

Consolidation as a Key to Success – an European Transport Enterprise Case Study

A. Kuśmińska-Fijałkowska, Z. Łukasik & J. Kozyra

Kazimierz Pulaski University of Technology and Humanities in Radom, Radom, Poland

ABSTRACT: Transport is one of the key elements allowing to achieve goals, tasks and plans. Transport need results from the necessity of moving from one place to another. To make it happen, the resource in the form of a means of transport is necessary. Another aspect is organizational actions. The basic source of transport demand is diversity of distribution of the factors allowing to run business. Due to globalization of economy, range and frequency of transports have considerably increased. New logistic chains, networks of terminals and intermodal connections are being created every year. The goal of all these actions is to reduce transport costs and improve the whole process. The authors of this article set a goal of defining the role of optimization of transport costs using a consolidation service. Conducted analysis confirmed that consolidation services reduce the costs of transport of small cargos.

1 INTRODUCTION

The globalized economy of modern times connected all regions in the world into one coherent whole [2], [6]. The products manufactured in Europe can also be received in the same quality from other regions such as China [3]. Industrial enterprise may save a lot of money using latest technologies, as well as producers located in the zones of cheap labour [13], [14]. The only condition is good organization of transport, which largely compensates longer distance, which also has to be paid for. Having partners in the whole Europe makes it possible for the forwarders to fulfil the requirements of the clients and they don't need to own their own cars or employ their own drivers [4], [15]. This cooperation lets carriers to increase the range of purchasers of shipping services [1].

Examined transport enterprise developed an innovative solution, that is, organization of railway collective consignments. The company used the opportunity to group smaller consignments into larger ones, therefore, its services are more economically beneficial. A strategy of analysed transport enterprise has always been, among others, grouping consignments. Well-developed network of warehouses-terminals and regular connections between 640 places in Europe allow to create an effective flow of cargos between any places in Europe [5], [7], [8], [9], [11]. Analysed transport enterprise is currently number one in European road transport and third in global sea and air transport using the latest IT technologies (Fig.1).

