

R E P O R T



# TECHNO LOGICAL

# REVOLUTION

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DIRECTIONS IN THE DEVELOPMENT OF THE  
TRANSPORT-FORWARDING-LOGISTICS (TFL)  
SECTOR

O C T O B E R 2 0 1 9

## TECHNOLOGICAL REVOLUTION

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# **T E C H N O** **L O G I C A L** R E V O L U T I O N

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TRANSPORT-FORWARDING-LOGISTICS (TFL)  
SECTOR**



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# PREFACE

## MARCIN WOLAK

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Dear Sir or Madam,

The world is moving forward. Today, nobody will deny that the technological revolution - the fourth industrial revolution - is unfolding before our eyes. It touches upon automation, processing, and exchange of data. Internet of Things (IoT), cloud computing, artificial intelligence, robotics, autonomous cars, nanotechnology, digitalization. These terms are entwined in today's language. The way we live every day is fundamentally changing. The changes that are taking place are unmatched in the history of the world - especially in terms of the pace at which they occur. It all affects how the business looks today. Industry 4.0, which can be understood as the deepening integration of intelligent machines, is not all. The technological revolution is also a change in the approach to production and business processes. It is also a change that redefines the role of people in the industry and its environment. Finally, it is also a new approach to logistics and transport itself, where we

increasingly come across the concept of Logistics 4.0. It must be smart. It must be flexible, fast and safe - tailored to customer's needs. It must be effective and competitive.

We present you with a publication in which we look at the changes taking place in the context of the development directions of the Transport-Forwarding-Logistics (TFL) sector. In the first part, we look primarily at the situation of the industry, but also into the future, taking into account the needs and changes in the labor market. In the second part, we analyze changing environmental conditions. Today, when the global economy is based on oil, we look at the future from the perspective of alternative fuels. We wonder how the autonomization and digitalization of the economy will proceed. We explain what sharing economy and instant pricing mean in transport. We explain the already mentioned concept of logistics 4.0. In the last part, we look at the opportunities and threats related to decentralization and cybersecurity. Finally, we also say that you should be open to innovation, be ready to invest and remind you not to be afraid of change under any circumstances. The TFL industry is undoubtedly changing. But this is followed by new opportunities for business activity, as well as modern jobs. It is, therefore, necessary to look at the technological revolution from the perspective of possibilities. Because the revolution is inevitable and our openness and the most complete understanding will allow us to reap the most benefits from it for ourselves and the changing world around.

Enjoy your reading!

# INTRODUCTION

Revolution usually takes place in conditions where, on the one hand, there is a great imbalance in a given environment, and on the other, there is a force with considerable resources to change the state of affairs. Is this the case now in the Transport-Forwarding-Logistics (TFL) industry?

All forecasts agree that along with the development of the world economy, transport demand will increase significantly in the coming decades. On the other hand, there are a number of factors that mean that the availability of transport space will not increase in line with market expectations. The most important barrier that prevents further growth of fleet is the shortage of professional drivers, which is already felt at almost every latitude.

The population of professionally active truckers is melting, and this profession, due to its nature, is not attractive to young people. What's more - the pressure of increasingly strict ecological standards is also becoming more pronounced, which will further increase the costs of expanding the fleet. Both factors will reduce the supply of transport space at least until autonomous and zero-emission technologies become more common.

Political issues overlap with these problems, i.e. ever stronger trends to protect internal transport markets. They further impede the rational distribution of available resources, making the cost of transport increase to an extent that will be felt by all consumers.

Ad hoc measures (e.g. increasing the capacity of transport units or the carrying capacity of infrastructure) are not able to meet the growing demand. We can witness a situation in which transport, after all called the „bloodstream of the economy,“ will become paradoxically the main brake on its development. The market imbalance is therefore easily noticeable.

On the other hand, the industry 4.0 trend in the global economy is becoming increasingly visible, which implies the use of data to make better decisions and allocate resources faster. It assumes that algorithms, armed with a large amount of data, can perform these tasks more efficiently than humans. The transport industry seems to be still at the tail end of these innovations. It is quite strange because transport can gain a lot. First, because it is a fragmented industry like no other. Transport resources, senders, recipients, intermediaries form a network that is difficult to efficiently handle using manual processes. Hence, paradoxically, despite the lack of cargo space, many carriers drive underloaded or empty.



At the same time, transport generates huge amounts of data that can be used to optimize its performance. Modern telematics in vehicles send information on their location and condition on an ongoing basis, ERP, TMS and WMS systems have data on the content and purpose of the load. There are also all kinds of beacons installed more often in the loads themselves, toll collection devices, drivers' mobile phones, electronic documents, including waybills and many more. It's a huge amount of data that seems underestimated. This huge amount of data, if properly stored and processed by algorithms, can contribute to a better matching of loads to the means of transport, to better use of each cubic meter of the semi-trailer and each kilometer of the route. It can also help to make better use of existing resources when they cannot be enlarged enough and in anticipation of greater autonomy in supply chains. So we have resources to change the existing state of affairs.

In this report, we will look at the most promising trends in the field of digitalization of the supply chain and processing of acquired data as well as their security. We will try to answer the question of how strategic decisions of private entrepreneurs and long-term support of public administration can stimulate the development of logistics 4.0 and whether there is a chance for a revolution that will change the future of transport and the way we work.

**SZYMON KNYCHALSKI**

editor-in-chief of Trans.info



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## WHAT IS THE TFL INDUSTRY - WHERE ARE WE AGAINST THE BACKGROUND OF EUROPE

**Transport and logistics are one of the most important industries that make a significant contribution to the development of the Polish economy. This is not only because the carriers obviously support the operation of industry and the manufacturing sector, but as a thriving branch, they also produce a significant part of the Gross Domestic Product (GDP). It should be noted that entrepreneurs from the TFL sector are also doing well on the EU market - in certain categories they are unquestionable leaders. However, the dynamic development of the industry that we have seen in recent years will depend in the future on whether Polish carriers and logistics specialists will catch the wind of technological change.**

The Central Statistical Office (CSO) data on GDP reveal best how much the TFL sector contributes to economic growth. The latest full CSO data on GDP - for 2017 - shows that the **“transport and warehouse management” has generated 5.8 percent of GDP. In 2017, it was PLN 115.3 billion.** It is worth noting that this result was the second largest in the concentrated service sector (the higher share in GDP - 15.7 percent was obtained in the „trade; repair of motor vehicles” segment). Estimates for last year show that Poland’s GDP increased by 5.1 percent. The growth rate in the “transport and warehouse management” sector was higher and amounted to 9.2 percent. (compared to 7.2 percent in 2017).

The next years will probably not be as good, as indicated by the forecasts of various institutions (including the European Commission, OECD, National Polish Bank). In 2019, GDP will probably fall below 5 percent. For transport, which is a service provider in relation to industry, construction, and trade, this heralds the onset of a slowdown. Also in Europe, signs of an economic slowdown have been visible for some time. The situation in Germany is particularly important for Poland, where, unfortunately, business climate indices have been falling for a long time. For Polish companies, including transport and logistics, the state of the economy of our western neighbors is important because they are our main trading partners (according to the Central Statistical Office, in 2018 goods sold to Germany accounted for 28.2 percent of Polish exports).

## THE SECTOR IS CARRYING MORE AND MORE

Let’s look at the numbers describing the Polish TFL sector. The Central Statistical Office’s report on transport in 2018 shows that there was an increase in transport by all modes of

transport except inland waterway (compared to 2017). In total, 2.191 billion tonnes were transported in 2018 (an increase of 6.8 percent compared to 2017). Road transport, as in previous years, had the largest share - **1.873 billion tonnes (an increase of 7.2 percent)**. Railways, second in terms of share, recorded a result of 249.2 million tons (increase by 4.1 percent). Calculated per tonne-kilometer, the entire transport sector achieved a result of 7.4 percent better in 2018 than the year before. Also in this approach, road transport dominated and increased by **8.4 percent**.

#### Freight transport (in millions of tonne-kilometers)

	2017	2018
Total	434 932	467 193
Road transport (including commercial)	348 559 (302 259)	377 778 (329 529)
Railway transport	54 797	59 388
Maritime transport	9 362	7 619

Source: Central Statistical Office (CSO)

The analysis of the transport market in terms of the directions in which orders are carried out shows that in 2018 domestic transport dominated in road transport (80.8 percent), similarly to railways (66.8 percent).

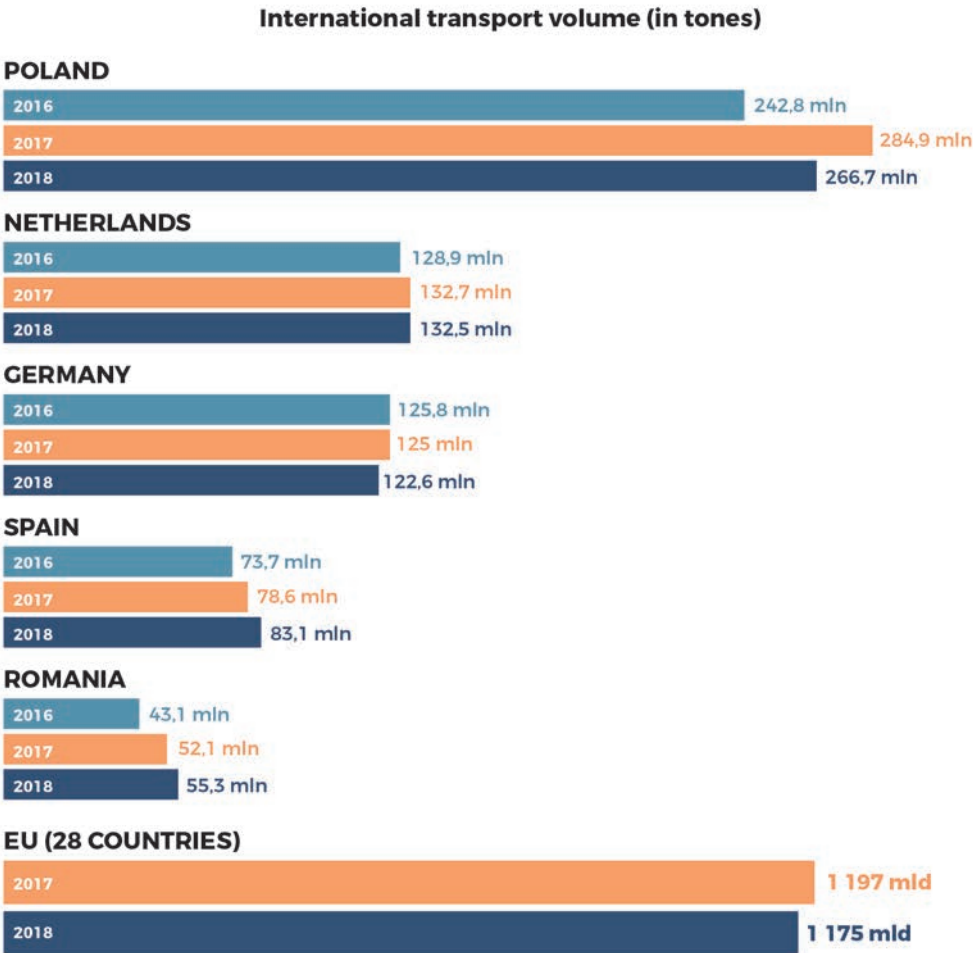
#### Road transport - freight transport by direction (in thousand tonnes, partly estimated)

	2017	2018
National	1 216 818,3	1 123 400,3
International - export	82 826,2	78 286,7
International - import	72 196,6	68 070,9
International - transit	3 932,7	3 169,1
International - between foreign countries	126 037,3	117 257,1

Source: Central Statistical Office (CSO)

Polish carriers have impressive results compared to other European Union countries. A glance at the latest Eurostat data for 2018 shows that over a fifth of international road transport in the European Union was carried out by Poles. In this respect, we have no equal in the entire Community. We are not only the leader in terms of international transport volume, but if we compare the next two countries in the ranking - the Netherlands and Germany, their combined result is smaller than the share of Polish carriers.

The entire volume of transported goods on the EU market in 2018 amounted to 1.175 billion tonnes (data from 28 EU countries). Poles had the largest share in working out this result - 22.6 percent of international transports (266.7 million tonnes). The Netherlands ranked second with half the result: 132.5 million tonnes.



Source: EUROSTAT

It is worth mentioning here that **since 2012 Polish transport companies continuously rank first in terms of the number of tonnes of goods in international transport.**

The strong position of Poles in international transport is also confirmed by German data. The report of the Federal Office for Goods Transport (BAG) shows that in 2018 Polish carriers took the lead in terms of the share of foreign trucks driving on German roads. **Last year, all trucks registered outside of Germany drove a total of 15.7 billion km (14.8 billion km on motorways) in Germany. Trucks from Poland traveled 6.1 billion km on toll roads, which amounts to 16.2 percent of all kilometers driven on toll routes.**

Carriers from Poland are also leaders in terms of cabotage in Germany. According to BAG data, in 2017, Polish trucks performed 64.3 percent of cabotage operations. This amounts to **13.1 billion tonne-kilometers** of transported goods.

Being the sixth largest country in the European Union in terms of population, Poland is not only an attractive market for producers and traders. Due to the location - as a border country of the Community, Poland is a natural gateway and base for expansion into eastern markets: Belarus, Russia, and Ukraine, as well as Central Asian countries (Kazakhstan, China). This is one of the reasons why the warehouse and logistics space market has been dynamically developing in our country for over a decade. **In 2008, there were 5.1 million sq m of warehouse space in Poland, and at the end of the first half of 2019, this number grew to 16.89 million sq m.**

This means that for the last 10 years the supply of warehouse space has tripled - and with a surplus. **There are currently about 70 new projects under construction,** which after completing the investment will increase the warehouse space by another **2.24 mln sq m.**

Importantly, the logistics facilities built in Poland are increasingly diverse in terms of their nature and function. A decade ago, big-box investments at major road junctions dominated, supplemented with Small Business Units on the Warsaw market. Currently, in addition to traditional logistics parks, other types of warehouses are being built such as municipal warehouses, cross-docks, and built-to-suit (BTS) investments.

Warehouses in Poland are also attractive in terms of rental costs, especially when compared to Germany. "In the area of the main logistics centers in Germany, rents range from around 4.70 to 7 euros per sq m per month. It's 50-80 percent more than base rents on major markets in Poland," says Cushman & Wakefield in the report Marketbeat - the warehouse market in Poland for the first half of 2019. The highest base rents invariably apply to the Warsaw-city market (between 4.80 and 5.25 euros per sq m per month). However, you have to be aware of the fact that the owners of warehouse facilities will increase rental rates.

According to the authors of the report, the prospects for the development of the warehouse market in Poland are still favorable. In the coming years, developer activity will cover to a larger extent medium-sized cities and regions that have not yet functioned on the logistics map. Along with the development of transport infrastructure, their position will increase, also due to the decreasing availability of qualified staff in large agglomerations.

## **DYNAMIC GROWTH WILL NOT BE EASY IN THE FUTURE**

Although global forecasts speak of an increase in transport demand, the economic slow-down and other international factors, such as Brexit, customs wars and changes in EU law, can affect the weaker growth dynamics of the Polish TFL sector.

"In the short term, by 2022, the projected economic growth and investment attractiveness of Poland will translate into a total increase in tonnage serviced by the transport sector in the country by 22.8 percent," estimate the authors of the analysis Transport of the future. Report on the prospects for the development of road transport in the years 2020-2030, prepared by the consulting company PwC in cooperation with the Employers' Union Transport and Logistics Poland. This will translate into an average annual increase of **5.3 percent**. And although the dynamics of volumes of cargo transported by Polish carriers will be positive at that time, it will start to slow down compared to the previous period. Increasing costs will follow along. PwC experts estimate that by 2021, the operating costs of the TFL industry will increase by 7 to 15 percent. Entrepreneurs will have to translate this into freight prices, which can rise by 3 to 5 percent in the next two years. At the beginning of the next decade, it is also possible that the demand will significantly shift towards domestic services.

Experts note that reducing transport performance in international transport services, e.g. by 20 percent, would mean a reduction in the total transport performance of Polish carriers by nearly 13 percent. Such a scenario is possible e.g. if the provisions of the Mobility Package, whose draft is at the final stage of the legislative path, become effective in the EU. If its set of regulations relating to road transport entered into force, the consequences would include an increase in costs of transport networks, a decrease in revenues associated with limiting access to the market and shifting the services of Polish carriers from Community markets to the domestic market. It should be remembered that the transport performance of Polish entrepreneurs in international transport accounts for as much as 64 percent of their total work. Therefore, adverse changes in law pose a serious threat to a large part of the transport sector.

A forward-looking perspective on how the transport sector in Poland can develop is presented in the Sustainable Development Strategy for Transport by 2030 adopted by



the government on 24 September 2019. This document describes the main goals to be achieved at the state level in order to increase the country's transport accessibility and improve the safety of traffic participants and the efficiency of the transport sector. The government plans, among others, building an 'integrated and interconnected transport network for a competitive economy' and improving 'the organization and management of the transport system'.

This is to be achieved, for example, by catching up on the neglect of the past (mainly infrastructural) and by entering into new technological and economic trends occurring in Europe and the world. All this should be implemented in stages by 2030 to ultimately ensure the sustainable development of individual transport branches and improve the conditions for the provision of freight and passenger transport services.

The Sustainable Development Strategy for Transport by 2030 also includes a sector development forecast, prepared on the assumption that transport processes in Poland are predictable, i.e. that their condition can be determined on the basis of current trends and future factors with a high degree of probability. It contains both a pessimistic and an optimistic scenario for the development of the industry in the next decade, with 2015 being taken as the base year. Importantly, the forecast does not take into account projects that may have a breakthrough impact on the sector's situation (e.g. Central Communication Port and related reconstruction of the rail infrastructure; possible expansion of connections in Poland under the New Silk Road together with the construction of a freight hub for land transport Europe-Asia).

As factors that will determine the demand for transport by 2030, the authors of the Sustainable Development Strategy indicated, among others:

- GDP, production of goods in individual sectors of the economy, exchange with foreign countries;
- technological changes (material and energy consumption);
- demographic changes (population, its structure, professional activity);
- household resources (income, consumption, equipment with means of transport);
- volume of service supply, quality of transport services, modernization of infrastructure.

The volume of demand for freight transport will be derived from the future volume of production in individual sectors of the economy. The Strategy reads that the main demand generators will be material production (especially the mining industry) and international exchange. The total volume of demand for freight transport (Polish and foreign carriers) expressed in tonnes in 2015-2030 in road transport will increase from 1550 million tonnes to **1746 - 1995 million tonnes** (minimum - maximum). In terms of transport performance, this branch of transport is expected to increase from 319 billion tonne-kilometers to 416 - 477 billion tkm.

Air transport will grow the fastest (4.9 - 7.1 percent per year increase in the volume of cargo tonnes). Whereas, the growth rate of rail transport is forecasted at 0.8 to 1.5 percent and road transport from 0.8 to 1.6 percent.

### Forecasted (min/max) volume of total demand for freight transport by mode

(implemented by Polish and foreign carriers) (million tonnes)

	2015	2020	2025	2030	Annual dynamics	2030: 2015
Road	1 550	1 674	1 733	1 746	0,8%	112,6%
	1 550	1 715	1 845	1 955	1,6%	113,2%
Rail (without shunting operations)	224	235	247	254	0,8%	113,2%
	224	240	260	280	1,5%	124,7%
Inland waterway	12	7	7	14	0,9%	113,6%
	12	7	8	17	2,6%	146,7%
Pipeline	55	57	59	60	0,6%	109,8%
	55	58	61	64	1,1%	117,4%
Maritime	70	79	87	95	2,1%	135,8%
	70	83	99	116	3,4%	166,3%
Air	0,1	0,1	0,2	0,2	4,9%	205,7%
	0,1	0,2	0,2	0,3	7,1%	279,4%
Total	1 911	2 052	2 134	2 168	0,8%	113,5%
	1 911	2 103	2 273	2 432	1,6%	127,3%

Source: J. Burniewicz, Forecast for the development of transport in Poland until 2030, 2017.

