, which is due to huge costs of roaming. If a customer wants to use monitoring services outside of a country, the other countries where the vehicle will travel must be specified. Based on this information, the monthly fee for the monitoring service is estimated.

The use of GPRS modules for data transfer and the associated high roaming costs significantly limit the global popularity of the existing products.

The cost of the currently existing systems limits their use by only mid-sized and large companies and only locally, in a single country. As a result, companies that use and provide logistical services are unable to take the full advantage of the available logistical resources [Chopra, Meindl, 2004].

INNOVATIVE MONITORING OF TRANSPORT ASSETTS

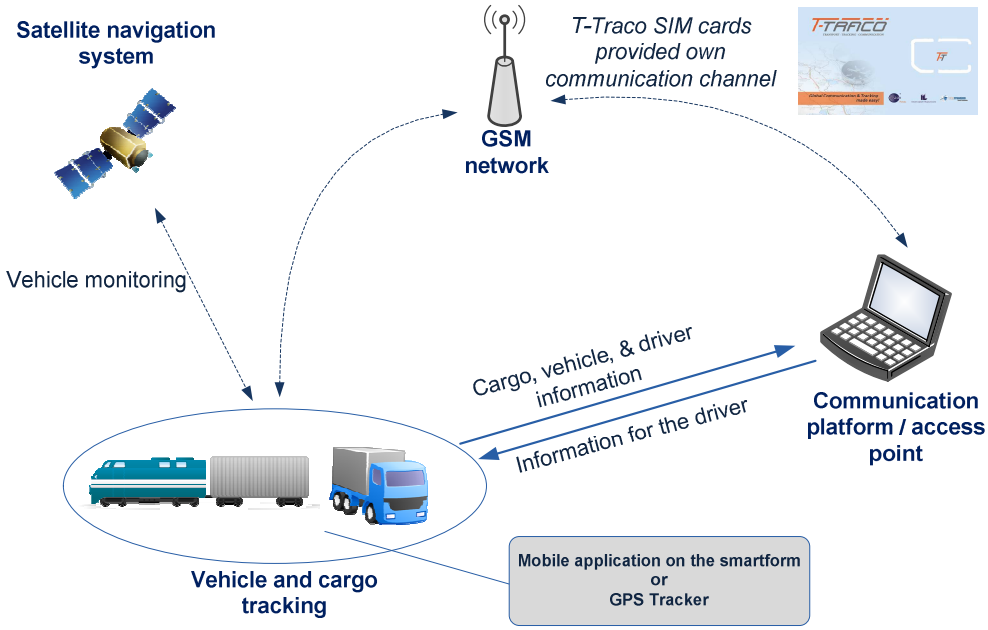
The main disadvantage of the existing systems is the high cost of the associated service, which practically prevents global monitoring of transport assets. For example, Industrial Supply Service GmbH offers railroad car/container positioning services for the price of 108 Euros a month. This fee covers information sent to the user on the location of the monitored means of transport every 60

minutes. Moreover, the service works only in selected countries (China, Russia, Belarus, Poland, Germany, and the Netherlands).

Knowing the limitations of the existing systems, the Institute of Logistics and Warehousing from Poznan, together with CallFreedom Sp. z o.o. from Bydgoszcz, has developed an innovative solution that enables global monitoring of means of transport without absolutely any roaming fees. The fundamental innovation in the system is the use of a method of data transfer from the mobile device to the server that is an alternative to the GPRS system. For this purpose, a device has been used that consists of three elements, two of which are identical as those used in other existing monitoring systems [T-Traco, 2014, Christopher, 1998]:

- a GPS module which enables determination of the location of the monitored means of transport,
- a GSM module with a SIM card of a mobile telephony operator which enables sending information to the server over the technical channel with current location of the monitored means of transport [Dabas, Dabas, 2009],
- a battery which supplies the energy required to support the operation of the rolling stock monitoring device.

A schematic diagram showing the operation of the system that uses the technical channel for transmission of data on the location of the means of transport is shown in Figure 3.



Source: prepared by the authors based on the information found at www.t-traco.com

Fig. 3. Schematic diagram showing the operation of the system for monitoring means of transport developed by CallFreedom and the Institute of Logistics and Warehousing
Rys. 3. Schemat operacji systemu monitorującego środki transportu stworzony prze CallFreedom oraz Instytut Logistyki i Magazynowania

The basic advantage and innovation of the system developed by CallFreedom with the assistance of the Institute of Logistics and Warehousing is the use of the technical channel for data transfer. The key advantage of the technical channel is its global reach and the lack of high roaming fees which so far have prevented broad implementation of the intelligent cargo concept [Herwono, 2000]. The major limitation is the size of the transferred data packet - not more than 180 characters in a single transfer. What is also important is that this channel is only accessible to mobile telephony operators. It can be compared to internal text messages (SMS) which are accessible only to mobile telephony operators. This is the line of business line of CallFreedom.