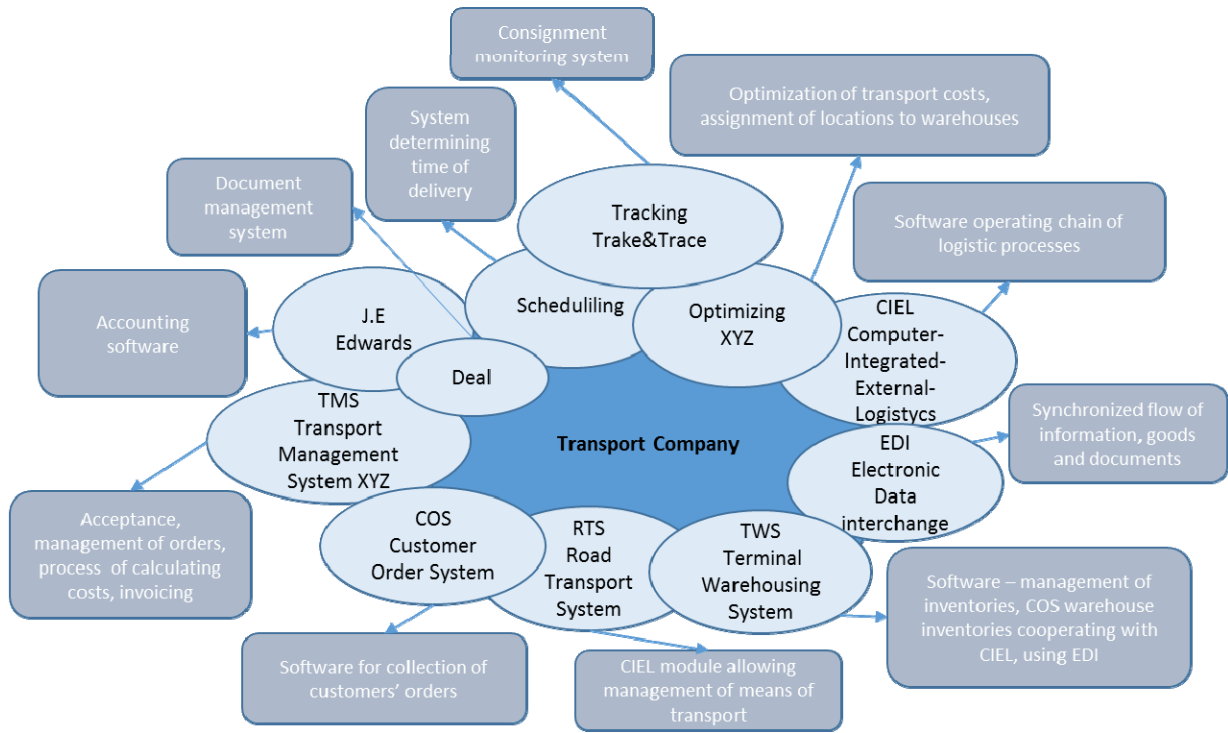


Figure 1. IT technologies applied in the examined transport enterprise

2 THE BENEFITS OF CONSOLIDATION ILLUSTRATED WITH AN EXAMPLE OF A WAREHOUSE IN NUREMBERG

Transport enterprise gets an inquiry from a corporation having five plants about optimization of transport costs. Using data about location of the suppliers, size of cargos and destination, such enterprise prepares a concept for every client. They will all be different depending on location of the suppliers, volume and place, in which enterprise is located (table 1) [16].

The next step is assignment of specific suppliers to particular collective warehouses and adding them to existing transport network [10], [11], [17].



Figure 2. The location of all suppliers (own work based on the use of Optimizing XYZ)

Analysed transport enterprise has many collective warehouses, mainly in Germany (Fig.3)

Table 1. A list of the suppliers and average weekly volume (own work) (LDM value-length of a loading box [m])

Customer	Code	City	No. of opallets	LDM [m]	Mass [kg]
A-Monachium	10117	Berlin	6	2,4	1400
A-Monachium	30159	Hannover	2	0,4	200
A-Monachium	44135	Dortmund	1	0,4	50
A-Monachium	50667	Cologne	2	0,8	100
A-Monachium	95444	Bayreuth	3	1,2	400
A-Monachium	70173	Stuttgart	3	1,2	300
B-Praga	33098	Paderbon	4	1,6	400
B-Praga	37001	Goettingen	1	0,4	300
B-Praga	38440	Wolfsburg	2	0,8	300
B-Praga	14467	Podczdam	3	1,2	500
B-Praga	8001	Zwickau	2	0,8	800
B-Praga	1099	Drezno	1	0,4	50
B-Praga	36001	Fulda	2	0,4	200
B-Praga	68159	Mannheim	3	0,6	500
B-Praga	76131	Karlsruhe	2	0,8	300
B-Praga	86150	Augsburg	5	2	1000
B-Praga	93047	Regensburg	6	2,4	1000
C-Pisek	85049	Ingolstadt	2	0,8	300
C-Pisek	97070	Wurzburg	4	0,8	500
C-Pisek	60306	Frankfurt	3	0,6	600
C-Pisek	99001	Erfurt	4	0,8	500
C-Pisek	9001	Chemnitz	14	2,8	3300
D-Brno	7751	Jena	3	1,2	500
D-Brno	69115	Heidelberg	1	0,4	200
D-Brno	70173	Stuttgart	2	0,4	400
D-Brno	89073	Ulm	5	1	900
D-Brno	94315	Straubing	20	4	3800
E-Salzburg	33501	Bielefeld	3	0,6	500
E-Salzburg	56001	Koblenz	20	8	8000
E-Salzburg	74072	Heilbronn	4	1,6	600
E-Salzburg	96450	Colburg	5	1	1000
E-Salzburg	92224	Amberg	1	0,4	200
E-Salzburg	83022	Rosenheim	2	0,8	350

