THE NEW TECHNOLOGIES IN THE FIELD OF LOGISTICS

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Abstract

The paper, arisen in the terms of new economy (taking into amount the importance of knowledge and innovation in all economy spheres), deals with current entrepreneurship profitability problem in the field of logistics. At the beginning, the paper briefly defines main spheres where optimization can take place and thus lead to higher entrepreneurship profitability and the decrease of operational costs. Next, the author focuses on the field of road means of transport and presents progressive technologies of cargo transport. Among others, the use of longer semi-trailers (Eurotrailer, LongPlex) and EMS (European Modular System) vehicle combinations is solved. These vehicle-combinations bring the operator (road-transport enterprise) an increase of transport capacity and/or an increase of payload. They also reduce fuel consumption, environmental impact (in the field of air pollution) and external costs of road cargo transport. Thus they bring benefits for both road-transport enterprises and society.

Key words: logistics; road cargo transport; cost-savings; ecology; new economy.

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Introduction

The impact of transport costs on trade in different product groups is wide-ranging. For instance, the impact of a doubling of costs in shipping on any given product is to decrease its trade by 18%, on average. But e.g. in the case of agricultural products, the trade decrease reaches 37% (Korinek & Sourdin, 2009). The **production cost** advantage is not sufficient to overcome the disadvantage linked to the value of **transport costs**. As the amount of transport costs decreases, the range of tradable goods widens. Countries and regions are affected not only by the **growing mobility of commodities** but also by that of **production factors** (e.g. capital and labour). Lowering transport costs change firms´ and workers´ incentives to move => it´s crucial to have a good understanding of how firms and workers react to these changes in order to assess the full impact of trade and transport policies. In this respect, it

should be stressed that **policy-makers** often overlook the fact that their decisions impact the location choices made by firms and households. Transport costs vary by commodities, regions and routes (Thisse, 2009). An obvious determinant of transport costs is the **distance between trading partners**. Traditionally, distance has been used in gravity equations as a proxy for transport costs since a higher distance implies a longer journey and an increase in the associated costs (Martinez-Zarzoso, Garcia-Menendez & Suarez-Burguet, 2003).

Enterprises are still searching for new, more economical, highly sophisticated and if possible more ecological solutions in various areas of their entrepreneurship. Among others, they solve their **cost effectiveness** and an **adequate level of customer service**. One of key spheres, in the field of logistics, is transport cost-efficiency. In this paper, the author focuses on **progressive road means of transport** which have a great potential to make road cargo transport more efficient, more sustainable and according to (Jones & Short, 1994) with lower social/external costs.

1. Main optimization spheres

Following areas of optimization in the field of road cargo transport are:

- seeking for locations with the highest market potential where consumer demand is high and transport costs are low (Thisse, 2009);
- the purchase of modern (safer, more economical and ecological) motor-vehicles – lorries and prime-movers;
- the purchase of modern towed-vehicles – trailers and semi-trailers – bringing a decrease of operational costs, a higher payload and/or higher loading-unit capacity;
- the education of drivers in certain knowledge and skills – eco-driving, cargo securing, etc.;
- the implementation of a fleet management system in an enterprise, which helps to increase vehicle-fleet usage, optimization of transportation routes and the decrease of operational costs;
- in justified cases – the use of accompanied combined transport (A-CT) or unaccompanied combined transport (U-CT) systems instead of applying a routine direct road transport;
- in the field of U-CT – e.g. the use of foldable ISO containers that reduces costs of empty transports (Konings, 2005);
- the use of vehicle-combinations with non-standard length and/or non-standard weight and with improved superstructures (loading spaces).

*As mentioned hereinbefore, the **author focuses on the last problem**.*

2 Special road cargo transport solutions

2.1 Semi-trailers with extended length

There are four types of extended semi-trailers – three German: *Koegel Big-MAXX* (also called Eurotrailer), *Koegel LongPlex* and *Fliegl XtraLong* and one British named "*SCM*".