The forecast also estimates that by 2030 total transport performance by individual transport modes will change in the following ranges:

- road by 30 - 49 percent
- rail by 19 - 33 percent
- maritime by 48 - 81 percent
- air by 111 - 188 percent

## Forecasted(min/max) transport performance of individual transport modes

(billion tkm)

	2015	2020	2025	2030	Dynamika roczna	2030: 2015
Road	319	383	405	416	1,8%	130,1%
	319	395	438	477	2,7%	149,3%
Rail (without shunting operations)	51	54	58	60	1,1%	118,6%
	51	55	61	67	1,9%	132,7%
Inland waterway	2,2	0,9	1,0	1,9	-1,0%	86,5%
	2,2	1,0	1,1	2,5	0,8%	112,6%
Pipeline	22	23	24	25	0,9%	114,4%
	22	24	25	27	1,4%	123,9%
Maritime	158	178	206	235	2,7%	148,4%
	158	187	233	287	4,0%	181,4%
Air	0,4	0,6	0,7	0,9	5,1%	210,6%
	0,4	0,7	0,8	1,3	7,3%	287,9%
<b>Total</b>	553	639	694	738	5,1%	210,6%
	553	662	759	862	3,0%	155,9%

Source: J. Burniewicz, Forecast for the development of transport in Poland until 2030, 2017.

The calculations assume an increase in transshipments in Polish seaports to 95 - 116 million tonnes in 2030. Large containers will account for about 25 - 31 million tonnes. Similarly, more transshipments are expected at airports, with about 213-289 thousand tonnes in 2030.

According to the authors of the Strategy, the forecast of transport demand in Poland also shows the scale of necessary infrastructure investments. The country's road network accommodates approximately 20.8 million motor vehicles, including 2.2 million Polish trucks (including 247 thousand tractors) and around 0.5 million foreign trucks (total number

of trucks - including vans - exceeded 3.2 million units). The current plan for the development of the motorway and expressway network predicts that there will be about 7850 km of roads (2100 km of motorways and 5750 km of express roads).

# DEMOGRAPHICS

## AND THE SITUATION ON THE LABOR MARKET IN THE TFL SECTOR

The growth dynamics in road transport of goods in the last decade indicates that this industry is highly susceptible to changes in the business cycle. The industry also plays an important role in the economy in terms of added value and revenues generated for the state budget. Industry representatives predict that the coming years will be a period of intense changes, and the forecasts for economic growth and trade confirm that by 2022 one can expect an increase in volumes in road transport of goods in Poland.

The key condition for this increase is the availability of drivers. According to industry representatives, the driver gap currently reaches as much as 20 percent of labor demand, but in the long run, it can be expected to be reduced thanks to the autonomization of transport.

The analysis of economic, demographic and technological factors shaping the balance on the labor market for truck drivers was prepared on the basis of the report Transport of the Future by PwC, which was created in 2019 with the support of the Employers' Union "Transport and Logistics Poland" and partners: Santander, Uber and DAF.

## GENTLE OPTIMISM AND NEW CHALLENGES IN TRANSPORT

The coming years promise to be moderately positive for the Polish transport industry. The estimated tonnage serviced by the Polish road haulage industry will increase from around 1.17 billion tonnes in 2018 to around 1.44 billion tonnes in 2022, with an average annual increase of 5.3 percent. The key factors that contributed to the expected level of growth are moderately optimistic GDP forecasts for the country and Poland's foreign trade.

However, the first signs of an approaching storm appear on the industry horizon. In addition to the expected deceleration of economic indicators at the level of the European Union, which will affect the industry in the long run, the European Parliament in April voted on the provisions of the Mobility Package unfavorable to Polish carriers. However, the biggest threat will be the driver gap, reaching as much as 20 percent of labor demand at the end of 2018 according to PwC research.

## Development of the Polish road haulage industry

**23%**

Expected total increase in volumes in the Polish road haulage industry in 2018-2022 (tonnage of goods transported)

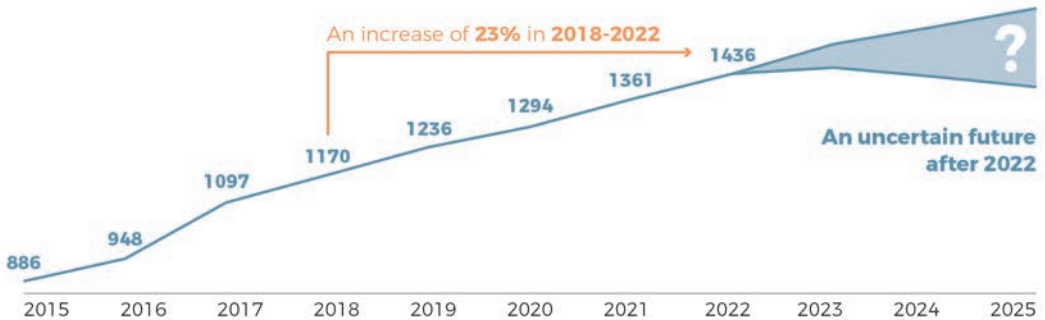


**7-15%**

The level of cost increase in the industry by the end of 2020 in the opinion of its representatives.



### Forecast of tonnage changes in the road haulage industry 2015-2025 (mln ton):



Source: Transport of the future: Report on development prospects for road transport in Poland in 2020-2030

## DEMOGRAPHIC CHANGE DOES NOT HELP

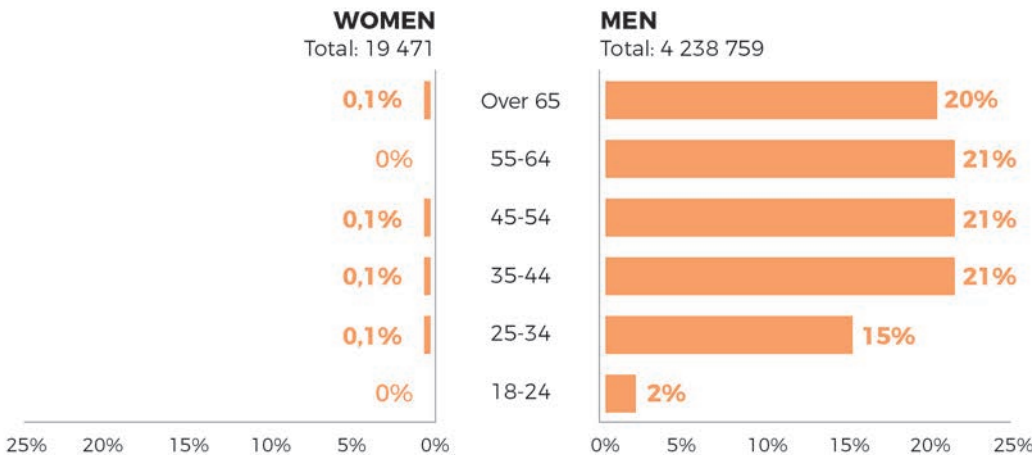
The phenomenon of an aging society is well visible in the industry. In Poland, close to 20 percent of people currently authorized to drive heavy goods vehicles have already reached retirement age, so with great probability will leave work in the next five years. Another group, 21 percent, are drivers who will reach retirement age between 1 and 10 years from now. This means that by 2030, up to 40 percent of professional drivers may leave the market only because they have reached the retirement age. People under 35 constitute only 17 percent of those who are authorized to drive heavy good vehicles.

The work of a truck driver is associated with disadvantages, such as frequent and long periods of isolation from family and friends, strict control of driving time and rest period, and difficulties in accessing social services. For such practical reasons, young people may not want to work in this profession. Given the current age structure, it can also be presumed that relatively high earnings in the industry are not a sufficient incentive for them. According to Transjobs.eu data, the average wage of drivers servicing international routes

is estimated at over 7,000 PLN net, and on domestic routes approximately 5,000 PLN net (these amounts include additions to the base of remuneration).

New drivers often don't have the right experience, either. In the opinion of employers in the road transport sector, the quality of work of those who start work and are just gaining experience is the biggest problem. Partially, vocational schools help in the fight against the lack of adequate staff, which in 2017 opened 136 classes with a mechanic driver profile (compared to 27 in 2016). However, this is not enough to fill the gap with the current forecast growth of the industry.

**Age structure of persons authorized to drive heavy goods vehicles in Poland, 2016 [%]**



Source: General Inspectorate of Road Transport

**THE SHORTAGE IS GROWING DESPITE THE IMMIGRATION OF DRIVERS FROM ABROAD**

The situation is similar with regard to employees from abroad - their inflow is not high enough to fill the labor supply gap. Currently, more than 65,000 drivers from other countries, mainly from Ukraine and Belarus (respectively 72 and 24 percent), but also from Russia and Moldova.<sup>1</sup> drive Polish heavy goods vehicles. Due to the exhausting availability of employees from Eastern Europe, carriers should consider the possibility of recruiting employees from other directions, in particular from Asian countries such as Uzbekistan, India, Nepal, Philippines, and Vietnam.

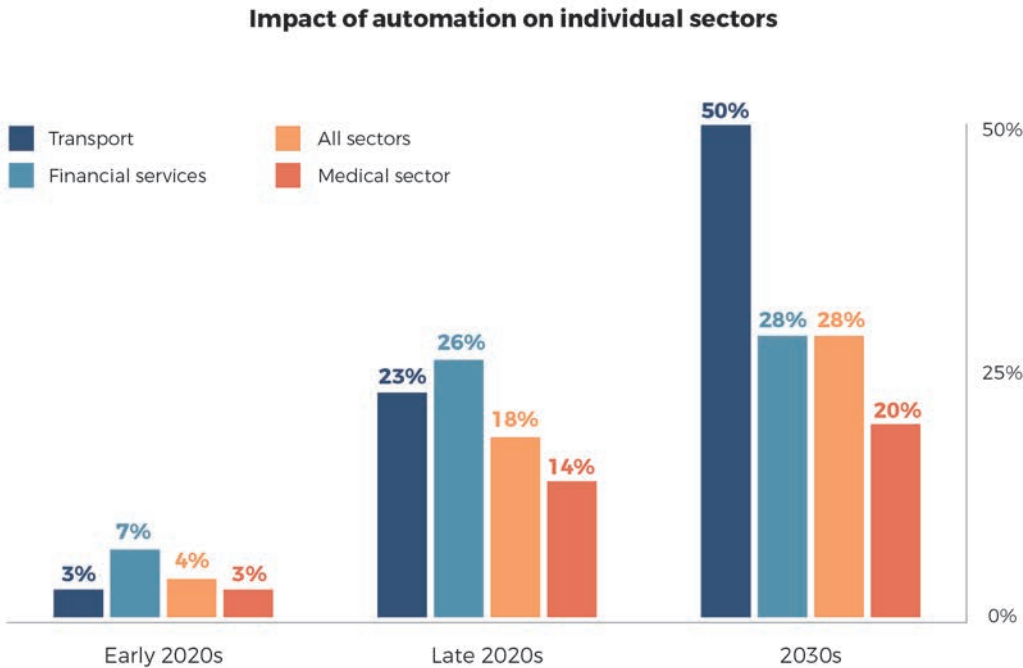
Despite the influx of immigrants and the opening of further classes with a driver-mechanic profile, it is estimated that the shortage of drivers in relation to 2015 (100-110 thou-

sand drivers) by 2022 may almost double and reach the level of nearly 200 thousand people. A shortage of employees, if it entails an increase in wages, will also indirectly lead to an increase in the costs of transport operations.

## AUTONOMOUS VEHICLES LATER, AUTOMATION A LITTLE FASTER

Autonomous transport can be the answer to long-term labor shortages in the TFL sector. According to PwC<sup>2</sup> analysis, since the end of the third decade of the 21st century, automation in transport will be faster than in any other sector. This is likely to have a positive impact on the industry and can help fill the growing staff shortages. It is estimated that at the turn of the 2020s and 2030s, 23 percent of current jobs in transport can be fully automated. This amount may increase in the 2030s up to 50 percent. After 2025, autonomous vehicles will allow reducing transport costs by up to 28 percent compared to 2016.

Logistics operators will feel the positive effects of technological development faster than carriers. Market leaders are already implementing technological innovations. For example, in 2017, the logistics and distribution center of the American Amazon group was opened in Kołbasków near Szczecin, which can boast of automated rack relocation using robots.



Source: PwC



The TFL industry will undoubtedly be the beneficiary of the new technological revolution. In Poland, autonomous vehicles will start to fill the gap in the driver's supply not earlier than in a five-year perspective, due to the current state of technological solutions development and the lack of law that would even regulate the testing of autonomous vehicles on the road. In the short term, improvement in efficiency in the industry can also be achieved through digitalization. This will be influenced by technologies such as: TMS, FMS, online service purchase platforms, robotic process automation and intelligent telematics-based transport systems. Such technologies will reduce the time-consuming administrative tasks of drivers and office workers. Telematics solutions also allow optimization of e.g. fuel consumption by vehicles.

## **COMMON INTEREST**

According to the PwC report mentioned at the beginning, representatives of the road transport industry expect an increase in costs in the range of 7-15 percent until the end of 2020 compared to the end of 2018. There are multiple reasons for this, including the effects of introducing provisions of the Mobility Package, a persistent shortage of drivers on the labor market, an increase in costs due to environmental regulations and higher price of road tolls. With the observed low level of margins in the road transport segment (EBIT = 3.72 percent in 2017), the increase of the expenses may lead to the elimination of the least effective entities from the market. It is highly likely that the rise in costs in the industry will be reflected in the increase in rates of transport services, which in turn, due to higher prices of products on store shelves, will be felt by consumers. Therefore, solving the problems of road transport is in the interest of both the government and citizens.



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## ALTERNATIVE FUELS - THE ELECTRIC FUTURE OF ROAD TRANSPORT

**The automotive industry is currently in a phase of revolutionary change. Companies from around the world are investing billions of euros in new technologies, such as digitalization, autonomous driving and - above all - electric drives. Along with increasingly higher emission standards, electromobility is becoming a strong trend not only in the passenger car segment, but also in the van and truck segment. What changes can we expect in the coming years in the area of road transport?**

According to data from the European Environment Agency, from 1990 to 2016, greenhouse gas emissions from the transport industry in the European Union increased by 26.1 percent, and in Poland by 162.4 percent. In 2016, in EU-28 countries, road transport was responsible for 72.1 percent of GHG emissions, and 28.65 percent of nitrogen oxides emissions. Vans, trucks, and buses generated 27.4 percent greenhouse gases on European roads (around 6 percent of all emissions), passenger cars - 43.7 percent, and motorcycles - only 0.9 percent.

In 2019, the European Union institutions, for the first time in history, decided to set emission targets for heavy road transport. The new regulations, which came into force on 14 August 2019, assume that from 2025, all truck manufacturers sold on EU markets will have to reduce the average CO<sub>2</sub> emissions generated by new vehicles by 15 percent – compared to EU average in the reference period (1 July 2019 – 30 June 2020). Moreover, from 2030, emissions will have to be further reduced by 30 percent. Also, in the years 2019-2024, a super-credits system will be in force, rewarding zero and low-emission cars.

In theory, the compromise worked out by the EU is to help meet the objectives of the Paris Agreement, contributing to the reduction of CO<sub>2</sub> production by about 54 million tonnes in 2020-2030. The European Union argues that the changes will also translate into economic benefits, especially among small and medium-sized enterprises, which will save significant amounts of fuel thanks to low- and zero-emission cars. According to forecasts, during five years of service life, a truck bought in 2025 will save 25,000 euros, and in 2030 - 55,000 euros. The degree of reduction in oil consumption in 2020-2040 will amount to as much as 170 million tonnes. Besides, the new law is to increase the level of innovation in the European economy, and GDP growth will create new jobs.

Currently, natural gas is a relatively popular alternative fuel for heavy transport. Compared to diesel, it reduces carbon dioxide, nitrogen oxides, and particulate matter (PM) emis-

sions. Zero excise duty on CNG and LNG for propulsion purposes, which has been in force in Poland since August 13, 2019, will affect the popularity of natural gas. Many truck manufacturers offer NGV models, such as e.g. Iveco, Scania, or MAN.

The introduced EU standards will undoubtedly lead to the popularization of electric vehicles, which have many advantages in terms of environmental performance. All-electric (BEV) and hydrogen (FCEV) models are virtually zero-emission - they generate neither carbon dioxide nor solid particles, nor nitrogen and sulfur oxides, i.e., compounds produced by combustion cars. An additional advantage of EV is the hushed operation of the drive system, which reduces noise pollution in the environment, a feature especially important at night.

Currently, electric vehicles constitute a small fraction of the new car market in Poland. According to the *Licznik Elektromobilności* published by the Polish Alternative Fuels Association and the Polish Automotive Industry Association, at the end of August 2019, 6,672 passenger cars with electric drive (both BEV and plug-in hybrids - PHEV) were traveling on national roads. In the first eight months of this year, 2,416 electric vehicles were sold in Poland, that's 89 percent more than in the corresponding period of 2018.

The electric trucks and vans fleet was much smaller at the end of August - 388 pcs. However, during the first eight months of 2019, a significant year over year growth of 163 percent (+ 96 items YOY) was also recorded in this segment. The above data shows that despite the dynamic increase in customer interest in low- and zero-emission vehicles, absolute numbers remain at a relatively low level.

The main barrier to the popularization of electromobility on a larger scale is the high price of electric cars compared to their combustion counterparts. As a result, many countries have introduced a system of support for potential EV buyers, which is designed to stimulate the market. Poland is no exception in this respect. Pursuant to the ordinance of the Minister of Energy on detailed conditions for granting and settling support from the Low Emission Transport Fund, in the case of entrepreneurs, the additional payment (or loan) to an all-electric M1<sup>3</sup> passenger car (price not exceeding PLN 125,000 net) will amount to PLN 36,000 PLN, car category M2<sup>4</sup> or N1<sup>5</sup> (up to PLN 70,000, category N2<sup>6</sup> up to PLN 150,000, and category N3<sup>7</sup> - even PLN 200,000).

**A limited market offer remains a barrier in popularizing EV, which is of particular importance in the commercial vehicle segment. Electric drives are implemented primarily for vans.** Some examples of BEV models available on the market are Nissan e-NV200, Volkswagen e-Crafter, MAN eTGE, Mercedes-Benz eVito, Renault Kangoo Z.E., Renault Master Z.E., and Maxus EV80. Plug-in hybrid vans are also an option, i.e., the Ford Transit Custom PHEV. Electrification in this segment is progressing very quickly.

For example, all Mercedes delivery models are to be eventually available with electric drive. The new EU standards enforce the introduction of zero-emission vehicles with a gross vehicle weight significantly exceeding 3.5 tonnes. Some companies have started intensive preparations for the upcoming changes. One example is Volvo Trucks, which implements limited production of electric models FL Electric and FE Electric. The permissible total weight of Volvo FL Electric is 16 tonnes, and the Volvo FE Electric - 27 tonnes. The FL Electric model can be equipped with lithium-ion batteries with a capacity of 100 to 300 kWh, and its range on a single charge was estimated at 300 km. In turn, the FE Electric model is equipped with lithium-ion batteries with a capacity of 200 to 300 kWh, allowing you to travel up to 200 km.

MAN also intends to offer electric trucks. The TGM model comes in two varieties. The 26-tonnes version has a range of up to 200 km. On the other hand, in the 18-tonnes version (truck tractor), it can drive up to 130 km on one load.

Mercedes presented the eActros model - in two variants, with a total weight of 18 or 25 tonnes, in a two- and three-axle version. The car received lithium-ion batteries with a capacity of 240 kWh, which were divided into 11 packages. The range of eActros is 200 km.

DAF has also developed an electric truck. The CF Electric model is the result of cooperation with VDL. The tare weight of this zero-emission truck is 9.7 tonnes. The vehicle is equipped with lithium-ion batteries with a capacity of 170 kWh, which provide a range of about 100 km on a single charge.