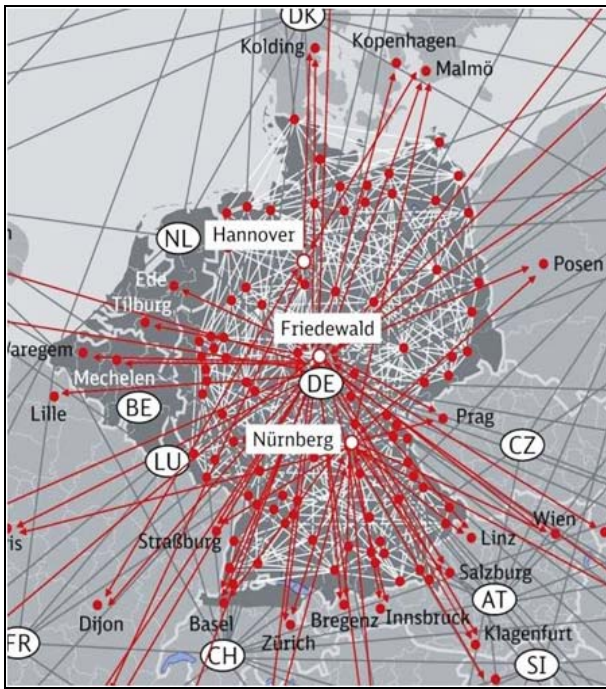


Figure 3. A network of collective warehouses

The most important warehouses of analysed transport enterprise are presented in table 2 [16].

Table 2. The locations of collective warehouses of the analysed transport enterprise

City	Code	X	Y
Bremen	28307	53,08	8,8
Hamburg	20095	53,55	9,99
Lohfelden	34253	51,28	9,55
Dortmund	44135	51,51	7,47
Luedenscheid	58507	51,22	7,63
Waldlaubersheim	5544	49,93	7,83
Osnabruck	49074	52,28	8,05
Mannheim	68159	49,49	8,47
Frankfurt	60306	50,11	8,68
Radeburg	1468	51,21	13,72
Leipzig	4003	51,34	12,37
Langenhagen	30851	52,45	9,74
Schweinfurt	97421	50,05	10,22
Barbing	93092	49	12,2
Heilbronn	74072	49,14	9,21
Leopoldshohe	33818	52,01	8,7
Nuremberg	90402	49,45	11,08
Hagen	58000	51,37	7,46
Doitzingen	71254	48,83	9,07
Regensburg	93047	49,01	12,1
Lichtenau	91555	51,62	8,9
Hodenhagen	29693	52,77	9,6
Arnstadt	99310	50,84	10,95
Cologne	50667	50,94	6,96
Oldenburg	26121	53,14	8,21
Wilnsdorf	57234	50,82	8,1
Garbsen	39217	52,43	9,6
Malterdingen	79363	48,16	7,79
Trier	54290	49,75	6,64
Augsburg	86150	48,37	10,9
Essen	45001	51,46	7,01
Maintal	63477	50,15	8,82
Magdeburg	39104	52,12	11,63
Haiger	35708	50,74	8,21
Stuttgart	70173	48,78	9,18
Friedrichshafen	88045	47,66	9,48
Waidhaus	92726	49,63	12,5
Coburg	96450	50,26	10,96
Dusseldorf	40210	51,23	6,77

However, most of them are only warehouses storing temporarily in order to organize transports, Strategic warehouses of the transport enterprise are presented in table 3.

Table 3. Strategic warehouses of the transport enterprise

City	Code	X	Y
Luedenscheid	51,22	7,63	58507
Frankfurt	50,11	8,68	60306
Leipzig	51,34	12,37	4003
Langenhagen	52,45	9,74	30851
Heilbronn	49,14	9,21	74072
Nuremberg	49,45	11,08	90402
Hagen	51,37	7,46	58000

After calculations made by the application, the suppliers will be assigned to specific collective warehouse (Fig.4)

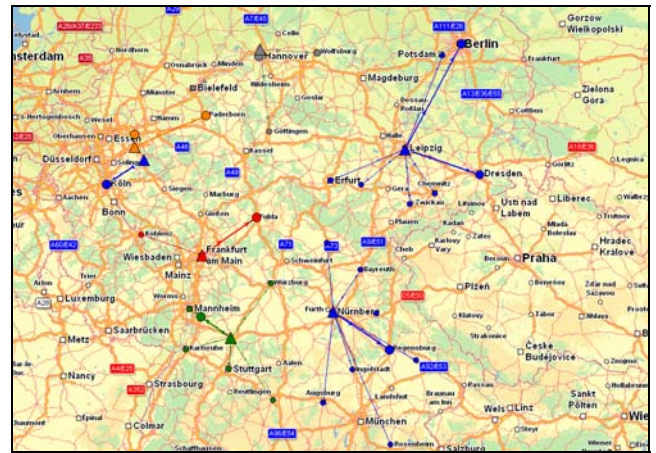


Figure 4. The assignment of the suppliers to specific collective warehouses (own work based on the use of Optimizing XYZ)

Final destination of all loading points will be a warehouse in Nuremberg, the best one in Germany when it comes to operational issues (Fig.5). It is also well-located towards location of the clients. This unit will also deal with organization of transports for some suppliers.