Semi-trailer SCM is not in road operation. British authorities did not allow that in December 2005. Author is not going to solve this semi-trailer in details, but for completeness he briefly adds that this trailer is 16 meter long and its capacity is 40 euro-pallets, or in intermodal version up to two swap-bodies B 825 (or one A 1650)[1]. The acronym SCM means "*Steering Correction Mechanism*" and tells that all axles of this semi-trailer are automatically steered to ensure sufficient on-road performance.
("DON-BUR," 2011)

Koegel Big-MAXX (further just "**Eurotrailer**"; see Fig. 1) is a 15.25 meters long semi-trailer. For the first time it was given into road operation in Germany in the year 2006. It´s also used in the Czech Republic[2], Sweden, Finland, Italy, Russia, Poland, Ukraine and Belarus. For example in Germany and Poland, more than 300 Eurotrailers are operating. The 15 meter length provides operator a capacity of *37 euro-pallets* in single-deck version (twin-deck version has twice as much: 74 euro-pallets) and *111 m^3 loading space*. Thus the Eurotrailer, in tarp-superstructure ("curtain-sider") version, offers four/eight more pallet-places and 9 m^3 more loading space[3] compared to a semi-trailer with standard (13.6 m) length. This increase of transport capacity leads to a *decrease of costs per pallet transported* (by ca. 10%) and in longer time horizon to *savings of journeys number* required for transport of certain amount of cargo. Another significant advantage is the possibility of *2 swap-bodies* (type C 745) transport when a "container-chassis" Eurotrailer version is used. Standard semi-trailer combination does not allow this – the use of drawbar trailer combination is essential. In the case of standard semi-trailer combination, it is e.g. impossible to deliver two ISO 1C containers from a consignor into a terminal (multimodal logistic centre) and instantly take two swap-bodies from a terminal to a consignee. The operator needs two different standard vehicle-combinations to transport these intermodal loading units (ILUs). Using the Eurotrailer – just one combination is enough. Another advantage in the field of U-CT is that a *cranable*

[1] explanation: e.g. number „825" means the length of a swap-body in centimeters => i.e. 825 centimeters
[2] since 2009
[3] a box-body (e.g. refrigerated) Eurotrailer offers 3 (or 6) pallet places and ca. 8 m^3 more loading space

version exists and in the field of A-CT the *use of system RO-LA* (Rollende-Landstrasse; "Rolling-Road" in English) is possible. The maximum gross weight of Eurotrailer-combinations meets current legislation (40 tons in international transport[4]).

Unfortunately current Czech and European legislation doesn´t allow general operation of these combinations because of their length. In spite the fact the Eurotrailer combinations (with the length of 17.8 meters) are circa one meter shorter than standard drawbar trailer combinations (with currently allowed length of 18.75 meters) and *don´t cause any problems in road traffic* either, the operators have to hold a permission of Ministry of Transport or a similar institution abroad and pay for it. In the Czech Republic the annual payment reaches ca. 22,000 CZK per operator. However, current praxis shows these payments are not a serious disadvantage.
(Rathouský, 2011), ("Koegel," 2013)

Fig. 1: Koegel Eurotrailer

Source: Koegel Eurotrailer [Web Photo]. Retrieved from www.newscomm.de (left); Koegel Eurotrailer [Web Photo]. Retrieved from www.eurotransport.de (right)

A box-type superstructure (on the left) and a cranable tarp-superstructure (on the right) are shown in Fig. 1.

Koegel LongPlex is quite similar to Eurotrailer concerning its maximum length but it is designed *only for transportation of ILUs* – especially swap-bodies. Compared to Eurotrailer, which has a rigid chassis, the LongPlex has a *telescopic chassis* on its rear overhang. This allows shortening semi-trailer chassis and thus meeting current legislation while transporting e.g. ISO container(s) – see Fig. 2.