Tesla Semi gained the most significant publicity among commercial electric vehicles. Even before the production began, the vehicle was ordered by companies such as UPS, FedEx, PepsiCo, Sysco, and Anheuser-Busch, among others. **The first Semi vehicles were to leave the factory gates in 2019, but this deadline was postponed to the end of the following year. The range of the vehicle, depending on the version, is from 480 km (300 miles) to 800 km (500 miles) on a single charge.** To achieve this result, the car's energy consumption is below 2 kWh per mile traveled, and the low air resistance coefficient is 0.36 Cx. Semi has an impressive performance. Acceleration from 0 to 97 km/h (60 mph) at a maximum load of 36.3 tonnes takes 20 seconds, and without load - 5 seconds, i.e., faster than many sports cars. The vehicle can drive on a slope at an angle of 5 degrees at a speed exceeding 100 km/h - 30 km/h faster than its counterparts with diesel engines.

In the future, fuel cell cars, where the hydrogen reacts with oxygen to generate electricity that powers the engine, can become an alternative to models that draw energy from lithium-ion batteries. The only by-products of this process are heat and water. FCEV vehicles are also locally emission-free. Their advantages include large (compared to BEV) ranges and relatively short hydrogen refilling time. The disadvantages are very high prices and poorly developed (and also very expensive) refueling infrastructure. Manufacturers such as

Toyota, Scania, and Kenworth are working on this type of vehicle. **One of the new players on the market is Nikola Motor, which intends to start the production of hydrogen tractor units with a range exceeding 1,200 km on one refueling. The company has received an order for 800 vehicles from the Anheuser-Busch concern.**

Electric trucks in the vast majority of cases have much more limited ranges than cars powered by diesel, natural gas, or hydrogen. But most manufacturers emphasize that they are intended primarily for the supply or provision of municipal services in urban areas. Their popularization will be enforced not only by regulations implemented at the central level but also by local standards, especially regarding the creation of low-emission transport zones, which are being implemented by more and more European metropolises. Their consequence is ultimately to exclude combustion cars from city center traffic - and then the use of electric vehicles will become a necessity for many entrepreneurs. In Poland, vehicles running on natural gas and hydrogen are also entitled to unrestricted entry to clean transport zones.

# AUTONOMIZATION

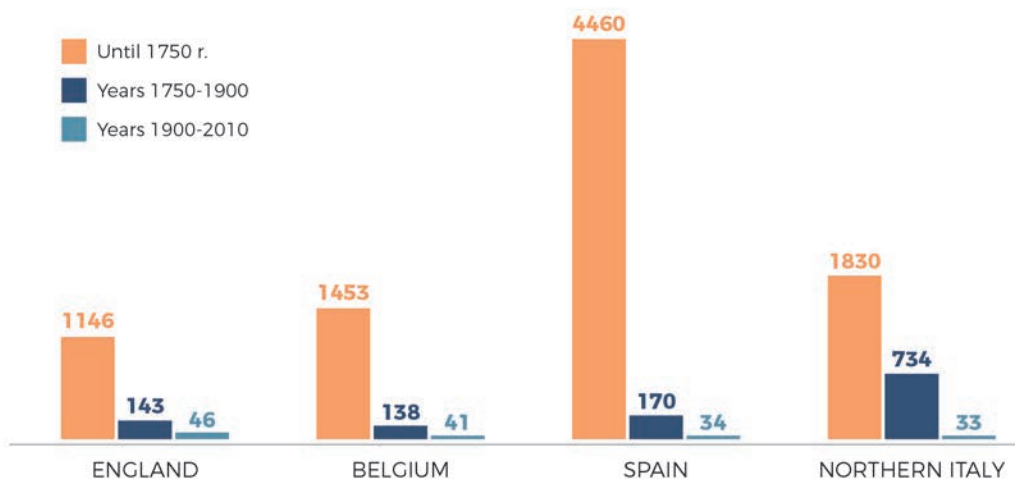
## AND DIGITALIZATION OF THE ECONOMY

**The digitalization of the economy is one of the most dynamic changes of our time. It can lead to both competitive advantage and loss. Despite this, the digital revolution is inevitable and will first affect industry and the broadly understood TFL industry.**

Fast economic growth is a relatively new phenomenon. According to the study E-development. Digital technologies and the economy, until the 18th century, economic development was unnoticeable in the scale of life of one generation, and the period needed to double GDP per capita was longer than 1000 years. The situation changed with the industrial revolution - in the 20th century GDP per capita doubled in developed countries every 30-40 years, which meant even a 4-fold increase in GDP per capita<sup>8</sup> during the life of one generation.

New digital technologies are spreading faster and faster in the world. Electricity in the United States needed 30 years to hit 10 percent of households. Landline phones needed 25 years, personal computers - 10 years, tablets - only just over 2 years. Currently, the digital revolution, which leads to a radical reduction in enterprise spending, is changing the way the economy functions at a galloping pace. Over the past 25 years, corporate investment in information and communication technologies (ICT) has raised Poland's GDP by more than PLN 180 billion.

**Number of years needed to double GDP per capita in a given historical period**



Source: "E-growth. Digital technologies and the economy" based on Maddison Project Database



Autonomization and digitalization can lead to both competitive advantage and loss. The problem is not only about whether and when to adapt to new requirements, but how to change your business to fully use the possibilities of intelligent solutions. Marek Prószyński from Trans.eu Group S.A. said that the TFL sector has all the resources it needs to meet its needs, "they just need to be released through digital technology and efficient management."

"Flexibility and technology are two words behind which lies the solution to the lack of economic resources. Digitalization has turned many large and stable businesses upside down. What was Nokia 10 years ago, and what is it today? Who remembers Kodak? Companies that were leaders in their markets a few years ago ceased to exist. Why? Because they did not notice or disregard the upcoming trend related to digitalization. Today, this is no longer a trend, but an irreversible force that is banging on the door at the TFL industry. Whoever does not open in time will fall out of business," says Marek Prószyński.

## WHAT IS DIGITALIZATION?

Digitization - a term widely used in economics. It is a series of strategic activities aimed at the best use of the potential of available IT solutions in the economy. Digitization can be defined as the sum of three components

Value of the ICT sector (information and communication technologies), in other words, government and business sector expenditure on technological solutions.

Value of the e-commerce market, i.e. the sum of purchased goods and services via the network (online).

The value of offline spending on digital equipment.

### KEY DRIVERS OF THE DIGITAL ECONOMY

- Internet of things
- Internet of all things
- Omnipresent connectivity
- Cloud based applications and services
- Big data analytics
- Automation, autonomization and robotization
- Multi-channel and all-channel distribution models for products and services

**THE PROGRESSIVE PROCESS OF DIGITIZATION OF THE ECONOMY CREATES NEW CONCEPTS FOR THE DEVELOPMENT AND IMPLEMENTATION OF INDUSTRIAL PRODUCTION, KNOWN IN POLAND AS PRZEMYSŁ 4.0.**

In Germany - **Industrie 4.0**

In France - **Nouvelle France Industrielle**  
Of the Netherlands - **Smart Industry**

Great Britain - **High Value Manufacturing Catapult**

Spain - **Industria Conectada 4.0.**

## DIGITAL PROGRESS IN POLAND

**According to the report by McKinsey & Company The Rise of Digital Challengers. Perspective for Poland, by 2025 digitalization in Poland will contribute additional PLN 275 billion to GDP.** This would allow achieving the level of digitalization of the most advanced economies in Northern Europe, so called Digital Frontrunners - Belgium, Denmark, Estonia, Finland, the Netherlands, Ireland, Luxembourg, Norway and Sweden. This is achievable because the pace of development of the digital economy in Poland has significantly accelerated.

"This process is developing at a rate of 7 percent annually. Three years ago, 6.2 percent of GDP came from digital services. In 2020, the impact of digitalization on GDP may be twice as large. Already today about 50 percent of Polish GDP depends on the flow of electronic data - as indicated by reports of the Ministry of Digital Affairs," assessed Jadwiga Emilewicz, Minister of Entrepreneurship and Technology, during the Congress Digitalization of the Polish Economy.

### The size and growth of the digital economy in Poland

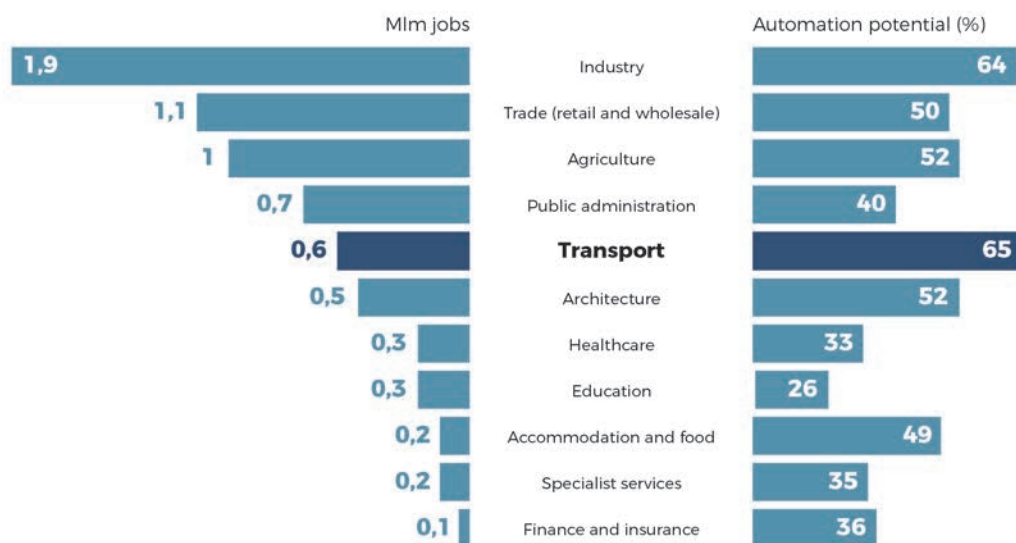
	Share of digital economy, 2016, % of GDP	Digital GDP per capita, 2016, €	Growth of digital economy, 2012-16, %	Growth of nondigital economy 2012-16, %
Poland	6,2	693	7,0	2,6
Digital Challengers <sup>9</sup>	6,5	746	6,2	2,6
EU Big 5 <sup>10</sup>	6,9	2264	3,1	1,2
Digital frontrunners <sup>11</sup>	7,3	3276	5,9	2,0
Sweden	9,0	4152	9,9	2,2

Source: McKinsey & Company, The Rise of Digital Challengers. Perspective for Poland (based on World Bank data), 2018.

Over the past decade, GDP growth in Poland has been mainly associated with employment growth and increasing productivity, which in turn is affected by progressive automation. According to expert forecasts, up to 49 percent of working time in Poland (equivalent to around 7.3 million jobs) is filled with activities that could be automated until 2030 using existing technologies. In Poland, transport, logistics, warehousing, and manufacturing sectors have the greatest potential for automation. This is evidenced by the analysis of experts from McKinsey & Company and "Forbes", who split employment data into 800 professions, to which they assigned individually 2,000 activities that require

18 types of skills. Calculation of the automation potential of individual activities and their share in the total working time showed that in the transport industry, the percentage of working time, suitable for automation using technologies available today, was 65 percent, in manufacturing - 64 percent, construction - 52 percent and in retail trade - 50 percent.

### Automation potential by industry



Source: McKinsey Global Institute

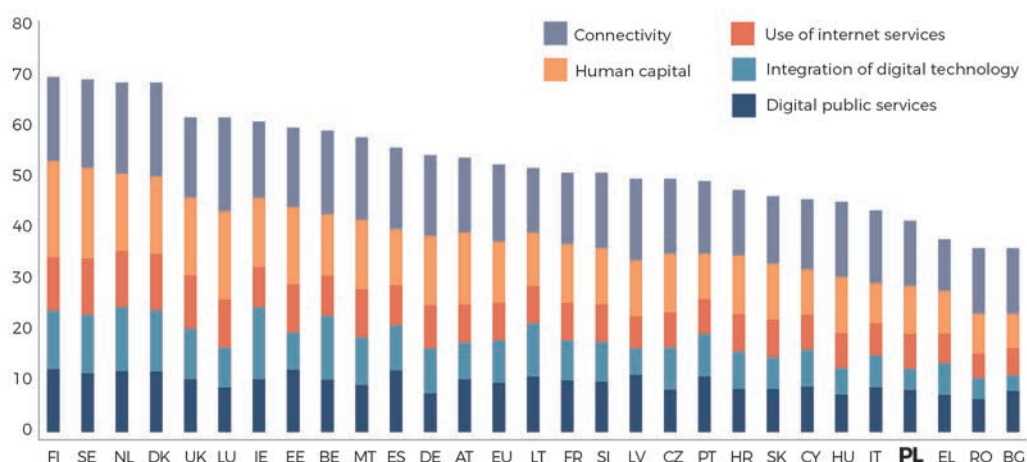
## MORE RESOURCES, FASTER PROGRESS

On June 11, 2019, the European Commission published the results of the "Digital Economy and Society Index" (DESI 2019). The purpose of the report is to assess progress in achieving the goals of the digital economy in the European Union, preceded by an analysis of 34 indicators from 5 main categories.

In the latest ranking from 2019, Poland fell from 24th to 25th place (Italy was ahead). Poland improved its ranking in terms of connectivity, human capital and internet use. A higher rate was also noted in the case of digital technology integration (electronic information exchange, large data sets, cloud, online and cross-border sales, social media).

The integration of digital technology indicator was 24.8, while the average EU result was 41.1. Why such a big discrepancy? The digital revolution in Poland is just beginning. The development of the economy depends on the increase in productivity, demographic growth,

## Digital Economy and Society Index (DESI) 2019 ranking



Source: The European Commission

investment outlays, development of energy and logistics infrastructure. Paul Romer, one of the greatest contemporary economists, drew attention to the fact that in addition to the main sources of value in the economy, which are work, capital and knowledge, there is one more important - rules. They guarantee the opportunity to benefit from the invested capital or to promote innovation that is currently taking place in the economy. Lack of rules results in an economic slowdown, especially in a region which - like the European Union - is divided into at least several zones in terms of development. Fortunately, the EU's efforts to unify the market are already bearing fruit. European Commission funds can help achieve the level of digitalization of the most advanced EU markets in this respect.

"The Digital Single Market provides a legal framework enabling citizens and businesses to reap the full benefits of digital transformation. Our goal was to adapt the EU budget to future challenges: digital transformation is taken into account in all proposals - from transport, energy and agriculture to health care and culture. To strengthen this trend, we are now proposing more investment in the fields of artificial intelligence, supercomputers, cybersecurity, digital skills and e-government," said Andrus Ansip, Vice President of the European Commission and former European Commissioner for Digital Single Market.

"The first pan-European digital program is extremely important in strengthening the leading role Europe plays in the world in terms of digital transformation. One of the main pillars of the program are investments aimed at acquiring advanced digital skills by citizens, enabling them to access and use the latest digital technologies," emphasizes Marija Gabriel, European Commissioner for Digital Economy and Society.

The European Commission plans to allocate EUR 9.2 billion for the new digitalization program in the EU countries in the financial perspective 2021-2027. The pool is to be divided as follows:

**EUR 2.7 BILLION** to finance projects for the development and strengthening of supercomputers and data processing, which is to ensure their more effective use, including in the small and medium-sized enterprises sector.

**EUR 2.5 BILLION** for the dissemination of artificial intelligence throughout the European economy, so that even the smallest enterprises have better access to research facilities and to carry out experiments in this field.

**EUR 2 BILLION** in protecting the digital economy and financing the most advanced cybersecurity devices and infrastructure.

**EUR 1.3 BILLION** for the digital transformation of administration and services of general interest, which aims to facilitate enterprises, in particular small and medium-sized enterprises, access to technology and know-how as well as facilities for analysis.

**EUR 700 MILLION** to help small and medium-sized enterprises and public administration deliver training and internships for their employees in order to acquire advanced digital skills.

## OPPORTUNITY, NOT A THREAT

Different sectors of the economy are susceptible to digital transformation to varying degrees, including in the scope of necessary changes. The data presented in the PwC report “CEE Transport & Logistics Trend Book 2019” shows that **68 percent of CEOs from the TFL sector in the world expect changes in basic technologies for the provision of services, while 65 percent expects changes in distribution channels.**

“One of the most critical trends affecting all sectors of the economy is digitalization, including in transport and logistics. However, here we see other, equally important factors that shape changes in this segment. Starting from changes in consumer behavior, i.e., a shift towards online shopping, through the lack of availability of personnel in Europe and changing labor law regulations, to investments in infrastructure as well as changes in contracts and relations in the international trade arena that open new transport routes



## Forces shaping transport and logistics



Source: <https://www.slideshare.net/PwCPolska/cee-transport-logistics-trend-book-2019-pl-120545296>

between Europe and Asia,” says Michał Mazur, partner at PwC, leader of the transport and logistics team.

PwC experts emphasize that companies from the TFL sector can use digitalization to increase revenues, simplify procedures, transform services, products, and business models, and reduce the impact of the lack of qualified personnel.

“We can expect that digitalization will change the way consumers interact with companies, which is already evident in the procurement of services provided via the internet and on mobile devices, ranging from personal transport services, through taxi services, to car-sharing and public transport tickets. Such services may soon cease to be perceived as particularly innovative,” says Maciej Starzyk, manager of the transport and logistics team at PwC.

“Digitalization is primarily an opportunity, but only for those who can accept the upcoming changes and are flexible enough to respond to them appropriately and prevent a crisis. It is worth noting that in Chinese, the word crisis (“weiji”) has two meanings. The first means danger or threat; the second is the beginning of a new path or opportunity,” emphasizes Marek Prószyński.

There are many examples of “weiji” in this positive sense. The UPS logistics operator has used algorithms to minimize the number of left turns. As a result, the company saves 4.5 million liters of fuel per year, minimizes CO2 emissions by 20 thousand tonnes, and delivers 350,000 packages more.

The Danish sea carrier Maersk Line uses predictive analytics to reposition empty containers better. Thanks to the information on the degree of utilization of individual vessels, the company can save millions of euros (the cost of transporting empty containers for Maersk is over 900 million euros per year). Girteka Logistics has also invested in creating a dedicated algorithm, which services approx. 7.5 thousand shipments per week. The technology worth almost one million euros will allow the carrier to match drivers with vehicles and to manage loads better, taking into account the dimensions, weight, and type of loads, as well as the type and parameters of vehicles. The self-learning algorithm will be able to plan transport for 5,000 trucks.

Digitalization of the economy manifests in giving the industrial products additional functionalities. This applies to means of transport in particular. Automotive companies initially saw the opportunity to increase the ability to compete on the market by expanding the use of electronics in individual car assemblies. They changed their attitude when they realized that the integration of information and communication technologies allows much more than improving traditional products, e.g., enriching the equipment and increasing the technical performance of manufactured vehicles (Monograph of the European Finan-

cial Congress "Digitalization of the economy and society. Opportunities and challenges for infrastructure sectors" under the auspices of the Gdańsk Institute for Market Economics, edited by Jerzy Gajewski, Wojciech Paprocki and Jana Pieriegud).

Autonomization and virtual haulage services market have become a field of expansion for manufacturers of means of transport. It is characterized, among others, by providing a virtual fleet of road transport means. The virtual fleet is created in accordance with the principles of sharing economy (economic model based on the sharing of underused resources and services).

Daimler is a good example when it comes to using the virtual fleet. The company introduced the CAR2SHARE Cargo project to the market of transport services. It has separated some of the manufactured delivery vehicles and made them available to the virtual fleet, which consists of two elements: vehicles owned by Daimler and vehicles already sold and at the disposal of dispersed owners. The data used is transferred between persons and devices.

Another project created by Daimler is a digital truck ID, Truck ID, connected with a virtual wallet - Truck Wallet. They are saved - currently in prototype versions - in a cryptographic processor in the form of encrypted software programs. The information stored in the wallet is sent to another device via WLAN. The solution can be widely used, e.g. to simplify the service of toll collection from trucks (currently the driver must enter the data into the system manually), provide the truck with the option of sending digital shipping documents, taking over partial control and accounting for subcontractors by verifying when the given truck was used by the driver. With this solution, it is also possible to support vehicle leasing and short-term contracts - the customer can pay directly in the vehicle, and the truck is able to decide on its own whether the appropriate conditions have been met.