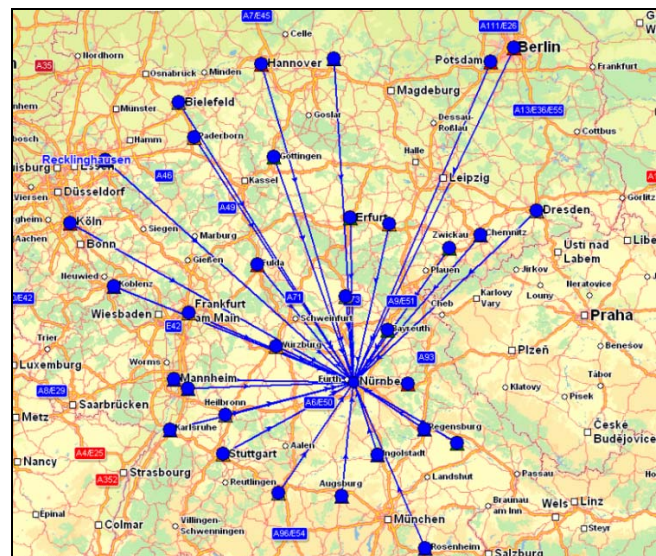


Figure 5. The location of the suppliers towards collective warehouse (own work based on the use of Optimizing XYZ)

Analysed transport company using well-organized network of collective warehouses and transitional terminals can deliver all cargos from Germany to Nuremberg within 2 working days (Fig.6).

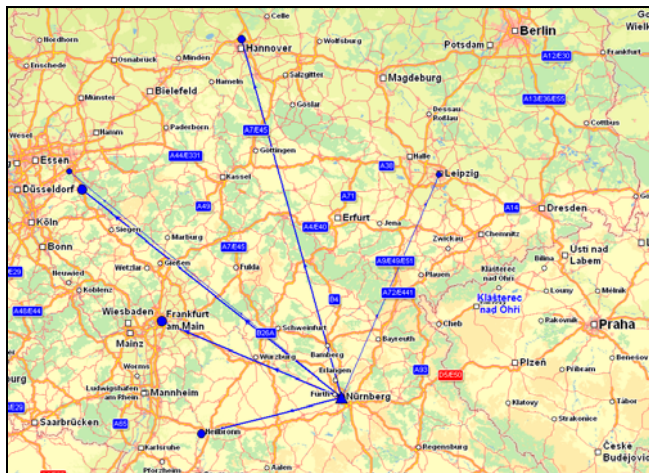


Figure 6. The location of nominated warehouses towards Nuremberg (own work based on the use of Optimizing XYZ)

The last stage will be delivery of consolidated goods from Nuremberg to all clients (Fig.7).



Figure 7. The location of the clients towards collective warehouse (own work based on the use of Optimizing XYZ)

The average speed of transit in the analysis is 65km/h. LDM value, applied in the analysis is a unit representing length of a loading box, measured in meters. Transport costs based on average rate on current transport market and consolidation tariff of the transport enterprise are presented in table 4.

Table 4. The average rate per one kilometre for particular cars (own work based on the offers of various forwarding companies)

Car type	Dimensions (length / s / h)	0-300 km	301-800 km	>801 km
3,5 t	6,0/2,4/2,7m	0,8 €/km	0,75 €/km	0,65 €/km
6 t	7,2/2,4/2,7m	0,9 €/km	0,85 €/km	0,8 €/km
21 t	13,3/2,5/3m	1,3 €/km	1,25 €/km	1,2 €/km

Due to location of specific suppliers, size of cargos and destination, transport enterprise offers clients one of the solutions of pt. 2.[16]

3 THE CONSOLIDATION OF DIRECT CAR ILLUSTRATED WITH AN EXAMPLE OF CLIENT A

Client A, located in Munich presents current organization of transports, run by other forwarding company (table 5).