As the research that has been conducted has proven, the system based on the technical channel, developed by CallFreedom and the Institute of Logistics and Warehousing, is unique on the global scale and ensures much more efficient, cheaper and more stable operation compared to the existing Track&Trace systems in operation worldwide.

All the solutions offered in the market use GPRS or SMS communication for transfer of data to the user's server. In the case of the GPRS system, the roaming data transfer fees are much higher than the domestic fees. Another very important aspect is the rate of utilization of the network resources and the resulting delays in data transfer.

This has been confirmed in the research performed by the authors on selected routes in selected countries of the European Union. For example, two devices were compared along the 162 km long route from Bydgoszcz to Płock in Poland. One of the devices sent data on the position of the vehicle over the GPRS system (using SIM cards of selected Polish operators), while the others used the technical channel using SIM cards provided by CallFreedom. The purpose of the research was to detect delays in the transfer of data using the aforementioned two alternative communication solutions. The research was performed using mobile devices coming from the same manufacturer (Sony Xperia S). On the 162 km long route, each device sent a total of 594 packets with data on the longitude and latitude, the current speed, and the time of measurement. In the case of the device based on the GPRS system, 511 data packets were sent with a delay of at least 1 minute. Thus, as much as 86% of information reached the server with a delay. 408 packets, or 68.7% of all transferred data packets, reached the server with a delay of 10 to 30 minutes. On the other hand, the device based on the technical channel sent 589 out of 598 packets, or 99.2% of all packets, without any delay. Only 5 data packets reached the server with a delay equal to approximately 1 minute, but this was due to a change of the BTS transmitters owned by different operators (mobile devices with SIM cards provided by CallFreedom log in with the operator whose GSM signal is the strongest in a given region).

Table 3. Results of the research on the reliability of the GPRS channel and the technical channel used in rolling stock monitoring systems

Tabela 3. Wyniki badań nad niezawodnością kanałów GPRS i technicznego stosowanych w systemach monitorowania ładunków

Position	Positions sent over the GPRS channel		Positions sent over the technical channel	
	pcs	%	pcs	%
total number of positions sent	594	100%	594	100%
delay >= 30 min < 1 h	16	2.694%	0	0.000%
delay >= 10 min < 30 min	408	68.687%	0	0.000%
delay >=5 min < 10 min	46	7.744%	0	0.000%
delay >= 3 min <5 min	23	3.872%	0	0.000%
delay >= 2 min <3 min	6	1.010%	0	0.000%
delay >= 1 min < 2 min	12	2.020%	5	0.842%
no delay in position data transfer	83	13.973%	589	99.158%

Source: prepared by the authors

In conclusion, the system developed by CallFreedom with the assistance of the Institute of Logistics and Warehousing enables very effective, global, and inexpensive monitoring of means of transport. This is possible thanks to a combination of existing GPS and GSM technologies. The system developed by CallFreedom and the Institute of Logistics and Warehousing is the subject of a patent application submitted at the European Patent office and is protected in accordance with applicable regulations (patent application no. EP13460072.5 dated 30 November 2013).

AN EXAMPLE OF REAL TIME ROLLING STOCK MANAGEMENT

This present article describes an example of practical management of rolling stock using

system based on the solution developed by CallFreedom and the Institute of Logistics and Warehousing.