Progress in the automotive industry is an excellent illustration of the fact that technology development is a self-propelling process. Robert Metcalfe, creator of the Ethernet network protocol, said that the usability of computer networks increases in proportion to the square of the number of nodes in the network. What does it mean? Two computers are two computers, and their potential is the same. In the meantime, if we combine them, their capacity is much higher. Even 15 years ago, driving was considered a function which can never be autonomized, due to its complexity. This belief persisted even more for trucks carrying multi-tonne and valuable loads. Today, however, we know that the introduction of autonomous (unmanned) vehicles is inevitable.

In June this year, an autonomous, connected to the network and electric vehicle Volvo Trucks Vera is part of an integrated solution to transport goods from a logistics center to a port terminal in Gothenburg (Sweden). This is the beginning of a larger project under which the company will implement a networked system consisting of several vehicles



monitored by a control tower. The system will enable a smooth and continuous flow of goods. Unmanned trucks will also be used this year by the Russian manufacturer KamAZ. As part of a Odysseus Kamaz project, the company will use the existing infrastructure inside the plant to transport finished parts from the production line to the warehouses.

Will autonomous trucks also appear on public roads? No doubt, though, it's hard to say when. The first tests were successful - in 2016, autonomous DAF, Daimler, IVECO, MAN, Scania and Volvo vehicles set off from various places in Europe, including from Sweden, Belgium, and Germany to arrive in Rotterdam, Netherlands. Connected through Wi-Fi, the cars moved independently in columns consisting of 2-3 vehicles and kept a constant pace. One man supervised the vehicles, whose task was to intervene in the event of an incident. All trucks reached their destination without hindrance. It was the first experiment of this type in Europe, although not the last. Unmanned truck test periods have just begun on public roads in Sweden. The unmanned 26-ton Einride T-Pod is controlled by a 5G network. The truck travels a distance of about 300 meters between the warehouse and the freight terminal for DB Schenker in the city of Jönköping. The tests will last until the end of 2020.

The development of digital technologies in trucks is a manifestation of the implementation of the concept of Industry 4.0 in logistics systems. TFL sector will be the first to make full use of the autonomization of transport means. Relatively uncomplicated road conditions, enabling independent driving, lack of staff, and the need for quick deliveries are some of the conditions favoring the transition. In this way, digitalization and autonomization will go beyond the confines of closed spaces (factories, warehouses) and reach the outdoor sector, creating the concept of Logistics 4.0.

## SHARING ECONOMY AND INSTANT PRICING

**The study by Jerzy Janczewski from the Academy of Humanities and Economics in Łódź shows that by 2025 global revenue from sharing economy will contribute as much as 335 billion dollars in five key areas (financial services, transport, hotel industry, tourism and staffing). How big will be the contribution of road haulage sector? Time will tell. Experts, however, argue that this is one of the main trends that you should be interested in. “The first attempts are made to create open supply chains in which data is constantly exchanged with customers, which leads to business optimization,” says Dr. Halina Brdulak, associate professor at the Warsaw School of Economics. Such optimization means cost reduction by 20 or even 30 percent. As you can see, it is worth the effort.**

The idea of sharing economy is not new. Already in the 1970s, American researchers wrote about sharing economics, focusing on sharing goods with other users. Today, sharing is becoming one of the most important trends in the economy and it seems that it can cover almost anything. It enables the use of cars and apartments by many different people, exchange of used handbags, toys and even free time.

“It is estimated that worldwide, up to 5 percent of the market is based on the sharing economy. We want and need to share, which is largely due to market trends: high demand for specific goods and services, the need to focus on the effectiveness of business activities, savings, ecology,” argues Dr. Marian Noga, economist at the WSB University in Wrocław.

### WHERE DOES THE SHARING ECONOMY BOOM COME FROM?

It is the result of a “collision of megatrends,” whose presence should be taken into account, regardless of the type of business. According to PwC, we are talking primarily about:

- 1. The technological breakthrough**
- 2. Limited access to resources**
- 3. Urbanization**
- 4. Demographic and social changes**

To see the potential of these megatrends, just look at the data. Today, almost 4.4 billion people worldwide have access to the Internet, and over 5 billion to mobile devices - according to the latest Global Digital Report 2019. As early as 2011, it was estimated that "by 2020 there will be 7 times more connected devices than people."

It's not everything. PwC, referring mainly to passenger cars, states that "on average, a car is effectively used for only one hour a day". Truck data is also meaningful. Depending on the research (Chinese, American) - from 25 to 40 percent of vehicles are used inefficiently (due to insufficient or even zero filling of the cargo space).

Changes in business are also dictated by social changes, i.e. active entry into companies of the generation of the so-called millennials (also to managerial positions), for whom the use of modern technologies and peer-to-peer systems (a network of equivalent dependencies based on communication between everyone) and ecological trends (closing diesel city centers, reducing CO2 emissions) is an everyday reality.

"The whole joke is, however, that the sharing economy is based on trust. And it's a two way street with trust," comments Dr. Marian Noga.

That's a fact. 46 percent of Poles aged 16 and over do not trust strangers. The situation looks better, and that's understandable, when it comes to relatives or, from a business point of view, with colleagues. 98 percent trust the former and 82 percent the latter - according to data from the Central Statistical Office of Poland for 2018. For a more complete picture, it is worth looking at trust in specific industry institutions. According to the global Edelman Trust Barometer 2019 ranking, the TFL industry and other closely related industries have something to brag about - **the transport industry is trusted by as much as 68 percent of respondents, commerce industry - by 69 percent, and the automotive industry - by 70 percent.** The latter increased by 2 and 7 percentage points respectively during the year, while in the case of transport they remained at the same level.

## EFFICIENCY ABOVE ALL

"Sharing company data does not mean revealing all cards. It can instead help the company gain much more than when it closes to the outside world," assures Dr. Halina Brdulak.

"Sharing economy seems crucial specifically in the case of transport - a segment that is certainly an important branch of the national economy. It certainly creates GDP, and therefore prosperity. At the same time, however, it depends on production and trade. Therefore, you cannot create growth determinants from it, on the contrary," says Dr. Marian Noga, adding that there are many indications that it would be better to reduce the number of transports, even noticing one of the biggest problems of the industry: one carrier goes empty, while another has so many loads that it lacks cars. For both, this situation is unprofitable. Therefore, it is worth remembering that developing transport is necessary, but it must be done effectively.

Dr. Noga points out that it is worth thinking about tools that would show a full picture of the load market and make it possible to share storage space, goods and cars. "This is what access economics is all about," he adds.

## THEY ARE RACKING THEIR BRAINS

The need brings about solutions. Limited space for storing goods is a good example. And almost everyone begins to reckon with it. American startups MakeSpace and Omni, which help small entrepreneurs and even private individuals in finding temporary warehouse spaces in cities, exemplify this trend. The concept of urban discreet warehousing, to put it simply, means that home, office, garage, storage or basement owners can share free, unused space with those who need it to store their belongings.

"A merciless trend of rapid urban density requires it. It is estimated that about 66 percent of the global population, will be living in cities by the year 2050," reads Sharing Economy Logistics - Rethinking Logistics With Access Over Ownership report.

**However, it should be remembered that the problem with a large number of loads on one hand, and empty, unused spaces on the other, does not bypass the TFL industry. Quite the opposite - it becomes a challenge over which the giants are racking their brains.** It seems necessary to create applications and platforms that enable establishing communication between the two extreme poles of the problem with the cargo space.

One such platform is DHL Spaces, which allows you to search for free storage space, check its location, size, and even book it in advance. The American startup Flexe works similarly. It collects data on unused warehouse space available to external companies (it is estimated that it has over 370 warehouses). In the European Union, there is Wareh.com, which operates with a base of nearly 6,000 verified and secure warehouses in 26 countries. A unique feature is that transactions on Wareh.com are concluded similarly to popular booking websites offering accommodation.

## THE PROBLEM OF EMPTY TRUCKS

The problem of unused cargo space in trucks is similarly demanding. The data speak for themselves. "One in four trucks on the road in the U.S. and Europe is driving empty and, among the loaded trucks, typically only just over 50 percent loaded," according to the report Sharing Economy Logistics.

And again - companies are building platforms to connect shippers with goods, with carriers who, for example, do not want to return empty from an area where it is difficult to find a return load. This is how platforms like Saloodo!, Convoy and Huochebang work. This type of connection between various participants of the supply chain, even those who have not previously cooperated with each other, is also made possible by the Tff (Trans for Forwarders) application, i.e. a tool that automates all transport management - from freight acquisition to finding a carrier. Metrix is another platform that offers features such as a map of loads throughout Europe.

## DOZENS OF PALLETS INSTEAD OF ONE

Sharing economics, according to practitioners, also means close cooperation with subcontractors. When the company's own capacities are insufficient, subcontracting can be beneficial both in terms of price and quality.

**"In fact, the sharing economy is very deeply rooted in transport, even in such a way that most logistics companies do not have their own fleet, but operate based on contracts with subcontractors,"** comments Marek Pluciak, solutions design manager at Raben. Raben, as the largest logistics operator, has also signed contracts with permanent subcontractors - this is a European model of cooperation of logistics operators in the field of transport. On the other hand, when it comes to courier services, they cooperate with courier companies specializing in this field.

"We build the cost-effectiveness of transport by consolidating several shipments from different customers, delivered to one recipient," adds Marek Pluciak.

This is just one example. In the case of groupage transport the company repeatedly combines many different shipments from different customers in one transport, thanks to which it saves, e.g. on the number of routes. The customer also saves because handling one pallet for one contractor is much more expensive than when combined with several dozen others.

## OPENING TO NEW POSSIBILITIES

Since we are talking about prices, it is worth realizing the presence of another trend, closely related to sharing economy - instant pricing. "This trend has developed, among others, thanks to the Internet of Things and Services. Gradually, it turns out that almost everything can be valued immediately, without a lot of work. The key, however, is one - possibly comprehensive and wide exchange of data between enterprises," explains Dr. Marian Noga.

"Business intelligence, electronic business support and decision making are the future. People managing transport in the company must have the most comprehensive systems that will collate data and suggest the best solutions," he adds.

"For all this to function properly, however, it is necessary for the company to have access to data on the entire economic environment, as much information as possible from other companies in the industry, algorithms that will analyze and compile these data, and a team, which includes sociologists who will be able to track the results and related customer behavior. Not only based on the past, but also able to predict trends of the future," echoes Dr. Halina Brdulak.

Industry representatives talk about the need to develop this type of solutions. "In domestic distribution, individual valuations are not as popular as in international distribution, and the market currently does not signal the needs of this type. In turn, international distribution has a strong need for fast "spot" valuations (instant quotes, one-off offers), which is why we have the right tools in this product to meet the demands of our customers," confirms Marek Pluciak.

## LOGISTICS 4.0.

### AUTOMATION IN THE SUPPLY CHAIN

**“The history of logistics is at the same time the history of automation, from the steam engine, through the forklift, to today’s order collecting and packaging robots,” argues the American consulting firm McKinsey & Company. Such a relationship requires investment, something that business managers are now beginning to realize. Nearly 70 percent of CEOs from around the world count on the fact that the basic technologies of providing services will change. Slightly less, 65 percent believe that the changes will affect distribution channels. “The sector will change under the dictation of digitalization, shifts in international trade, software solutions, internal changes in trade and the development of solutions in the field of machinery and equipment,” according to the PwC report “CEE Transport & Logistics TrendBook 2019”.**

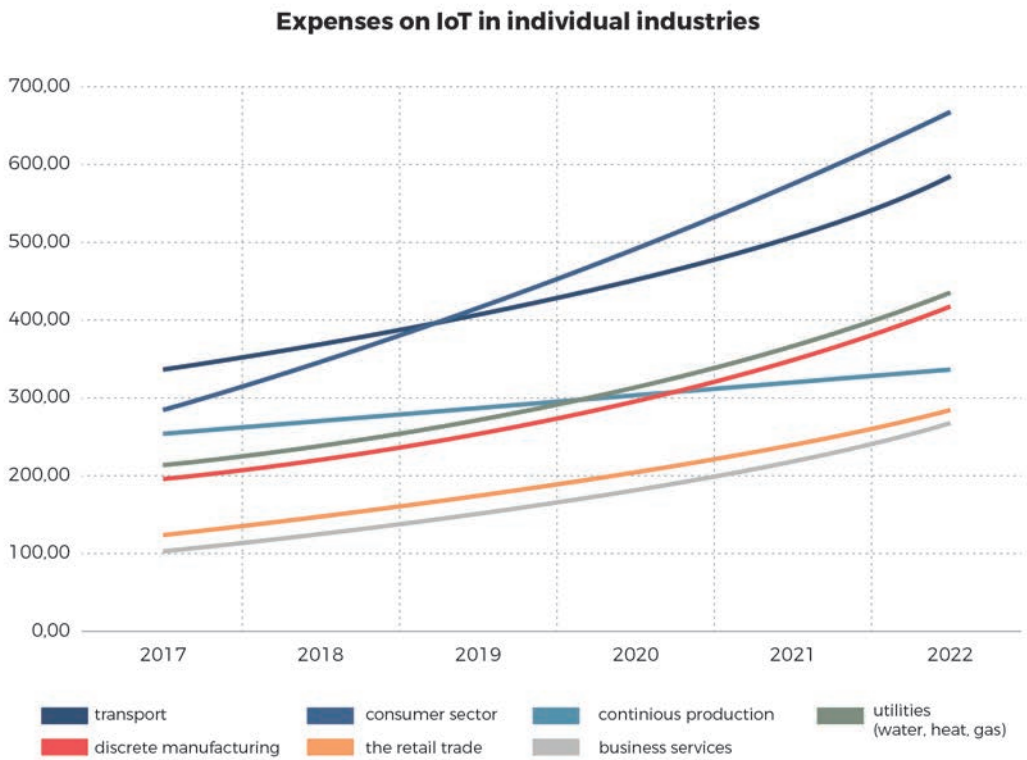
“Digital maturity should be understood as the ability of an organization to build an effective business strategy and gain competitive advantage through the use of digital solutions,” instructs the Digital Economy Lab.

What solutions are we talking about? First of all, about digitalization, artificial intelligence, Big Data, blockchain and the combination of various products and services within the Internet of Things (IoT). In the industry sector alone, investment in such solutions is expected to bring additional revenues of 2 to 3 percent annually, according to researchers. According to forecasts, efficiency will also increase by nearly 18 percent until 2020.

Companies are therefore preparing for changes. Over the next five years, in four out of five enterprises, the value chain will be digitized (a concept that divides activities performed in the enterprise into categories of valuable activities, including but not limited to supply, logistics, supply and service of products). By 2020, investments in IoT are expected to reach up to EUR 140 billion per year - according to PwC calculations. This is the situation in industry. However, changes in this sector will necessitate changes in closely cooperating industries, such as the TFL sector.

In transport, expenditure on IoT is steadily rising. And to such high levels that only the consumer goods sector is overtaking this industry. Last year, USD 367.43 million was allocated to the Internet of Things in transport. It is estimated that this year it will reach 404.24 million, and in the next - 450.29 million. In 2022, this sum may reach almost USD 590 million - according to the estimates presented in the ‘IoT in the Polish economy’ report prepared

by the Internet of Things (IoT) Working Group, which was established in 2018 at the Polish Ministry of Digital Affairs.



Source: Worldwide Semiannual Internet of Things spending in specific industries, June 2018

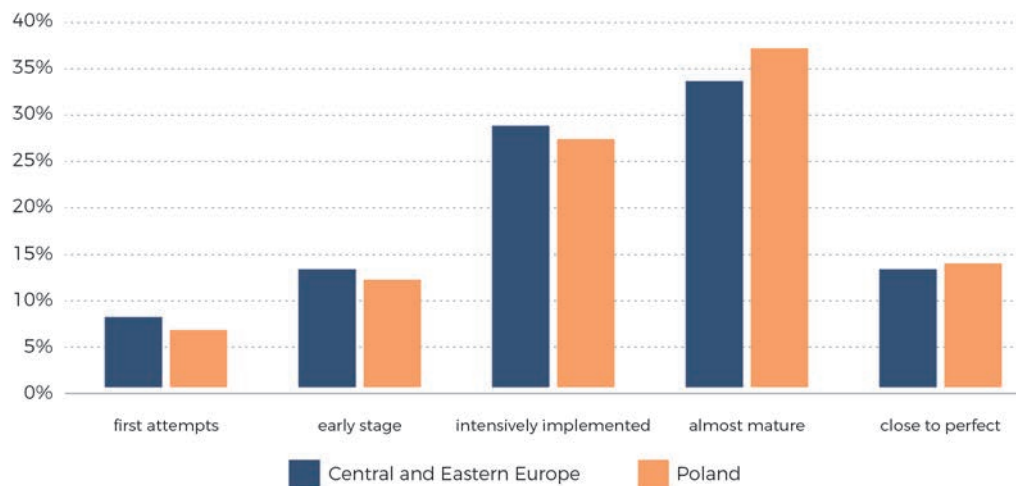
As the experts working in the said group argue, compared to the whole world, countries of the Central and Eastern Europe look moderately - certainly below the level presented by Western Europe and North America, at least in terms of the number of companies that deal with the implementation of solutions that support the IoT. Nevertheless, Poland is doing quite well in this region.

Compared to other countries, there are more companies that declare that they are at the “almost mature” or “close to perfect” level of adoption of digital transformation solutions.

The coming years will be very dynamic. The working group of experts for IoT forecasts that within the next few months, “70 percent of organizations will use commercial IoT platforms to develop and implement IoT applications, and over 50 percent will have environments built from IoT platforms from many suppliers.”



### The declared level of adoption of Digital Transformation solutions in Poland against the background of Central and Eastern Europe



Source: IDC CEE Digital Transformation Survey, 2017; N = 311

"In the coming years, a high growth rate of the IoT technology and solutions market (about 13 percent year-over-year), is expected. This means that the Polish economy has a great chance to absorb this technology, and if the existing restrictions are removed, this potential may increase further. Barrier removal, including in terms of regulation or development of new communication technologies (including 5G), will bring dynamic development of IoT in Poland," the experts ensure.

## ERRORS - HUMAN DOMAIN

The TFL industry is aware of the potential of IoT. "Companies must keep up with the needs of customers and quickly respond to challenges posed by the supply market. It is necessary to modify the way of thinking and be ready to flexibly adapt to changes that take place very quickly and cover many areas. Even 20 years ago, no one thought about autonomous trucks that move without a driver. Today, such vehicles move on public roads between the DB Schenker terminals in Sweden. The digital revolution requires companies to create new solutions," admits Marta Miciałkiewicz, IT Management Lead at DB Schenker.

Marek Pluciak, solutions design manager at Raben states that "the integration of IT systems of logistics operators involved in the supply chain is key. Maybe not for the whole chain, but in the initial phase, certainly for its key nodes. Hence the need to standardize solutions and carriers."

"It's nothing unusual. It is necessary today, for example, to constantly analyze an increasing amount of data and correct flows in the network. Based on this information, it is possible to create and analyze plans for the future. Unfortunately, the quality of the analyzed data is not always the best, which is largely due to the need of involving a human being in their generation. Some data can be obtained automatically, others, unfortunately, must be entered manually. And that's where errors sometimes appear," he adds.

## **WORK FROM SCRATCH IN THE COMPANY**

Automation is the solution. However, experts warn that it is not enough to invest in additional sensors, telematics and the Internet of Things in connection with the most sensitive procedures.

"The key is to build a strategic transformation plan in the company. Success will not be ensured by modifying one process, but by rebuilding the entire activity," advises Dr. Andrzej Bujak, professor and head of the Logistics Institute at WSB University in Wrocław.

"You have to start from scratch, i.e. from investment in human resources. Preparing employees for technological change will make them able to take advantage of new opportunities and understand the need to implement new solutions. Next, we must make an assumption of what we want to achieve as an institution in this digitalization and automation. What exactly do we want to digitize and to what extent. Also think about who to work with and connect by exchanging data," he adds. Dr. Bujak advises to create the so-called mind map (concept developed by Professor Hans-Christian Pfohl from the European Logistics Association).