Table 5. Transport schedule of client A (own work)

Code	City	Date	Hour	D [km]	WT [h]	DT [h]
10117	Berlin	2.07	08:00-09:00	0	1	0
30159	Hannover	2.07	13:30-14:30	286	5,5	4,5
44135	Dortmund	2.07	18:00-19:00	212	11	8
50667	Cologne	3.07	08:30-09:30	93	2,5	1,5
95444	Bayreuth	3.07	17:00-18:00	954	11	9
70173	Stuttgart	4.07	10:30-11:30	281	4,5	4,5
80331	Monachium	4.07	16:00	239	9	9

1565

D – Distance WT – Work time DT – Driving Time

In this case, transit lasts one and a half day. It is an important factor affecting financial situation of the enterprise. The longer time of transport, the higher costs of frozen capital and higher risk in the event that there are no components for production. Many options of transport savings are not introduced due to the impact on the level of the so-called inventory that represents money deposited in parts, those stored in a plant and currently transported. The whole process starts at the moment of receipt of goods from a supplier who prepares a consignment and invoice in SAP.

Due to size of a cargo, client A orders 6-tonne car, the whole distance is 1565 km, the average cost per one kilometre for such car is 0,8€, the cost of additional place, the so-called stop 25€ (Fig.8). Therefore, freight is 1377€.

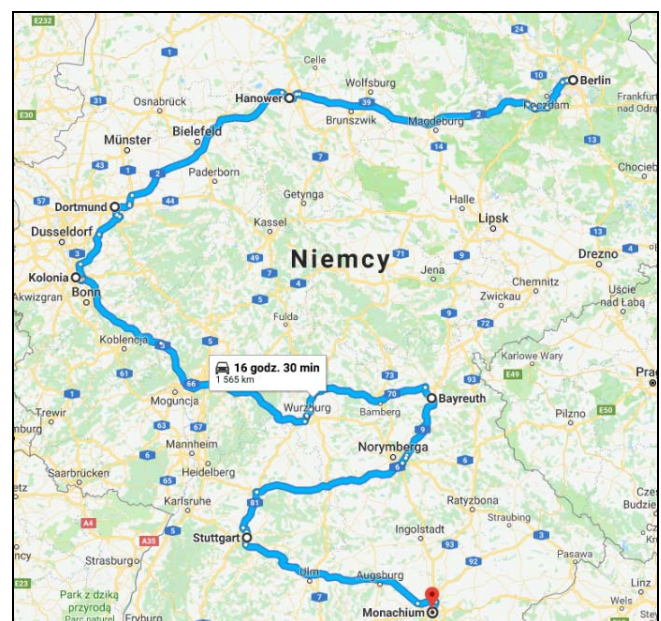


Figure 8. Current organization of client's A transport (own work based on Google Maps)

Using determined weight tariff that verifies costs of transport of cargos to the warehouse in Nuremberg towards postal code of a supplier, the rate for receipt

of all suppliers and for handling operations is 359,09€. The disposal of a car is 89%, therefore, flow organization is well-optimized (table 6). The problem is distance that car must cover to take all, even small cargos.

Table 6. The cost of a consolidation service for a client A

Code	City	Number LDM of pallets	Mass [m]	Handling [kg]	Transport	
10117	Berlin	6	2,4	1400	12 €	169,29 €
30159	Hannover	2	0,4	200	4 €	31,41 €
44135	Dortmund	1	0,4	50	2 €	16,69 €
50667	Cologne	2	0,8	100	4 €	22,02 €
95444	Bayreuth	3	1,2	400	6 €	45,44 €
70173	Stuttgart	3	1,2	300	6 €	40,24 €
Total		17	6,4	2450	34 €	325,09 €
Disposal of the car			88,89%	48,83%		359,09 €

Analysed transport enterprise offers delivery of every cargo from Germany within 2 working days. In this case, goods loaded on 02/07 can be collected in a warehouse only on 04/07. In order to optimize the time of delivery, all cargos planned after 02/07 must be speeded up to this day (table 7).