The usage of LongPlex semi-trailer offers operator costs-reduction and brings positive contribution in the field of ecology. Another advantage is that LongPlex´s

[4] according to Directive EC 96/53

tara-weight is the same (ca. 5.4 tons) as in the case of standard semi-trailer. Nowadays, a testing-period of LongPlex semi-trailer is running in Germany and the extension into other countries is expected.
("Koegel," 2011, January 21), ("Koegel," 2012, August 1)

Fig. 2: Koegel LongPlex

Source: Koegel LongPlex [Web Photo]. Retrieved from http://blog.truck-mobiles.de/feldversuch-kogel-longplex-alternative-zu-lang-lkw (left); Koegel LongPlex [Web Photo]. Retrieved from www.koegel.com (right)

On the left of Fig. 2, the scheme of ILUs transport possibilities is shown. On the right, a picture of two swap-bodies C 745 loaded on a LongPlex semi-trailer is presented.

2.2 European Modular System

European Modular System (EMS) vehicle-combinations are 25.25 meter long trucks designed especially for long-haul transports. Their capacities vary from 150-160 m^3 of loading space or, measured in ILUs, three TEU (three ISO 1C containers). Their maximum gross weights vary from 40-60 tons and usually have 7 or 8 axles.

EMS vehicle-combination may be one of these configurations:

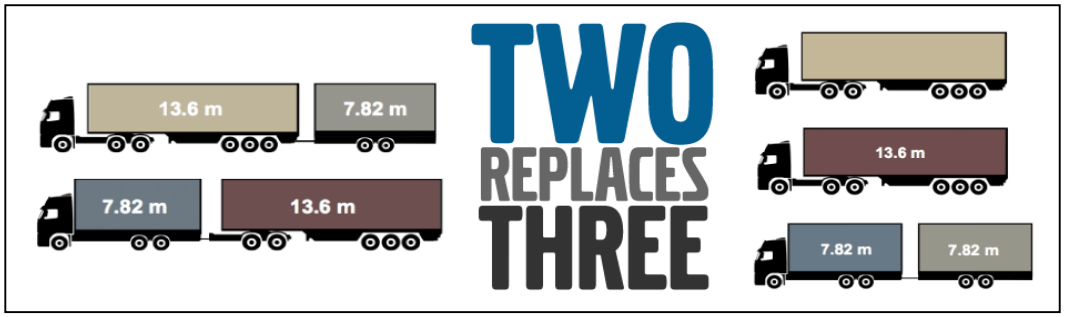
- tractor + semi-trailer + central axle trailer ("volume-oriented variant");
- lorry + converter dolly + semi-trailer ("weight-oriented variant");
- lorry + central axle trailer + central axle trailer;
- tractor + interlink semi-trailer + semi-trailer.

Most frequently used EMS configurations are first two of the above list (see Fig. 4 and Fig. 5). Naturally, EMS combinations do not comply with current legislation – permission for their operation is essential. But e.g. Sweden, Norway, Finland, Denmark and Netherlands

have allowed a general operation of these trucks. Among countries where EMS trucks have been operating *in a special permission regime* belong mainly: Belgium, Germany, Russia and the Czech Republic (since 2008). Often, the operation is restricted on certain routes of road network. Nowadays the *Yussen Logistics* is the only company to operate these trucks in our country.

With the EMS, two trucks are used instead of three to carry the same amount of cargo. If EMS were standard, two vehicle combinations would be able to replace three (see Fig. 3), resulting in 30% fewer trucks on the roads, lower total fuel consumption and lower emissions. If EMS were to be adopted throughout the EU, CO_2 emissions would be annually reduced by 10-20 million tons.

Fig. 3: Number of trucks reduction scheme



Source: EMS [Web Photo]. Retrieved from http://www.moreproductivetrucks.com/energy_and_environment.html

All EMS configurations are composed of standard vehicles – lorries/tractors and trailers/semi-trailers. The only special "elements" of certain EMS combinations are *converter dolly* and *interlink semi-trailer*. Thus, one of core advantages is that EMS combinations may be decoupled into standard vehicle combinations and comply with current legislation. They have potential to cut number of realized journeys of one third thanks to higher capacity (both in cubic meters and TEUs) and this way improve road cargo transport ecology and effectiveness. Thanks to higher number of axles, the wear to road surface does not increase, compared to standard trailer or semi-trailer combination. The only problem may cause some bridges. But as mentioned above, we are able to avoid this problem by defining exact routes suitable for EMS combinations.
(Rathouský, 2011), ("The long HGV," 2013), ("Energy and Environment," 2010)