It involves analyzing:

- what is the basis for the main processes in the company,
- where are the biggest barriers,
- where the largest losses are incurred,
- what are the links between the various activities in the company and how should flows be organized between them,
- what should be done to achieve efficiency gains.

## **LOOK AT GLOBAL TRENDS**

Transformation based on digital revolution is crucial for several reasons. "If we look at Polish dynamics of trade exchange, we will see that invariably nearly 30 percent of export goes to Germany - a country that consistently introduces solutions related to automation and digitalization. Nothing unusual. The concept of Industry 4.0, from which it all began, was

created in Germany. When the key partner, with whom you have the largest trade turnover, changes, you have to keep up with it,” advises Dr. Andrzej Bujak, professor at WSB University in Wrocław. “Otherwise you may run off course. A German company, who has different expectations for the exchange of information and the implementation of the flow, will focus on automation, and not e.g. on e-mail exchange. It will give up on suppliers who cannot keep up with the changes,” he warns.

Global trends require digital solutions. “First on the list is an aging population. Companies should start to focus on the Y and Z generation, which is now entering management positions and has specific expectations in terms of achieving goals, work behaviour and spending free time. They are people for whom the use of modern technologies and automating operations is the norm,” explains Dr. Halina Brdulak, associate professor at the Warsaw School of Economics. “Second trend is the climate change and ecological movements that correspond to it, third, globalization and regionalization and fourth - the digitalization itself,” says Dr. Brdulak.

According to experts of the Working Group on Internet of Things, the focus on digital technologies will:

- reduce human error, which is the most important cause of accidents in transport sector,
- help create a multimodal transport system combining all types of transport into one integrated service that will allow efficient transport of people and loads from door to door,
- reduce the energy consumption and exhaust emissions.

## THE INDUSTRY HAS CONCERNS

First, however, it is important to face a number of barriers, which include “quite large investment costs, lack of experts and well qualified staff that understands the needs of the market, and mentality,” mentions Dr. Andrzej Bujak, professor at WSB University in Wrocław. “Talking to company representatives I heard many times: ‘I know about automation, but this is not the moment. Everything works fine for me, I’ll wait until things break down.’”

That’s when it may be too late according to experts. The industry also has concerns about the security of the data it is exchanging. Another major factor that is stopping companies from investments is the uncertainty about what partners are planning.

“Many say ‘I introduce changes, automate processes, but I am not sure if these changes will affect my business. If contractors don’t go in the same direction, what will happen to these changes?’” notes Dr. Bujak.

## FROM EXOSKELETONS TO RPA

Despite the fears, automation is taking place. The warehouses use AGV (automated guided vehicles), i.e. automatically controlled vehicles that transport pallets and cartons. The so-called swarm robots are also used, work on a problem like a swarm, operating according to written algorithms. Drones and exoskeletons help people.

In many tasks, the Internet of Things and artificial intelligence can even replace humans. "Algorithms can perform, for example, the work of a forwarder who quotes. Thanks to this men can do something more creative," indicates Dr. Halina Brdulak.

The goal is primarily to look for savings at individual stages of the supply chain. Different companies do this differently.

"From the point of view of a logistics company, it is necessary to deeply analyze and identify individual areas of operations that need improvement or adaptation to the new environment. Of course, we analyze the network on an ongoing basis and search for the possibility of introducing solutions that optimize processes and flows. Currently, it is difficult in our conditions to automate distribution - there are no tractors that drive without drivers, and AGV trucks that can unload goods at cross dock without human intervention, are not yet cost-effective for logistics operators," explains Marek Pluciak from Raben.

"We have tools based on a data warehouse, regarding the distribution and flow of goods through warehouses, which will enable the creation and analysis of data at the user level - without the support of the IT department in obtaining it. And this is associated with a great savings of time, because as practice shows, the demand for IT department support is very high," he adds.

"We also use a specialized calculation tool for modeling processes and flows, finding bottlenecks and optimizing networks," reveals Pluciak.

DB Schenker is also aware of the need to modify the company's operations in terms of logistics 4.0. "RPA (Robotic Process Automation) is one of the tools supporting the supply chain automation. This digital employee can replace a person in tedious activities. Thanks to the fact that it is digital, it doesn't get bored and doesn't make mistakes resulting from inattention or lack of concentration. Thanks to robotization and automation, many repetitive tasks can be performed much faster. RPAs at DB Schenker in Europe perform over 130 processes. Each robot gives different savings, so it's difficult to clearly estimate the benefits. First of all, we note that RPAs allow the employees to change the way of thinking and encourages them to look for processes that require automation," explains Marta Miciatkiewicz, IT Management Lead.

"We also focus on the development of the Internet of Things, and examples of our activities are smartboxes that measure all parameters of shipments. They inform about their GPS location, temperature, shocks and humidity. Before their implementation, customers themselves analyzed the information about transported goods through the data loggers inserted into the packages. However, they did not receive real-time information. Today we want to give them such an opportunity by choosing the right service on the site," she adds.

According to industry representatives, this type of investment is necessary to keep up with the most important trends in TFL sector. "One of the most important trends is the availability of tools for tracking shipment parameters. Customers can and want to check their location from anywhere in the world. They are able to order the transport of goods quickly and easily, e.g. using the application on the phone. Consumer expectations have necessitated changes in the method of delivery. Increasingly, the customer, apart from information about the location of his package, is also informed about the route traveled or the date of delivery. Equally important is the order reporting system, as well as a transparent and clear way of exchanging information with the customer," explains Bartłomiej Centlewski, head of IT Management Land Cluster NEE at DB Schenker.

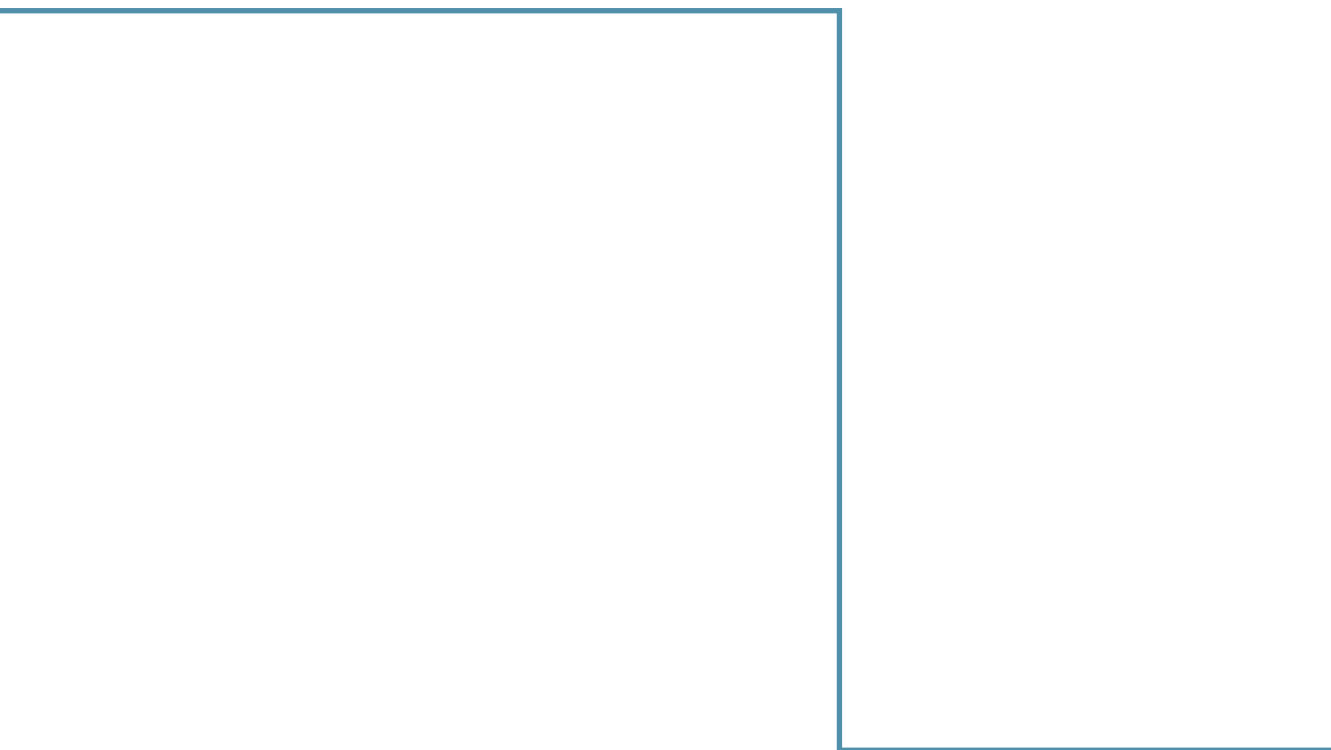
"One of the continuing trends is also the creation of systems in which there are more and more autonomous elements, self-steering machines, collision-free transport and dynamically planned routes depending on the traffic volume," he adds. It also draws attention to a new concept that is becoming increasingly popular, i.e., blockchain.

"This system allows decentralization of data by processing it in the cloud. The solution is forward-looking and flexible - it can result in the creation of one platform for everyone, both for operators and customers," explains the expert. "The result will be a reduction in costs and standardization of messages and documents. Profit will become visible to the entire industry, because it will solve the problem of having your own platforms and any costs associated with them. This will give you the ability to dynamically scale your resources."

"We also notice the trend of full process automation. One example is the auto-replenishment (supplementing) of the customer's warehouse, which is programmed to use the so-called safe stock, i.e. secure inventory. When the warehouse system shows that the products are starting to reach minimum levels, they can order the relevant goods or components, without human assistance. They will appear in the forwarder's system and will be delivered to the place. All this is carried out according to a set scenario, taking into account all services (VAS), regulations and standards," adds Centlewski.



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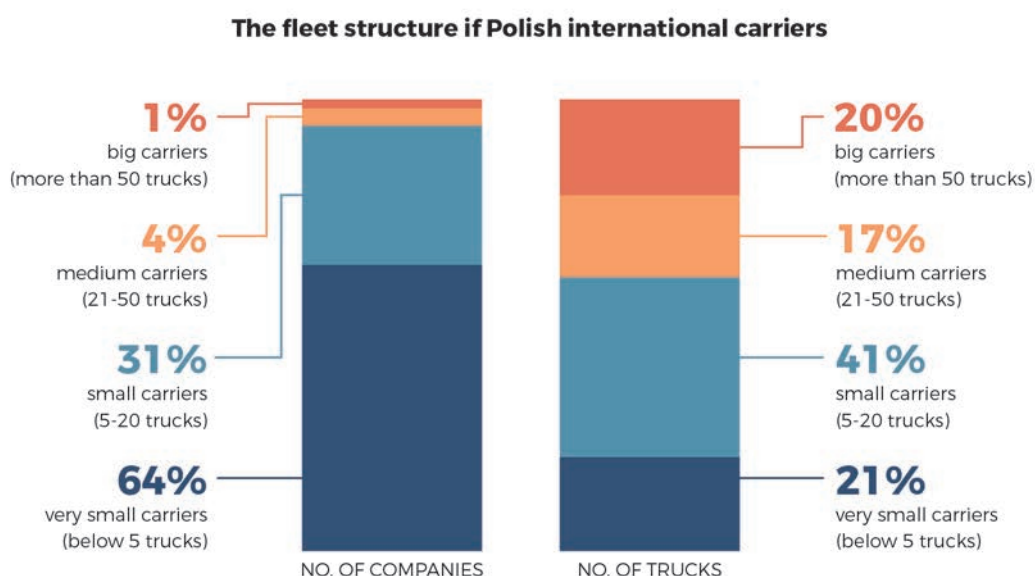


## DECENTRALIZATION AND TECHNOLOGY

**More and more entities from the transport and logistics sector complain about growing resource problems. We're talking both about the lack of human resources, which mainly affects truck drivers, as well as available cargo space. The solution to these problems may be the latest technology (including platformization and blockchain), which, supported by the change in mentality of the employees in TFL sector, will allow better use of existing resources.**

According to a report published in September 2019 by PwC Poland<sup>12</sup>, if the current gap in the supply of drivers is maintained and the estimated increase in tonnage volume in 2018-2022 remains, there will be a shortage of approx. 200 thousand drivers on the market.

The second important problem for entities in the TFL sector is the insufficient amount of cargo space, which is particularly severe at seasonal highs when demand significantly exceeds supply. However, as the data show, the real problem may lie not in the lack of resources, but in their improper use. This is clearly demonstrated by the study carried out by Trans.eu in August 2018.



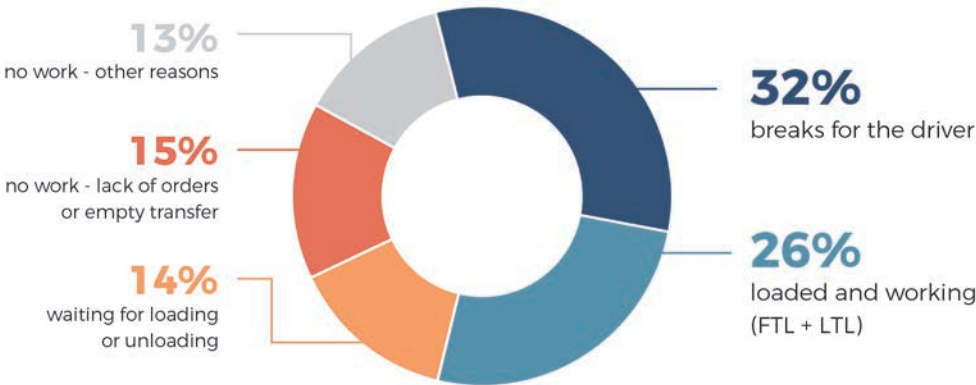
Source Trans.eu Group



Trans.eu researchers asked carriers with no more than 5 trucks (such small family businesses dominate on the Polish transport market) about how they specifically used vehicles, hour after hour, within 5 days. The researchers wanted to find out how exactly the trucks were used within this timeframe.

It turned out that even during this period of intense activity, when the industry commonly complains about the lack of access to cargo spaces, 15 percent of them stood in parking lots or in bases due to the lack of orders. Almost as many were stuck in loading or unloading. On the other hand, almost one third of the trucks were at a standstill due to holiday leaves, which is understandable during the period considered. Only a quarter of the trucks from the companies surveyed were fully utilized.

**The daily structure of fleet utilization in small Polish carriers up to 5 trucks (August 2018)**



Source: Trans.eu Group

This shows that even at the peak of the season, the resources are not lacking. Therefore, the skills and tools that will allow to free up resources and make better use of them, are crucial.

## HOW TO MAKE BETTER USE OF RESOURCES?

The TFL industry is making many attempts to solve the problem of lack of resources in various ways. Organizations such as Transport and Logistics Poland (TLP), which brings together dozens of large entities from the industry, are lobbying for changes in driver training. In this way they want to give the possibility of wider and easier access to the driver profession<sup>13</sup> to various social groups.

Attempts are also being made to increase the size of the trucks so that they can carry a larger load with one order. Such solutions have already been implemented, among others in Germany<sup>14</sup> (so-called Lang LKW with a length of 25.25 m) and Sweden<sup>15</sup>

In Poland, industry organizations are also lobbying for legal changes that would allow trucks of larger size and larger gross vehicle weight (GVW) to travel on the road. For now there are no positive results.

However, the attempts at legal changes described above are limited. It is impossible to indefinitely increase the size of lorries, or facilitate access to the driver's profession for new social groups, or employ non-EU workers to drive vehicles<sup>16</sup>

The greatest potential lies in technology and changing work organization. The key concept here is digitalization, which should include detailed description of: platformization, sharing economy and blockchain.

## **SHARING ECONOMY AND PLATFORMIZATION WILL HELP SOLVE RESOURCE PROBLEMS IN THE TFL INDUSTRY**

95 percent of Polish transport companies with an international reach are entities with up to 20 vehicles. These companies own approx. 60 percent of fleet resources in Poland. The conclusion is simple: huge fragmentation. It is similar in other countries.

Fragmentation means that we have thousands of dispersed units - resources. Organizing these units and finding a way to work with them optimally in a situation where each of them uses different tools for work, communication and management style is a great challenge. It is impossible to combine all these elements properly without technology.

However, more and more solutions appear on the market that eliminate the problem of dispersion and lack of resources by combining the so-called data islands. Today, each operator works as a separate island. He has dedicated tools, often created especially for one company, his own base of carriers with whom he exchanges data and orders. He contacts the outside world by e-mails, telephones, etc. He is actually cut off from external resources, and access to resources and the ability to organize them on time is the main task of freight forwarding around the world.

However, modern technology already today allows to connect "data islands" and thus allows access to a huge resource base from the entire market, not only domestic but also European. This is called platformization, i.e. the combination of distributed data islands and resources into one platform, to which almost all entities on the TFL market have access.

The trend of digitalization and platformization has accelerated rapidly in recent years and before revolutionizing the shipping and logistics industry, it has revolutionized many branches of the economy. Examples include platforms such as Airbnb, Blablacar, Booking, Allegro, etc. They all operate according to the principle that everyone offers their services in one place, to which many entities have access.

**According to the PwC survey, 54 percent of global logistics operators expect digitalization to increase their revenues.**

It should also be added that all of these platforms, thanks to a different organization of resources and the use of algorithms, allow automation of decision-making processes. A situation in which technology, instead of a human being, selects the best carrier to match the order based on selected criteria, is an example of this. Man sometimes needs an hour or two to choose a carrier. The algorithm will do it in a few seconds.

## **BLOCKCHAIN**

The term, as well as the technology were known some time ago mainly on the cryptocurrency market. Blockchain, or block chain, is used - generally speaking, to store and send information about transactions concluded on the Internet, which are arranged in the form of successive data blocks.

Thanks to blockchain, the supply chain can become more transparent and efficient. In the long term it will also bring measurable, and quite significant savings to its participants by enabling fully secure digital document circulation (so-called e-CMR), among others.

This is proven by numerous reports and scientific articles (including How the Blockchain Revolution Will Reshape the Consumer Electronics Industry By Jong-Hyouk Lee and Marc Pilkington<sup>17</sup>, The impact of the blockchain on the supply chain: a theory-based research framework and a call for action by Horst Treiblmaier<sup>18</sup>, Continuous interconnector supply chain using Blockchain & Internet-of-Things in supply chain traceability by Deloitte<sup>19</sup>, Does blockchain hold the key to a new age of supply chain transparency and trust? by Capgemini<sup>20</sup>, but above all by practical solutions of this technology already used in the logistics industry (Blockchain in transport and logistics. VGM, or how they do it at Kuehne + Nagel<sup>21</sup>, Blockchain in transport and logistics. See how the TradeLens platform helps shippers, logistics and customs officers<sup>22</sup>, Thanks to blockchain, Auchan and Carrefour network logistics began tracking food<sup>23</sup>, Pharmaceutical transport: Blockchain allows you to control

temperature deviations much better<sup>24</sup>, Document flow without papers and ... monitoring in transport. Blockchain makes it possible<sup>25</sup>

## **FULL USE OF RESOURCES THANKS TO SHARING ECONOMY THANKS TO CHANGE IN MENTALITY**

The technology described in this chapter will have a huge impact on the development of not only Polish, but also global transport. However, for the change to take place in practice, one more condition must be met. Even the most advanced technology may not work if it is not supported by a conscious and effectively managed mental change. Only breaking the habits and common patterns among employees will create the opportunity for optimal use of technology and thus the release of resources in transport and logistics.

Blockchain can enable secure circulation of digital documents between multiple entities within one order. You will not have to break the confidence barrier. Technology will do it for us. However, the order itself will not happen without relations and willingness to cooperate between entities, often competing.

Let's imagine a situation in which two forwarders from competing forwarding companies are faced with the task of organizing the transport of goods from Paris to Warsaw. Both are to carry the same goods. Both loads will fit on one truck. Today, each of them works separately, does not share information about resources, routes, orders. Therefore, each of them will order one vehicle to carry out their order, i.e. use more resources than necessary.

Technology already gives freight forwarders the opportunity to work together in similar situations. This is the strength of the digital economy and sharing economy - opening up to resources that until recently were closed in many dispersed centers, e.g. shipping companies with their own contact base. However, without the will to cooperate, the achievements of engineers will become useless.