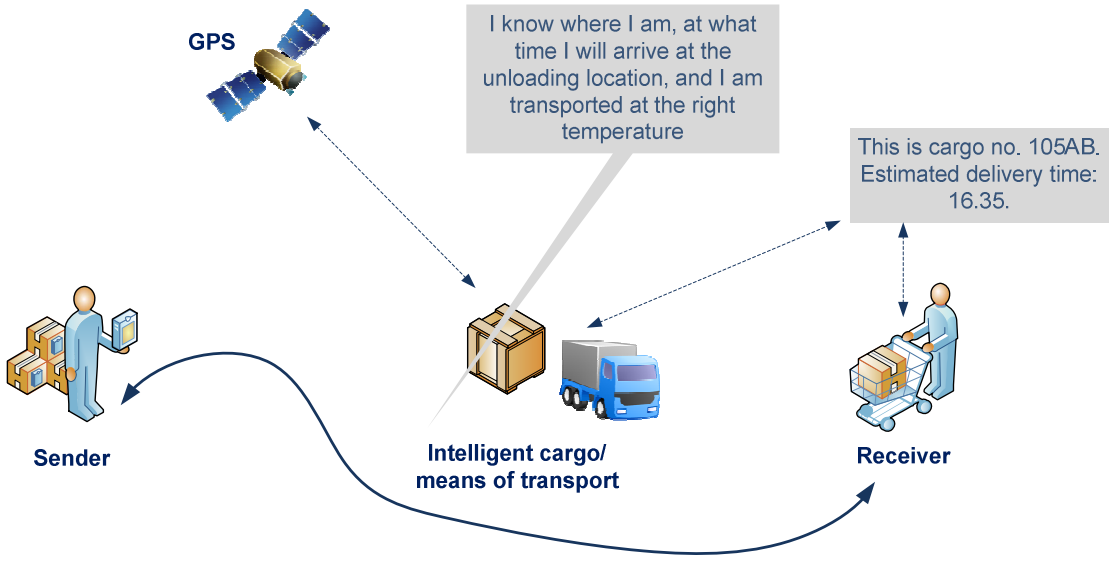
The comprehensive system (T-Traco) consists of the following components:

– a communication platform that enables management of rolling stock in real time,
– mobile measurement devices installed on railway cars; and
– a mobile application available for smartphones with the Android system which enables visualization of the location of selected cars.

Two categories of users have access to the platform:

– transport service providers,
– customers - the owners of the goods shipped in the car.

This enables the car owner not only to monitor in an ongoing manner the position of the car and the task that is being performed, but also to share this information in real time with the owner of the cargo who has commissioned the shipment. This enables automatic notification of the consignor and the consignee about the status of the shipment. This is shown in Figure 4.



Source: prepared by the authors

Fig. 4. The intelligent cargo concept in practice
Rys. 4. Koncepcja inteligentnego ładunku w praktyce

The T-Traco system enables global monitoring of transport assets in real time. The user can identify the travel time of each car, as well as the times and locations of demurrage. Figure 5 below shows the view of the application that can be accessed by the user via a web browser. The system enables defining any zones corresponding to the location of a specific facility, e.g. a shipping container terminal. As a result, the user receives not only information about the current location of each vehicle, but also information about when it entered or left a specific point - zone.

In the case of fleets of several hundred vehicles, their management without an appropriate alert system would not be possible. The T-Traco system enables the user to freely configure the platform so as to receive only the key information. The user can automatically receive the following information, via email or SMS:

– vehicle in movement,
– vehicle demurrage,
– vehicle entered a point,
– vehicle left a point,
– vehicle entered a zone,
– vehicle left a zone; and
– estimated date of arrival of vehicle in a point/zone.

The number of automatic messages depends on the mobile devices that are used. Even the simplest devices installed on vehicle enable sending the above information (figure 5). If the user wants to monitor such elements as opening of doors or cargo temperature, additional measuring sensors must be used.

Table 4 presents a comparison of the fees and the reliability of the T-Traco system and the competing solutions presented in chapter "A review of existing solutions".

Source: prepared by the authors

Fig. 5. The mobile device used in the T-Traco system
Rys. 5. Urządzenie mobilne stosowane w systemie T-Traco

Table 4. Comparison of the operating costs and reliability of various rolling stock monitoring solutions
Tabela 4. Porównanie kosztów operacyjnych i niezawodności różnych rozwiązań monitorowania ładunku

Characteristic	Traditional rolling stock monitoring systems	T-Traco system
Monthly fees (24-months long contract)	Roaming fees - system operational only in selected countries	No roaming fees - global operation of the system within one flat subscription fee.
Reliability of the data transfer channel	GPRS channel - delays	Technical channel offered by CallFreedom - no delays

Source: prepared by the authors

CONCLUSIONS

The intensive development of Business Intelligence and Competitive Intelligence tools, access to information from multi-dimensional data analysis [Sołtysik-Piorunkiewicz, 2009] aggregated from various enterprise IT systems sources (usually in case of heterogeneous environments) has been significantly facilitated in recent years. However, vast majority of available tools supports only classical approach to organisation of transport processes within supply chains. To improve effectiveness and efficiency of transport processes a new approach is a must in the near future [Golinska, Hajdul, 2012]. Companies need to collaborate based on the agreed data standards

within secure and reliable virtual supply chains. However, while development of solutions within global freight management system, such as T-Traco, the objectives must be taken into account:

- to provide fast and affordable methods for logistic SMEs (forwarders and transport operators) to connect to data interchange networks established at local, national or international level that enable them to collaborate and possibly increase their profit,
- to allow consolidation of data across networks operating at the different levels, e.g.: to share at the national level local information from different forwarders and to monitor cargo flows by linking and consolidating data from independent sources,
- to demonstrate and assess the benefits achievable through large scale adoption of the proposed solution, in terms of:
  - better utilization of vehicles and less administrative costs for SMEs,
  - increased load factor,
  - better synchronization of freight traffic through ports, road and rail infrastructure.