Fig. 4: EMS – volume-oriented variant

Source: EMS [Web Photo]. Retrieved from http://www.euro-combi.de/bilder-img.php?imp=5

Fig. 5: EMS – weight-oriented variant

Source: EMS [Web Photo]. Retrieved from http://www.groenewegen.eu/index.php?option=com_news&Itemid=22&id=28

Partial conclusion:

Wider usage of above mentioned trucks has potential of road cargo transport decrease (up to 1/3) concerning realized journeys and higher use of CT systems (un-accompanied mainly). Thus, the overall *increase of road-traffic safety* and *protection of the environment* are achieved. Longer vehicle-combinations may be a *measure for expected growth of road transport demand* in following years. This means, they are without doubt *contributive to sustainable transport* and sustainable development of society.

3 Progressive construction of road vehicles´ superstructures

3.1 Streamlined semi-trailers

The only in production of streamlined (so called "Teardrop"; see Fig. 6) semi-trailers and lorry/trailer superstructures (bodies) has been British producer DON-BUR since the

year 2006. DON-BUR declares that the use of the semi-trailer brings savings in fuel consumption on average 11% (declared minimum is 4%). In certain cases[5] even 20%. By the same number a decrease of CO_2 emissions appears => on average, more than 8 tons of CO_2 are not emitted into the atmosphere per a vehicle and year. Other advantage of teardrop shape is loading space enlargement by ca. 10%. Teardrop vehicles have been used mainly by operators in Great Britain, not on continental Europe. The reason is obvious. The heights of vehicles doesn´t comply with current European legislation. The limit is 4 meters whereas Teardrop vehicles measure usually ca. 4.2 meters. Nevertheless, the demand for Teardrop vehicles is e.g. in Canada and Australia. Among European operators belong DHL and Marks & Spencer. ("DON-BUR," 2013), (DON-BUR, DON-BUR Teardrop Trailer)

Fig. 6: Tractor with the DON-BUR Teardrop semi-trailer

Source: DON-BUR Teardrop semi-trailer [Web Photo]. Retrieved from http://blog.raneystruckparts.com/fuel-efficiency/are-teardrop-semi-trailers-the-future-of-fuel-savings (left); DON-BUR Teardrop semi-trailer [Web Photo]. Retrieved from http://www.donbur.co.uk/eng/products/aerodynamic_teardrop_trailers_rigids.php#.UadsfNhj6So (right)

3.2 Boat-tailed semi-trailers

Another aerodynamic invention is a "*boat-tail*" system at the rear of a semi-trailer. Several systems exist across Europe, Canada and the USA. As for Europe – mainly Scania, Renault (Optifuel Lab) and Mercedes (AeroTrailer; see Fig. 7) have introduced their systems. The boat-tail system is frequently combined with side skirt fairings which cover the whole sides of a semi-trailer (including its wheels) and with rear diffusers.

Declared reduction of wind drag is 18% and reduction of fuel consumption and CO_2 emissions from 2 to 15%. Unfortunately, superstructure modifications make semi-trailer longer than currently allowed. If legislation is changed this year[6] as expected, the boat-tail

[5] influenced by route choice and speed when savings are measured
[6] 50 cm long boat-tail is to be allowed

projects can save up to 5 tons of CO_2 emissions annually as well as save 2,000 liters of diesel fuel per truck. (Import RPM, 2011)

Fig. 7: Mercedes-Benz Aero Trailer

Source: Mercedes Aero Trailer [Web Photo]. Retrieved from http://www.importrpm.com/mercedes-benz-aero-trailer

Conclusion

In the terms of *knowledge economy*, the paper provides operators, professionals and students information on selected progressive solutions in cargo transport sphere. All technologies/systems solved have significant potential for road transport enterprises in the terms of entrepreneurship efficiency increase.

Furthermore, they **bring customer more effective transport solution** with potential of transport price decrease. In general, the **added value for the society** is more efficient, ecological with less emissions and "smaller" CO_2 footprint (e.g. in the terms of **GoGreen** program) and even safer transport. On the other hand, certain changes in legislation are essential to allow extension of these vehicles across Europe.

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