The key is the role of a true manager who understands all these changes and processes, and therefore can predict and implement appropriate solutions in advance. Not forgetting that people are still responsible for the success of the whole. The role of the manager is to introduce a change in mentality to the company in a timely manner.

# CYBERSECURITY

## IN TRANSPORT

Threats to cybersecurity are usually associated with the financial sector, and in particular with banking. This is where extensive collection of the most valuable data are found, such as customer logins and passwords for electronic banking systems.

Meanwhile, in 2018, the cybercriminals' strategy changed and suddenly the TFL sector became the second most attractive target for hackers, rising to this position from the 10th place it had only a year earlier<sup>26</sup>

Not without significance in changing this trend, was the spectacular "success" of NotPet-ya ransomware, which targeted primarily Ukrainian entrepreneurs, but ricocheting hit Maersk and its partner network, causing perturbations in the global supply chain. This event opened up a completely new perspective for attackers.

The claim that the transport sector is highly dependent on technology is a truism, but it is worth remembering a few other important elements that make the TFL industry also particularly vulnerable to attacks and incidents.

The most important risk factor is a dense and complicated network of connections throughout the entire supply chain, with individual participants representing a very different level of development in terms of technology and cybersecurity. Considering the fact that **only 20 percent of companies require their suppliers and subcontractors to apply certain cybersecurity standards<sup>27</sup>**, it is highly probable that some of them may be a potential source of threat to the entire network.

Another important fact is that this industry often operates on very low margins, which effectively demotivates owners and management boards to invest in expensive security, specialized employee training and the purchase of IT services of guaranteed, high quality.

Supply chain participants, including transport companies, have access to sensitive data on the value of freight and its location. In the era of increasingly intelligent IoT (Internet of Things) devices installed in modern vehicles, the risk of an attack consisting of, e.g. immobilizing a car with valuable cargo in a selected location or sending false information about a change of destination, is increasing.

Information obtained by criminals can be used for smuggling, terrorist activities, for attacks on clients of logistics companies - especially if the clients come from countries involved in armed, commercial or diplomatic conflicts. Companies operating in just-in-time mode are particularly sensitive to interference.

#### **Key cybersecurity risks to prepare for:**

- System unavailability (WMS, TMS, EDI) or data loss;
- Ransom extortion (ransomware);
- Violation of data integrity (unauthorized changes to data, e.g. regarding payments, directions of delivery, routing);
- Disclosure of confidential information, customers or personal data;
- Cargo theft;
- Destruction of resources (e.g. as a result of interference in the operation of equipment, systems);
- Loss of reputation (e.g. as a result of exposure to the risk of customers or business partners in situations where the company is the source of infection).

The situation is made worse by the fact that almost nobody wants to talk about their problems. Attacks are not disclosed due to fear of loss of image, even if companies are required to do so by law. The fear of losing face is greater than the fear of potential punishment. Thanks to this, hackers have an easier task.

In the perspective of the next 10 years, it is expected that the overall number of attacks, which will also be better prepared and more precisely targeted, will fall. Criminals will patiently wait for the right moment of the attack and look for the most valuable assets of companies that have the financial resources necessary to pay the ransom or who have the most valuable information from the point of view of the criminal world.

Another trend is the increase in the activity of hacker groups at the services of countries (Russia, North Korea). It is estimated that among the so-called "bad actors" as much as 49 percent implement government orders, 26 percent are so-called ideological hackers (hobbyists), and 20 percent are attacks of criminals (ransom, theft).

According to the latest edition of The Cybersecurity Handbook prepared by Thales and Verint<sup>28</sup>, **Poland is in the top twenty countries most vulnerable to cyberattacks.** The

hackers target energy and transport, where they primarily steal data and penetrate the network. This may indicate preparations for future attacks.

It is also worth to follow the changes in law, which places more and more emphasis on cybersecurity issues. Some of the regulations, such as the European NIS Directive<sup>29</sup> and the resulting Act on the National Cybersecurity System<sup>30</sup> already point to transport as the sector of the so-called key services, for which very specific requirements have been defined for the security of IT/OT systems and networks. The scope of this type of regulation will undoubtedly be expanded, and the requirements for key service operators will gradually increase.

It's time to accept the fact that nobody is immune to hacker attacks and to think about what can be done when such an attack occurs. Such an approach will allow to talk about this subject without fear and will enable the creation of a common front against future attacks.

#### **Actions that limit the risk of cybersecurity violation:**

- introducing the principle of limited trust in relation to suppliers and subcontractors;
- enforcing the use of uniform security standards throughout the entire supply chain, regardless of the company's size and scope of tasks performed;
- regular risk analysis;
- developing plans for incident management and business continuity in the event of an incident;
- employee training and raising cybersecurity awareness;
- exchange of information on incidents and threats in the TFL industry (for example through working group meetings, anonymous platforms, etc.)
- using solutions developed by other industries - e.g. in the financial and energy sectors.

## AUTONOMIZATION AND ELECTRIFICATION OF MEANS OF TRANSPORT

**6.3 million trucks and 31.5 million delivery trucks travel on the European Union's roads. Some of them are already communicating with each other and sending various data, some are remotely diagnosed and controlled. However, this is just the beginning. Trucks are becoming more autonomous, intelligent and eco-friendly. Soon they will radically change transport efficiency.**

Improving safety, solving the problem of professional drivers' deficit, eco-friendly vehicles, fast delivery of goods, reducing costs or relieving truckers in their daily work - these are the basic benefits pointed out by manufacturers who invest increasing amounts of money in autonomous trucks. The arms race of automotive concerns is understandable. Competition on the market is very high, and the progress of digitalization and the increase in demand for new technologies - inevitable.

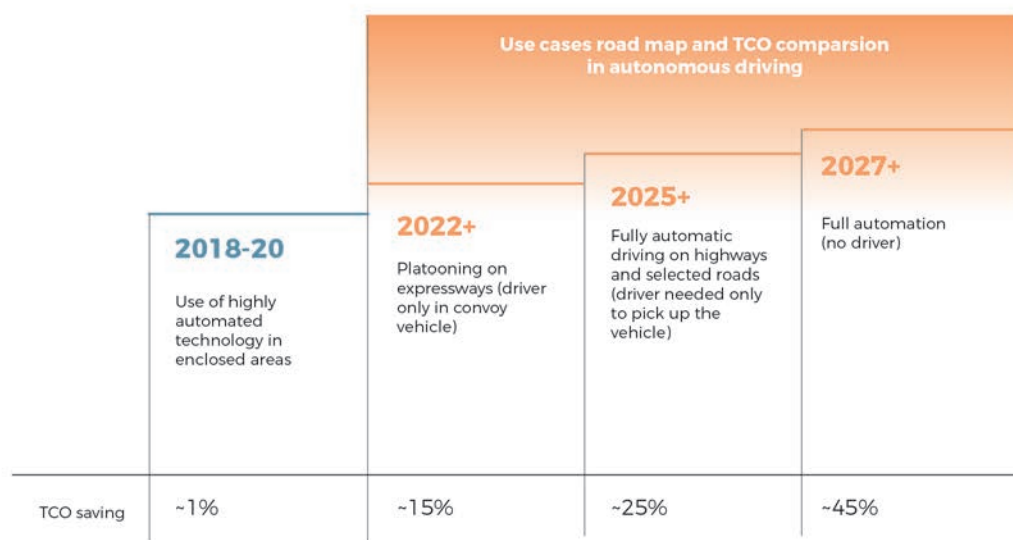
"By failing to comply with the requirements of the digital revolution, in 15 years, up to 43 percent of market leaders can go bankrupt," said Bartłomiej Gola, general partner of the SpeedUp Group, investment fund for projects at early stages of development. "The pace of change is accelerating, which is characteristic of current reality. Today, companies from many industries may have little time to change."

"The number of changes over the next decade in this business (digitalization and autonomous vehicles - editor's note) is comparable to the number of changes that have taken place over the past 50 years," said Wolfgang Bernhard, head of Daimler's truck and bus division.

"Due to digitalization of road transport and the dissemination of autonomous trucks, by 2030, freight costs will decrease significantly, delivery times will be shortened and commercial vehicles will be more efficient," reads the PwC report The Global Truck Study 2018. This is also confirmed by McKinsey & Company analysis - in the report Route 2030: The fast track to the future of the commercial vehicle industry. The company's experts ensure that the road to full autonomy in road transport can take about 10 years (with the current digitalization, and it should be noted that it is becoming more dynamic), although "the first cases of using independent vehicles will occur in the coming years."



## Autonomous driving use cases are starting to hit the market



Source: [www.mckinsey.com](http://www.mckinsey.com)

## FULL AUTONOMIZATION AROUND THE CORNER

Without digitalization and autonomization, the transport sector may be on the brink of collapse. According to Central Statistical Office data from 2018, empty mileage accounts for 34 percent of all journeys in Poland and 12 percent in international transport. Half of the transport does not use the total capacity of trucks. The premise of intelligent vehicles is therefore extensive optimization - reduction of downtime, management of logistics processes, elimination of duplicate journeys.

“Robotics and autonomous devices will really change the efficiency of transport and logistics. These are the main factors affecting the increase in efficiency. Autonomous vehicles that continuously transport parts from the warehouse center to assembly lines in industrial facilities increase the efficiency of production lines. In warehouses, thanks to robots helping to prepare orders and autonomous transport carts, which are lighter and more flexible compared to large automatic systems, it is easier for us to introduce changes. The same happens in road transport,” said Thierry Almès, senior innovation manager at GEFCO.

“We can easily track each parcel and be informed about the next stages of its transport (e.g. loading, transport, unloading, delivery). The technology supports truck drivers who can easily optimize the route thanks to data on weather, routes and traffic. Technology informs when to accelerate or slow down to optimally move from point A to point B, while consuming 4 percent less fuel. The flow manager is also assisted by semi-autonomous or increasingly programmable robots that increase efficiency, helping to make the right

decisions and avoiding risk,” says Vincent Champain, president, GE Digital Services Europe and general manager at GE Digital. Society of Automotive Engineers - an organization of automotive, aviation and industrial machinery engineers - divides vehicles into **6 levels of autonomy**.

**Level 0.** Most of the currently moving vehicles are at level 0 autonomy. This is a simple, manually controlled technique. The driver is not supported by any advanced technologies, although some systems, e.g. emergency braking are available.

**Level 1.** The lowest level of autonomy. The vehicle is equipped with a single automated driver assistance system, for example steering or adaptive cruise control.

**Level 2.** The vehicle is equipped with advanced systems that provide steering and both brake and acceleration support. At this level, cars are not yet fully autonomous because human presence is required. The driver can take control of the car at any time.

**Level 3.** Vehicles monitor the environment and other road users. They can make certain decisions themselves, e.g. accelerating next to a slow moving car. However, they still require human control - the driver must remain vigilant and be ready to take over if the system is unable to complete the task.

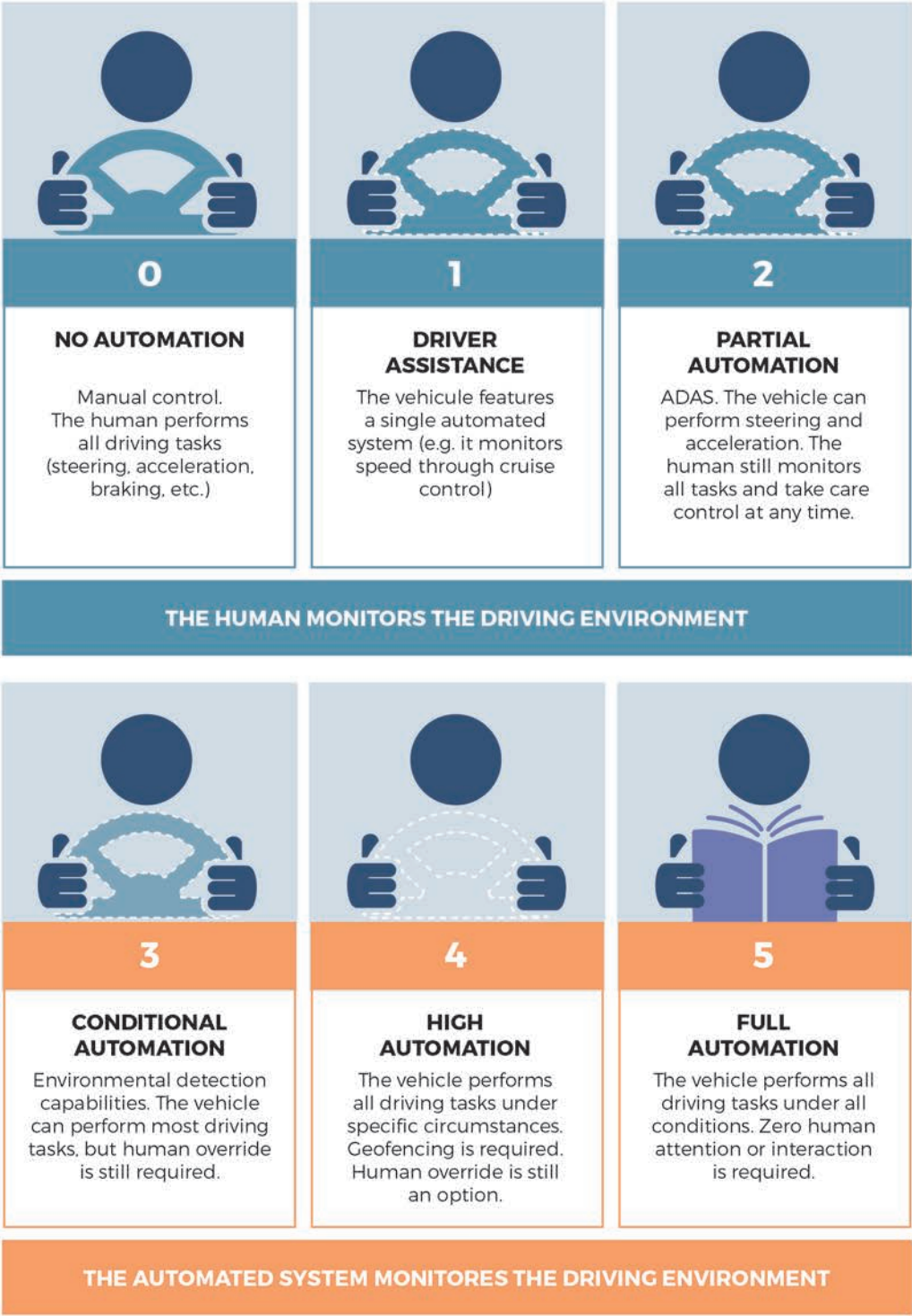
**Level 4.** Vehicles may decide to intervene if something goes wrong while driving or if there is a malfunction. No human involvement is needed, but there is still room in the cab for a driver who can drive the car manually. Trucks of this type can move independently, but for now only in a limited area - until proper infrastructure and regulations are created.

**Level 5.** Full autonomy. No human factor or remote control is required. The vehicle is not restricted in any way (e.g. geofencing, which restricts the vehicle to certain zones the crossing of which is impossible or strictly controlled). Although trucks with level 1-4 are already in use, level 5 vehicles are not allowed anywhere in the world. For now.

## HOW TO SAVE MILLIONS, ON EVERYTHING

The trucks currently available for sale meet level 2 requirements. They can independently change the speed, lanes on highways, connect to other devices and create a convoy, maintaining a constant distance. It was the trucks at this level of autonomy that took part in the successful European Truck Platooning Challenge in 2016, during which six manufacturers (DAF, Daimler, Iveco, MAN, Scania and Volvo) traveled from different places in Europe to Rotterdam. Experts say that in the next few years manufacturers will be able to sell vehicles at an extremely technologically advanced level 4. **So the question arises - and then what?**

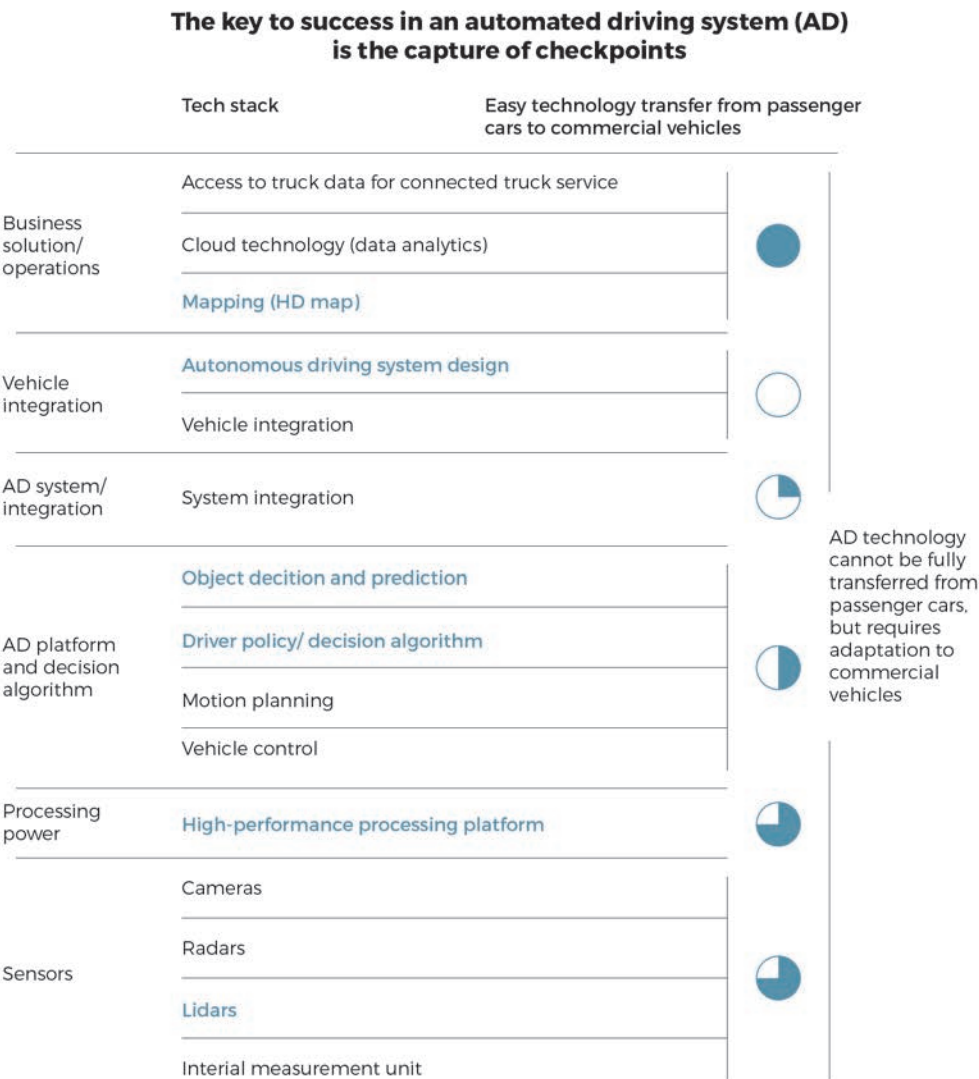
Levels of driving automation



Source: [www.synpsys.com/automotive/autonomous-driving-levels.html](http://www.synpsys.com/automotive/autonomous-driving-levels.html)

According to PwC research, digitalization, automation of logistics processes and autonomous delivery vehicles will reduce transport costs in the next decade by 47 percent. The American investment company Morgan Stanley estimates that autonomous trucks would bring the industry savings of USD 168 billion (over EUR 150 billion) on an annual basis.

Tests conducted in the United States have shown that autonomous vehicles can help reduce transport costs, for example, by reducing fuel consumption and eliminating unnecessary downtime such as driver rest periods. Delivering cargo from Los Angeles to New York costs over 4,000 euro. 75 percent of this sum is the employment costs, which include drivers' rest periods resulting from the regulation of working hours, refueling, servicing, etc. Continuous driving can reduce these costs by increasing the annual mileage even twice.