To conclude, lean and secure digital supply chains allows sharing of resources and joint cooperation of transports that is of multi-dimensional nature. It positively impacts both companies that use transport services and the ones that provide such services. Furthermore, these companies are closely connected to the environment in which they operate. In many cases the main objectives of companies and the society are not identical. The proposed solution makes it possible to organize logistics process while taking into account economic, social and environmental aspects.

Additionally, the positive reception of the solution by the leading manufacturers and distributors in Poland allows hoping that the solution will soon be accepted and employed in business activity.

This hope is also fortified with the growing awareness the companies have of their impact on the environment. It can now be observed that companies exhibiting advanced social awareness often shape their activities not only with their own strategies in mind, but also taking into account the objectives and values of the society. Corporate social responsibility is a method of creating generally understood benefits, both for companies, as profits, and for its environment. Hence, it can be stated that a company following the principle of sustainable development is able to achieve a balance between its profitability and effectiveness, and social interests.

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WIARYGODNE ELEKTRONICZNE ŁAŃCUCHY DOSTAW TYPU LEAN - STUDIUM PRZYPADKU

STRESZCZENIE. **Wstęp:** Istniejące modele współpracy w łańcuchach dostaw charakteryzują się mało wydajnym wykorzystaniem dostępnych zasobów transportowych, wysokimi kosztami transportu, rosnącym natężeniem ruchu na drogach oraz emisją CO2. Potwierdzają to badania przeprowadzone przez Europejską Agencję Ochrony Środowiska jak i samych autorów. Aby zmienić istniejącą sytuację przedsiębiorstwa potrzebują skutecznie, bezpiecznie i efektywnie kosztowo wymieniać informacje pomiędzy uczestnikami łańcucha dostaw. Celem artykułu jest zaprezentowanie praktycznego przykładu globalnego zarządzania łańcuchem dostaw przy wykorzystaniu platformy komunikacyjnej T-Traco.
Metody: W pracy wykorzystano badania ankietowe, przegląd literatury jak i rezultaty z praktycznego wdrożenia platformy T-Traco.
Wyniki i wnioski: Wymiana informacji w czasie rzeczywistym w ramach globalnych łańcuchów dostaw (włączając w to komunikację ze środkami transportu oraz jednostkami ładunkowymi) jest podstawą realizacji wiarygodnych i wydajnych procesów w ramach cyfrowych łańcuchów dostaw.

Słowa kluczowe: cyfrowe łańcuchy dostaw, globalna komunikacja, aplikacje mobilne, track and trace

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SCHLANKE UND GLAUBWÜRDIGE, DIGITALE LIEFERKETTEN - EINE FALLSTUDIE

ZUSAMMENFASSUNG. Einleitung: Die bestehenden Organisationsmodelle von Lieferketten nutzen uneffektiv die zur Verfügung stehenden Transport-Ressourcen, charakterisieren sich durch hohe Transportkosten und verursachen ständigen Wachstum von Verkehrsstaus und der CO2 -Emission. Die Erkundungen wurden sowohl in den Forschungsergebnissen des Autors, als auch des Europäischen Ausschusses für Umweltschutz dargestellt. Zwecks Veränderung der betreffenden Situation bedürfen die Unternehmen effizienter, glaubwürdiger und zuverlässiger Lösungen für den Datentransfer innerhalb von Materialflüssen im internationalen Handel.
Methoden: Das Ziel der Arbeit ist es, eine praktische Anwendung des autoreneigenen Konzeptes eines Öko-Systems für Transport-Management im globalen Ausmass sowie dessen praktische Einführung bei der Inanspruchnahme der T-Scale-Plattform zu projizieren.
Ergebnisse und Fazit: Die T-Scale-Plattform ermöglicht ein Zusammenwirken von unabhängigen Transport-Benutzern und Anbietern von Transportdienstleistungen. Im Rahmen der vorliegenden Arbeit sind die aus einer solchen Zusammenarbeit resultierenden Vorteile, die von einer Gruppe von Unternehmen aus der FMCG-Branche in Polen erzielt wurden, zusammengestellt worden.

Codewörter: digitale Lieferkette, Zusammenarbeit, Transport, mobile Technologien

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