Cargo will be ready at 9 o'clock and will be taken by 6-tonne car, distance from Nuremberg to Munich is 195 km, according to price list of average costs, the rate per one kilometre for the distance of 0-300 km is 0,9€/km. The freight is 175,5€. Total transit is two and a half days, that is, one day more than now (table 8) (Fig.9).

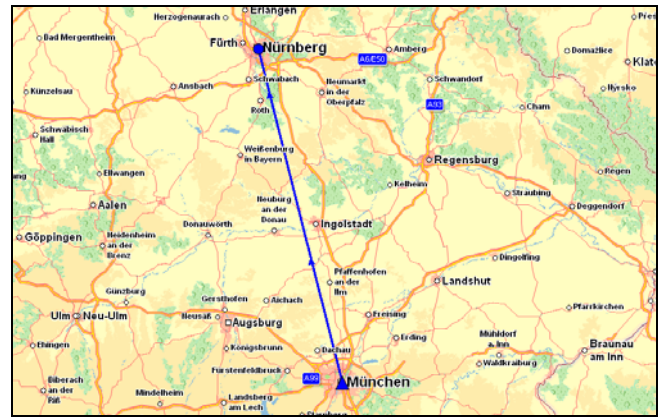


Figure 9. The route Nuremberg - Munich (own work based on the use of Optimizing XYZ)

Comparing current costs with a proposed offer, client may save EUR 40 thousand (table 9).

There is also an issue of determining the impact of extended transit on the costs frozen in material [12]. The value of cargo and number of production days of a plant will be required. The value of goods is fifty thousand euro, with five-day production line, it is ten thousand euro a day. Increasing the transit by one day will have a negative impact in the value of one day, that is, ten thousand euro. Comparing losses in material and saving in transport, the result is positive - thirty thousand euro (table 10).

Table 7. Time of delivery of cargos to Nuremberg (Client A) Own work

Code	City	Date	Hour	Code	City	Date	Hour
10117	Berlin	2.07	08:00	90402	Nuremberg	4.07	08:00
30159	Hannover	2.07	13:00	90402	Nuremberg	4.07	08:00
44135	Dortmund	2.07	18:00	90402	Nuremberg	4.07	08:00
50667	Cologne	2.07	08:30	90402	Nuremberg	4.07	08:00
95444	Bayreuth	2.07	17:00	90402	Nuremberg	4.07	08:00
70173	Stuttgart	2.07	10:30	90402	Nuremberg	4.07	08:00

Table 8. Transport of consolidated cargo to Munich (own work)

Code	City	Date	Hour	Code	City	Date	Hour
90402	Nuremberg	4.07	09:00	80331	Monachium	4.07	11:30

Table 9. The savings of a client A thanks to proposed offer of a transport company (own work)

Route	Car type	Distance	Feet	costs [€]
Suppliers -> Client A Monachium	6t	1565	5	1 377,00
Current total cost				1 377,00
Suppliers -> Nuremberg	consolidation			359,10
Norymbergia->Client A Monachium	6t	195	0	175,50
The proposed total cost				534,59
Savings of the week				-842,41
Annual savings				-40435,68

Table 10. The comparison of transport savings and inventory losses of a client A (own work)

Value of the goods [€]	50 000,00
Number of production days	5
Value of the commodity / day [€]	10 000,00
Savings in transport costs [€]	- 40 435,68
Inventory costs increased [€]	10 000,00
Final balance [€]	- 30 435,68

4 SUMMARY

The digitization of transport processes is possible thanks to systems of management of transports and invoices, or applications monitoring position of the cars. The programs optimizing costs are ideal solutions for enterprises having a network of terminals. These networks are becoming more and more important on the market due to pressure on reduction of costs.

In this article, the authors set a goal, which is defining the role of optimization of transport costs using a consolidation service. Conducted analysis allowed to prove that consolidation services reduce the costs of transport of small cargos. In the event of direct transports, the cars must cover many kilometres, only to take one small cargos or pallet. Medium and large cargos are not cost-effective for such organizations, however, direct and consolidation method can be combined to get optimal results. The impact on inventory costs was also taken into consideration in the analysis. Extended time of transit, caused by the use of a consolidation service should be in most cases covered by transport savings.

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