Source: [www.mckinsey.com](http://www.mckinsey.com)

You should not forget about fuel savings. The optimal vehicle speed, which allows you to save while driving, is about 72 km/h. Constantly maintained speed also plays a role. In addition, fuel-efficient consumption can also be increased by combining autonomous trucks into convoys, as was done with the European Truck Platooning Challenge. Dr. Hubert Igliński from the Department of International Logistics of the University of Poznań draws attention to the fact that **driving three trucks in a column with intervals of 4 meters allows to reduce fuel consumption by an average of 15 percent, i.e. 4-5 liters of fuel per 100 km.** Taking into account the average mileage of 100,000 km and fuel costs, one autonomous truck a year can bring savings of PLN 25,000 on fuel only. And remember that the reduction will also be due to improved tractor aerodynamics, because autonomous vehicles do not need cabs and can have a more streamlined shape, which reduces the drag coefficient. With a properly shaped vehicle, the operating costs of individual components are also lower, and the lack of a cab and other components also reduces the cost of truck production.

## CORPORATE SOCIAL RESPONSIBILITY

Reduced consumption of materials in the production process and reduced fuel consumption are primarily positive environmental effects. Currently, there are over 3.2 million trucks registered in Poland (from passenger cars with a grille separating passenger and luggage space to tractors with a total weight of 40 t). It is no secret that road transport is responsible for nearly half (and according to some sources, even 70 percent) of harmful substances emissions into the air - total fuel consumption is about 33 million cubic meters per year. For this reason, the European Commission places great emphasis on reducing carbon dioxide emissions. To do this, it is necessary to reduce the value of fuel consumption, because the combustion of each liter of diesel fuel involves the emission of about 2.62 kg of CO<sub>2</sub>.

Appropriate reduction of fuel consumption can be achieved thanks to the synergy of two requirements: eco-friendly driving techniques, offered by unmanned vehicles, and environmentally friendly technology, i.e. electric trucks. Unfortunately, the level of pollution and its effects are so severe that electrification alone is not enough. The production of electric vehicles is simply too expensive for mass use, at least at present. In addition, in Poland, energy is mainly based on fossil fuels, so trucks must be charged with electricity from non-ecological sources - coal power plants (interestingly, even then electric cars reduce emissions of harmful substances by 25 percent compared to vehicles with internal combustion engines).

Fortunately, an alternative exists. Hybrid trucks caught the attention of entrepreneurs. In 2016, Scania tested them with Siemens. As a result, the Swedes commissioned the first section of the electrified road around Gävle on the Gulf of Bothnia, 180 km from Stock-

## Potential savings for the US freight industry thanks to autonomous freight vehicles

In 2013, the investment firm Morgan Stanley conservatively estimated that autonomous trucks would save the industry \$168 billion. Analyses like these suggest a strong economic argument for trucking as a lead sector of autonomous vehicle technology.



Source: [www.driverlessreport.org/files/driverless.pdf](http://www.driverlessreport.org/files/driverless.pdf)

holm. Trucks move on it, using solutions known to us from trolleybuses. The difference is that the vehicle with the pantograph on the roof of the cabin is not attached to the traction - it uses an electric drive on the electrified section, and acts as a hybrid outside of it (powered by biofuel). A similar experiment is carried out in Germany. Five trucks were built for the eHighway project. The vehicles connect to the 5 km long experimental highway as soon as they are in its range. The tests will last until the end of 2022.

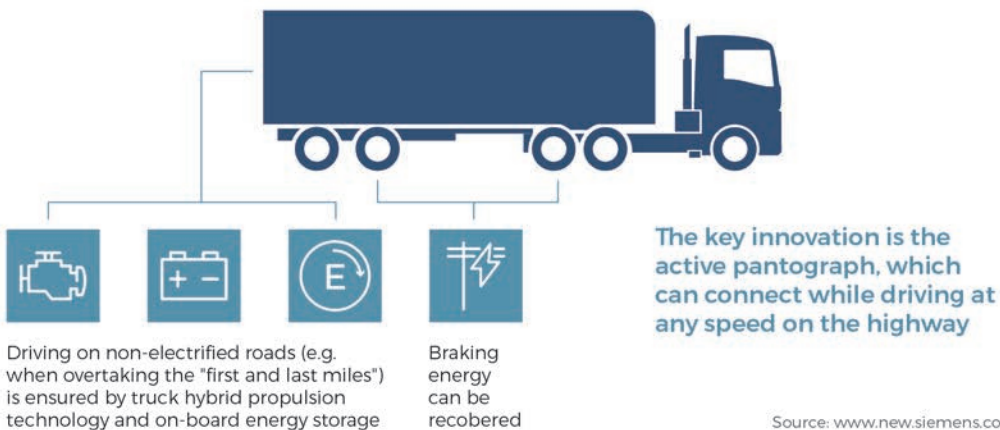
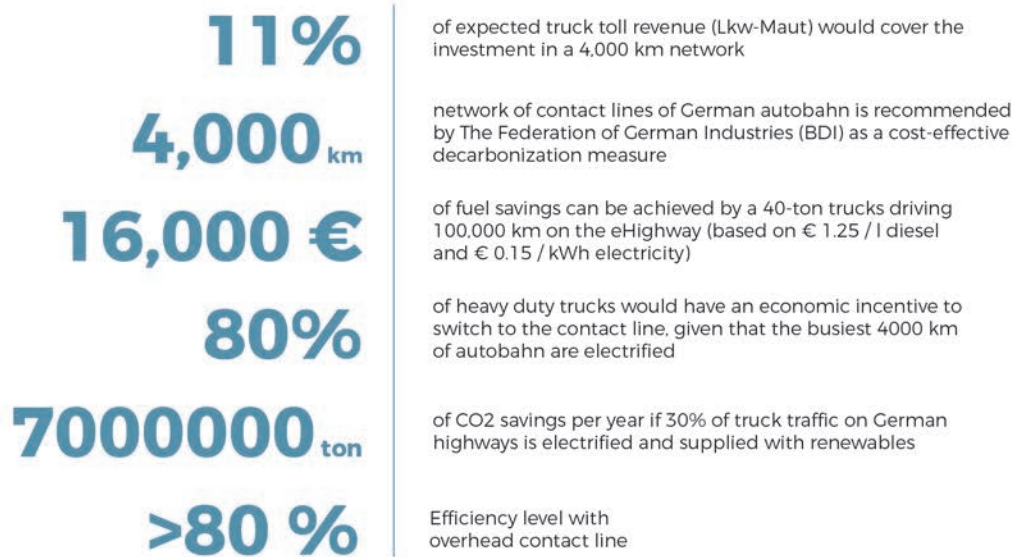
Similar solutions will have mass application relatively quickly. Last year, the European Commission proposed that in 2025 new trucks should emit 15 percent less CO<sub>2</sub> than in 2019 and that at least 5 percent of the new trucks sold in Europe were low or zero emission vehicles, i.e. hybrids or electric vehicles. In 2030, sales of such trucks are expected to account for 20 percent. It pays off in two ways - in environmental and economic terms, because electric vehicles and hybrids allow for considerable savings. According to data from the French Agency for Environmental Management and Energy (ADEME), by 2030 this type of truck will offer savings of 20-30 percent.



Electric vehicles also have a disadvantage that discourages people from using them - too high energy consumption (over 60 kWh/100 km) due to aerodynamic drag. In case of cars powered only by electric drive this reduces the vehicle's range and payload by approx. 300 kg while on the highway. It happens, for example, when accelerating while driving at irregular speeds.

For the time being, synchronized driving (so-called truck platooning) is of great importance. Integrated truck traffic contributes to reducing transport congestion (excessive increase in the number of trucks in certain periods), and this means optimization in the use of the truck park. Better organization means less delays in deliveries, shorter waiting times

### Electrified road freight transport - contributing to a sustainable transport sector



## Comparison of the total cost of ownership of trucks with a GVW of up to 12 tonnes

Drive Type	Total cost of ownership in eurocents per km in 2015	Estimated total cost of ownership in eurocents per km in 2030
Diesel	76,8	79,1
Parallel hybrid	80,2	77,7
Serial hybrid	83,3	77,3
Electric truck	110,2	80,3

Source: ADEME

for unloading/loading, faster transport and more orders, i.e. an increase in the efficiency of the entire supply chain. In practice, achieving the right level of synchronous driving is only possible by using trucks with an appropriate level of autonomy.

“During platooning tests, i.e. an integrated convoy of autonomous, digitally connected trucks, we noticed that fuel consumption drops by 5-15 percent compared to driving single trucks. This reduces costs and increases the efficiency of all transport,” emphasizes Thierry Almès.

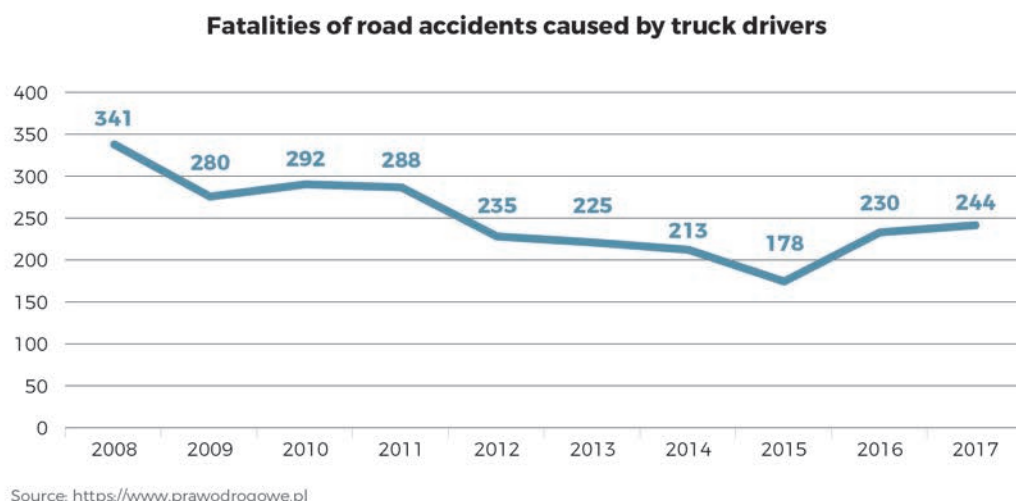
## SAFETY, LAW AND INFRASTRUCTURE FIRST

In the coming years, trucks will be able to autonomously monitor their technical condition in real time, which will facilitate and accelerate service, and this in turn will affect the level of road safety. In 2018, there were over 31 thousand road accidents. Over 27 thousand of them were caused by the drivers. In Q1 2019 alone, almost 16 thousand people were injured as a result of an accident at work, the majority of whom were professional drivers. According to the Polish Central Statistical Office data, 10 percent of such incidents are caused by the poor technical condition of the intangible asset (machine or vehicle).

Therefore, concern for safety should be considered as a leading condition for the development of autonomous vehicles. Not only by limiting the participation of drivers, but also by using the opportunities offered by digital technologies: faster response during emergency braking, constant availability of a system that does not get tired, lower fuel consumption. The issue of liability for an accident or breakdown is also important. Before unified law regulating the movement of autonomous vehicles in the EU is created, the question of investigating who is guilty of an incident must be established. Who should suffer consequences



and for what exactly? Is it the driver for making wrong decisions, the remote operator of the means of transport for misinterpretations, or the truck manufacturer for technical defects? Or maybe a software supplier, programmer, road manager, person responsible for mobile communication, algorithm?



In terms of legislation, Europe is not yet ready for autonomization of means of transport, although it has made considerable achievements over the past few years. Currently, Singapore and New Zealand are global leaders in the implementation of legal regulations concerning autonomous vehicles, and from European countries - Great Britain, Finland and the Netherlands.

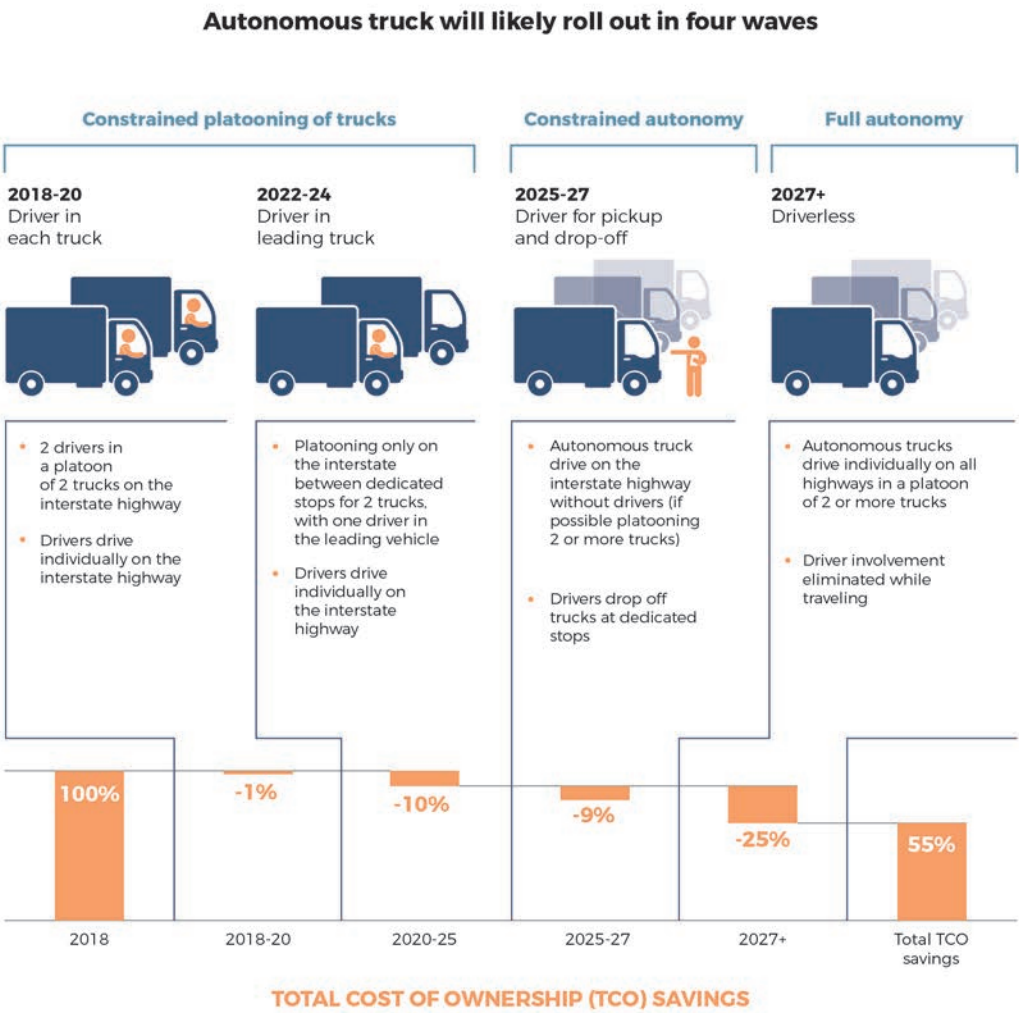
The fear of cybersecurity and hacker attacks is also justified. Connected vehicles can be easy prey for criminals. Therefore, terrorist attacks, cargo theft and road accidents can be more common. Implementation of protective solutions is at stake, but such protections already exist - even the manufacturers themselves use them. The mass use of level 4 autonomous trucks is not far but it won't be easy. Meanwhile, a real revolution will occur when level 5 vehicles become available to the public use, i.e. trucks without dashboards, acceleration and braking pedals, steering wheels, mirrors, professional drivers ...

## **SPEAKING OF DRIVERS...**

According to the estimates of the Polish Association of International Road Carriers, Polish entrepreneurs currently employ approx. 700 thousand drivers with category C, C+E and D licenses. Over 65 thousand are foreigners from outside the EU, mainly Ukraine and Belarus. Despite this support, staff shortages are still being felt. The solution to the deficit

problem may lie in the implementation of autonomous trucks for general use. They pose no threat to the driver's profession.

"Everyone who sees in autonomous and semi-autonomous vehicles an attack on the driver's profession is wrong. The fact is that many of our customers complain about the difficulty of finding a sufficient number of drivers. As a consequence, they limit their development and investments in the fleet. In contrast, autonomous vehicles are a reality. For example, Scania operates autonomous cars at the Rio Tinto mine in Australia, and the automatic, driverless MAN road service cars have already traveled 4,000 kilometers on German highways," says Andreas Renschler, member of the board of Volkswagen AG, responsible for the commercial vehicle department and president of Traton SE, a producer of commercial vehicles of brands such as MAN and Scania.



An unmanned truck, even fully autonomous, still needs the participation of a human: operator, analyst, engineer, programmer, tester, service technician, etc. One of the main reasons for the current driver deficit is the aging staff and lack of younger employees. The profession is not very popular, young people do not want to work as truck drivers. Unmanned vehicles are a chance to fill this gap and attract young people to the industry. The role of humans will be reduced to work in the IT area, which perfectly fits into trends in the labor market. As a result, autonomous trucks will fill the gaps when it comes to drivers' shortage and not replace the drivers.

A study conducted by PwC on the US market shows that already 9 percent of industrial manufacturers have adopted semi-autonomous or autonomous means of transport, and a further 11 percent intends to reach for them within the next 3 years. This number is relatively big when we speak of a technology, which raises many concerns in the industry. What are entrepreneurs afraid of?

According to PwC, almost 60 percent of manufacturers are afraid of implementing such technology because of the costs. 42 percent consider autonomous technologies too immature to invest in, 32 percent is afraid of safety-related problems, and another 32 percent fear that there are not enough qualified employees to operate these vehicles. Despite this, as much as 90 percent of American manufacturers believe that autonomous vehicles will help them save up to 25 percent of transport costs. This means that entrepreneurs will eventually decide to do it anyway. This is confirmed by the results of research on consumer acceptance of autonomous driving technology, carried out in Singapore - the more autonomous vehicles are in use, the greater the social acceptance of these means of transport.

## LAST MILE LOGISTICS

Online shopping gives customers many options. For example, they can search for products and order them anywhere, anytime. They don't have to waste time traveling to the store, looking for a parking space and standing in queues. E-shopping is delivered to the address chosen by the customer. However, before they get there, they must be completed, packaged and prepared for shipment. They are transported by external logistics companies, in particular CEP (courier, express, parcel) operators. Then the shipments are sent to the sorting plant, from where they are sent to local branches. The last stage is the transport of the parcel by courier to the place designated by the customer. Most often, the parcel goes to the customer's place of residence or work. This is called last mile. This is one of the most important phases of the online order process, because that's when the only direct contact between the courier company and the recipient takes place. The courier becomes a representative of the seller. This is often the weakest link in the supply chain - the quality of service at the last stage is decided by the person who delivers the shipment on time and in the right condition, while logistics processes at other stages are automated and optimized.

It is worth adding, however, that the last mile phenomenon is not only a feature of the e-commerce. It also includes supply from municipal warehouses or distribution centers and transfers between branches. According to KennisDC Logistiek, 80 percent of urban transports are currently performed by companies on their own, not by professional logistics service providers. This leads to lower efficiency in urban transport networks because of the lack of load consolidation from many senders. There is great potential in this area. According to the report *Urban Logistics Opportunities-Last-Mile Innovation*, prepared by Frost & Sullivan, expenditure on logistics in the world is expected to reach USD 10.6 trillion in 2020. 70 percent of these expenses will be generated by transport, and as much as 40 percent by last mile deliveries. In addition, there are many social costs associated with urban supplies - traffic jams, noise, pollution, etc. As a result, more and more local authorities are making changes to reduce the negative effects of vehicle traffic, particularly in city centers. They regulate the principles of organizing the delivery of goods and courier shipments in selected areas of the city and indicate the types of vehicles and their drives. Restrictions apply to the times of the day in which deliveries can be made, and the time of loading and unloading goods.

Returning to the last mile served by CEP operators, the biggest advantages of deliveries carried out in this way are door-to-door service and short delivery times. Both the sender

and recipient do not have to leave the office or home to use this service. Delivery is usually carried out on the next business day. The disadvantages of this solution are fairly high price of the service, the lack of an exact delivery date and difficulties in determining the correct address or the recipient's absence.

CEP operators undertake various actions to eliminate the effects of problems arising from deliveries to individual customers. These include both relatively easy organizational improvements and more complex solutions that require investment. One way is to adjust the delivery time of shipments to the time when the recipient is present in the place of residence (afternoon and evening hours). Due to the fact that couriers need to service a large number of clients (mainly business) during the day, it is an expensive solution because it requires additional staff.

Another way is to enable the customer to dynamically change the place and time of pick-up. The customer receives information about the upcoming shipment in advance and redirect it to another place or delay its delivery. Some customers just prefer to pick up the package themselves, because it is, for example, a gift or something that should not be seen by another person. This increases the number of effective deliveries and reduces the number of empty runs. On the other hand, the option of changing the delivery time or adding a time window requires reorganization of the couriers' work, which increases the operating costs of the CEP operator. That's when IT tools that enable optimization and dynamic route planning, regardless of changes, come in handy.

Another solution is to enable customers to send and receive parcels at specially designated points - so-called PUDO (Pick Up Drop Off). These are places where access for clients is relatively easy. This service is derived from the click & collect concept, which was initially developed by companies trading mainly in stationary outlets (e.g. retail chains), but gradually transferring some of their sales to the internet. Thanks to it, customers do not have to wait for the courier and pay for delivery. Special points are located in places such as grocery stores, newsagents, traffic kiosks, shopping malls and gas stations.

Currently, PUDO is one of the key trends in last mile logistics. This is the fastest growing service and one of the most frequently chosen forms of parcel delivery, among others in Germany, Great Britain, France or Belgium. CEP operators (DHL, UPS, DPD, etc.) invest in them, but also retail chains dealing in the sale of food products, books, drugstore articles, household appliances and electronics.

However, it should be noted that the concept of designated pick-up points is not a new solution. Such places existed much earlier, and they were post offices. It wasn't until a few years ago that CEP companies, which had a problem with undelivered shipments to individual customers, noticed them. This was mainly due to the abovementioned absence of customers at the indicated place of pickup. Their main advantage is convenience - we

can send, return or collect the parcel at the selected place and time. PUDO eliminates the problems associated with determining the correct address or the absence of the recipient at home. Unfortunately, they also have disadvantages.

The biggest problem is the limited availability of service due to the opening times of designated points. In addition, unlike the courier service, the customer has to bother to reach such a point and sometimes there is a queue of other customers who buy products or use the services. In this case, parcel machines are a helpful solution. Access to them is usually temporarily unlimited. InPost, which introduced parcel machines a few years ago, is a pioneer of this solution in Poland. Poczta Polska and DHL are also developing machines for sending and receiving parcels using the agnostic SwipBox network (independent of the operator). In this case, the last mile service is much easier and cheaper for the CEP operator. The courier transports a lot of parcels at one time and delivers them to one specific location. Collection of parcels by customers from the machines are characterized by the flexibility when it comes to place and date of delivery. When e-shopping, this is undoubtedly an additional argument for customers who are more mobile and want to be free to choose the place and time of pickup. Unfortunately, this can be an obstacle for people who are far from such machines, e.g. live in rural areas, less populated areas or are unable to collect the parcel.

For some customers, the door-to-door courier service will still remain the most convenient and reliable mode of delivery. The problem is also with larger goods, such as refrigerators, washing machines, garden equipment and tires. Parcel machines have limitations on the weight and dimensions of a shipment. Large products are still delivered directly to the address indicated.

Both PUDO and parcel machines are solutions that will develop in subsequent years and will slowly displace courier services, which will become premium services over time. Surcharges for delivery of parcels to the customer's door are more and more often discussed. CEP operators are expanding their services along with the development of out-of-home deliveries. For example, InPost develops refrigerators, where you can pick up parcels at a controlled temperature. In turn, DPD creates outlets next to the pick-up points (so-called city departments) with fitting rooms where customers can try on ordered items and, if necessary, return them immediately.

In the future, you can expect new parcel machine networks to be accessed by various CEP companies. Individual terminals may also be created, to which a specific recipient will have access. They combine the advantages of courier delivery (door delivery) with automatic parcel terminals (the possibility of collecting a parcel at any time).

Another way to deal with the last mile problem is to use customer cars as mobile PUDOs. When ordering products, the customer indicates his vehicle as the place of delivery. The

courier uses a one-time digital key to open the trunk and place the parcel in it. Then information about delivery is sent to the customer. Similarly, a parcel can be left in a specific part of the house (e.g. garage).

Another idea to solve the last mile problem is to use the concept of sharing economics, in particular crowdsourcing. Society and its resources are involved in the delivery of consignment services. The most famous companies abroad that provide such services through special applications include Amazon Flex, Deliv, Postmates and Instacart. Their dynamic development was possible mainly thanks to mobile devices and universal access to the Internet. They relate mostly to fast and direct urban deliveries, which is why they are more a complementary service rather than a competitive one for CEP operators specializing mainly in domestic deliveries using an extensive operational network consisting of many transshipment points.

There is a lot of talk about drones in the context of last mile logistics. Undoubtedly, they automate the process of parcel delivery to a customer, but it is difficult to imagine that they will be used on a massive scale. Every day, millions of parcels are delivered and all cannot be transported by drones. So they are used for urgent deliveries, in hard-to-reach places and where there is a low density of recipients. In addition, in many countries there are legal restrictions, e.g. flight at a certain height under human supervision.

Autonomous vehicles that will independently deliver products to customers are also a solution of the future. Intensive work is underway on their application, but due to numerous barriers - both technological, legal and social - we will have to wait a long time for their wide application. According to the report Parcel delivery. The future of last mile by experts from McKinsey, in the first place such solutions will be created in developed countries, where labor costs are high enough for the return on investment to be fast. In the case of developing countries where labor costs are relatively lower, technological changes will occur to a lesser extent and at a slower pace.

## **WILLINGNESS TO INVEST AND TAKE GREATER RISKS - DON'T BE AFRAID OF CHANGE**

Digitalization opens the door to an “intelligent” world. In such a world, the range of companies operating in it is expanded many times. Modern technology provides infrastructure that allows you to achieve any goal - faster, easier and safer than ever before. The risk decreases and the chances increase.

The decisions of logistics companies to investments in digitalization are primarily driven by the ability to optimize processes, reduce administrative burdens and increase workflow. Logistics operators who do not want to stay behind the competition and keep up with the growing needs of customers will have to focus on digitalization. It will change the face of transport and logistics within the next 5 years. According to the report by PricewaterhouseCoopers entitled CEE Transport & Logistics TrendBook 2019, up to 68 percent of CEOs from the logistics industry in the world expect changes in basic technologies of providing services. In turn, 65 percent of them expect changes in distribution channels. According to PwC experts, one of the five main trends that will shape the Polish and Eastern European transport and logistics market is digitalization.

“One of the most important trends affecting all sectors of the economy is digitalization. When it comes to transport and logistics, it is also influenced by digital solutions, but we see other, equally important factors that shape changes in this sector,” explains Michał Mazur, partner at PwC, leader of the transport and logistics team.

Digitalization of operational and contractual processes in the transport and logistics industry is not new. According to PwC experts, thanks to digitalization, companies can not only increase revenues, but also simplify processes, transform services, products and business models, as well as reduce the impact of the lack of suitably qualified personnel.

According to the authors of the report, digitalization will also change the way consumers interact with companies. We are already observing this process today - e.g. in orders for services made online and via mobile devices.

The B2B Global IoT Analysis report prepared by the Boston Consulting Group, shows that by 2020 the expenditure of B2B companies on technologies, applications and solutions based on IoT (Internet of Things) will amount to 250 billion euros (PLN 1.1 trillion). However, the authors of the document note that the transport and logistics sector will play a large



share in these expenses. Expenditure on IoT solutions only in this industry will reach EUR 40 billion (PLN 172 billion) by the end of next year.

In turn, according to McKinsey & Company publication *The rise of Digital Challengers: How digitalization can become the next growth engine for Central and Eastern Europe*, thanks to digitalization, Poland's GDP may increase by PLN 275 billion by 2025.

"There are already sectors in Poland today, e.g. financial and logistics, where the level of digitalization is higher than the average for Central and Eastern Europe. On the other hand, in many important areas from the point of view of stimulating the digital economy, Poland is achieving results or only close to the average for the region, or even lower than that. This applies in particular to the startup ecosystem (significantly lower number of startups per capita), the participation of adults in education, as well as the use of digital tools in the sale of e-commerce abroad," reads the report.

## **THE MAJORITY BETS ON BIG DATA**

The German logistics giant DHL commissioned a logistics consulting company - Iharrington group LLC, to prepare a report *Digitalization and the supply chain: Where are we and what's next?* To this end, surveys were conducted among 350 supply chain specialists from large companies.

It turns out that over 75 percent of them recognize the benefits of digitalization, according to a DHL report on digitizing the supply chain.

"On the information/analytics side of the digitalization equation, big data analytics won the vote for the single most important technology – by a 10 percent margin. Seventy-three percent of participants view this technology as significantly important. Cloud-based applications ranked second, at 63 percent, followed by Internet of Things at 55 percent. Sharing economy platforms received the lowest score in the ranking of important information/analytics technologies. On the physical side, robotics won hands down, with 63 percent of the DHL survey group rating these technologies as either 'very' or 'extremely' important. Autonomous vehicles earned second place, with 40 percent ranking the category as "very" or "extremely" important. Drones in supply chain applications – e.g., delivery, security, inventory management – brought up the rear with only 27 percent," reads the report.

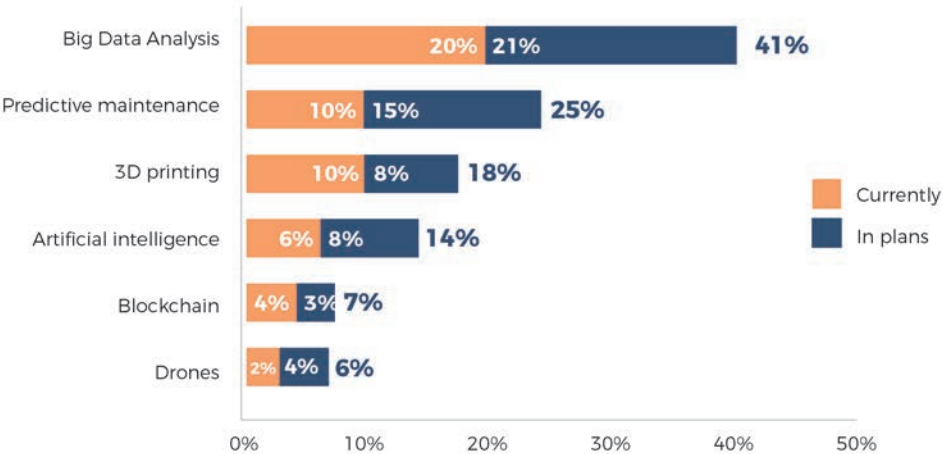
The results of this type of research help DHL further shape its digitalization strategy. On October 1, 2019, the company presented the 2025 Strategy, under which it will spend EUR 2 billion on digitalization. The Deutsche Post DHL Group plans to modernize its IT systems and offer employees targeted advanced training to enable them to use these technologies. Productivity will be increased through greater automation and improved transaction

processes, for example through warehouse automation and robots. In addition, DHL will also focus on the widespread use of data analysis. According to the group's estimates, investments will generate at least EUR 1.5 billion in net profit annually.

Also the report of the German organization BITKOM (Federal Association of IT, Telecommunications and New Media Companies) confirms that most transport and logistics companies have chosen and want to focus on data analysis in the future. One in five companies currently uses Big Data, and another 21 percent plan to use this tool. Predictive analytics, in turn, is used by 10 percent of respondents, and another 15 percent plan to implement it. 10 percent use 3D printing and 8 percent plans to use it in the future. 10 percent use 3D printing and 8 percent plans to use it in the future.

The value of Big Data for transport and logistics is also appreciated by the European Union, which, as part of the LeMO project, uses the analysis of large data sets to strengthen sustainable economic development as well as to increase the competitiveness of European transport. The project carried out in 2017-2020 is primarily used to improve the quality of customer service, increase operational efficiency, and maximize resource availability.

**What technologies or digital solutions in logistics does your company use?**



Source: BitKorn Research

**DIGITALIZATION HAS HUGE BENEFITS**

“Organizations believe digitalization technologies will help them reduce costs and improve profitability,” summarize the authors of the report commissioned by DHL, entitled “Digitalization and the supply chain: Where are we and what’s next?”

Digitalization allows enterprises to meet the growing demand for increased efficiency and flexibility as well as improving the quality of customer service.

“Undoubtedly, digitalization has an amazing impact on supply chains and operations worldwide and will not lose its relevance. Companies face a wide selection of new products and applications entering the market and gaining recognition in the industry. Having a targeted strategy for digitizing the supply chain is now key to assessing the environment of new technologies and setting directions for action so as to be able to benefit from them and gain a competitive advantage,” emphasizes the author of the report, Lisa Harrington.

According to José F. Nava, development director at DHL Supply Chain, we are dealing with a breakthrough in the supply chain industry.

“The traditional model faces an unprecedented level of revolutionary changes due to new hardware technologies combined with information and analytical solutions. Technology offers significant opportunities to reduce costs and improve profitability, but it also means that companies that fail to adapt, risk being left behind,” concludes José F. Nava.

# SUMMARY

The technological revolution affects almost every aspect of our lives. We undertook the task to touch on selected fields closely related to the TFL industry. Selected, because one publication is not enough to deal with all, when in principle each of them could be the subject of an individual report. As the Polish Road Transport Institute, we will definitely devote more attention to some of them. These issues are so important that they will influence not only our everyday life, but also the surrounding reality, and above all the economic position in the globalized world - both of enterprises and entire countries.

When talking about the prospects of changes or development directions of individual sectors, we often make the mistake of looking short-term. Especially recently, after a decade of continuous economic growth, we look at economic indicators and wonder if it is time for a slowdown or recession. And in such conditions, we reflect on the future. It is necessary to think differently about the investments and actions to take, by looking far beyond those frames that shape our emotions and taking a close look at the opportunities and threats. It is no different in the transport and logistics industry. We wrote about it in our previous publication *Transport and Logistics as a strategic industry for the Polish economy* (an online version is available at [pitd.org.pl](http://pitd.org.pl)). Poland cannot lose its chance, which results, among others, from the geographical location at the intersection of important international trade routes. The Three Seas Initiative or the initiative of the new Silk Road (also called the Belt and Road Initiative) should be important to us because of the role that Poland can play in them. But in this case it is not enough to have only the "hard" transport infrastructure. Something more is needed. Digital infrastructure is needed. In addition to the thriving Polish companies that support road transport, growing railways, growing logistics operators, emerging intermodal terminals, we need strong tech companies, innovative solutions, openness to change and involvement of state administration.

On September 24, 2019, the Council of Ministers adopted a resolution on the adoption of the Sustainable Development Strategy for Transport by 2030. It contains specific projects that are to create a coherent network of expressways, railways, airport networks, inland navigation and seaports. So, it's all about catching up with infrastructure and striving to ensure high transport accessibility while maintaining maximum safety. The authors of the document, however, do not forget the essence of our publication. The Strategy reads:

"The flows of goods and people will be optimized thanks to the synergy of transport and logistics activities with the maximum use of current trends, the so-called fourth indus-

trial revolution in the field of eco-economy, digitalization and intelligent systems. The logistics task will be to launch processes and implement innovative solutions leading to the optimization of the transport market functioning and resulting in, among others, the development of intermodal transport infrastructure, the digitalization of transport services, and the improvement of supply chains.”

This government document, therefore, mentions the need to build telematics systems supported by digital solutions to optimize and control transport processes in intermodal transport. We are also talking about the fact that digital technologies and intelligent transport systems should be seen as an important element of infrastructure in urban transport.

One of the chapters in the Strategy is entirely devoted to modern technological solutions, where the objectives of activities and specific tasks are listed (with a distinction between maritime, road, rail, air and inland waterway transport). This is a good omen, but from our point of view innovative solutions in transport and logistics deserve more attention. Particularly because of the impact they will have on Poland’s position on the logistics and transport map of the world. And here we mean, for example, the support for the creation of cross-border solutions for the management of e-CMRs (in various modes of transport) and their integration with systems for monitoring the flow of goods, toll systems, customs and reporting applications. After all, we can imagine that thanks to secure (from the point of view of foreign partners) digital solutions, goods from distant countries will be shipped through Poland (where duties and taxes will also be charged if necessary), only because all the required formalities will be carried out automatically, full integrated with business platforms and thanks to competitive, easily-available and high quality public e-services against the background of Europe. That’s what the country should strive for.

The agenda of the European Union can also come in handy. The Digital Single Market strategy has three pillars:

- Better access for consumers and businesses to digital goods and services across Europe.
- Create an environment in which digital networks and innovative services can flourish.
- Maximising the growth potential of the digital economy.

The latter is seeking to ensure that the European economy, industry and employment fully benefit from the opportunities offered by digitalization.

“We will invest in the most important strategic digital capabilities, such as artificial intelligence, high-performance computing systems and cybersecurity,” said Marija Gabriel, European Commissioner for Digital Economy and Society from 2017, thus proposing the launch of the Digital Europe program with a budget over EUR 9 billion to help implement digitalization projects. The main areas to be covered by the program are: supercomputers (development and strengthening of supercomputers and data processing in Europe), ar-

tificial intelligence (dissemination of AI throughout the European economy and society), cybersecurity and trust in technology (building cyber defense and disseminating knowledge about security) , digital skills (courses and training), **ensuring the widespread use of digital technologies throughout the economy and society (ensuring digital transformation of public administration and services and their interoperability across the EU, as well as facilitating access to technology for all enterprises, in particular SMEs know-how).**

## FACTORS DRIVING DIGITAL TRANSFORMATION

As we are approaching the end of this publication, it is worth collecting and listing the factors that drive technological transformation. Below is the infographic, which we took from the monograph of the European Financial Congress entitled Digitalization of the economy and society - opportunities and challenges for infrastructure sectors<sup>31</sup>. On the inner circle there are supporting technologies, on the external divided into 4, are the levers of the digital transformation process: automation, digital data, connectivity, consumer digital access. Which factors are the most important for the TFL sector today? Probably they are all important. However, while commonly used autonomous trucks traveling on public roads without full human supervision are more of a distant future, cloud computing and analysis of large data sets that allow to predict demand or make valuations are at our fingertips (this does not mean that we should absolutely ignore those that seem closer to the sci-fi script than to the actual future. In this way, we can expose ourselves to the threat of oversleeping a revolution)

Today, we are primarily witnessing how technology is changing how transport market participants are connected to each other. Logistics are automated thanks to transparency, efficiency, cooperation, trust, artificial intelligence and algorithms. The power of innovation, software and technology means that logistics are becoming more efficient and effective thanks to growing value of competition in the supply chain. Road transport is being changed by digital freight. Technology helps match available loads to carriers. Blockchain technology will also play an important role, as it is not about decentralized data storage or secure information exchange based on smart contracts. It is a solution that primarily brings a new philosophy to the way of doing business - to cooperation and trust.

## CONCLUSION

Technology, digitalization and innovation are most often guided by the pursuit of optimization, process simplification, task automation, i.e., in order to save resources. There is no denying that often business profits are the driving force behind the implementation of modern solutions. However, more and more often, concern for the common good

is of equal significance. Corporate social responsibility, commitment to climate protection, striving to reduce waste, including harmful waste, especially carbon dioxide - these environmental issues often come to the fore. And this is particularly important for supply chains. The transport of goods has been and will be necessary. Globalization increases expectations regarding the time and quality of delivery. Transport and logistics also generate huge demand for resources. Therefore, it should be remembered that the technological revolution, that sets the direction for development of the TFL industry, does not happen in a vacuum. It sets the direction to look for solutions that will allow better use of resources (cargo space, storage space, employee resources, energy, infrastructure, etc.) so that the change for the better is felt not only in the area of economics, but also in the protection of environment.

# ENDNOTES

- 1 General Inspectorate of Road Transport..
- 2 PwC, Report "Will robots really steal our jobs?"
- 3 Vehicles for the transport of persons having not more than 8 seats in addition to the driver's seat.
- 4 Vehicles for the transport of persons having not more than 8 seats in addition to the driver's seat and GVW  $\leq 5$  t.
- 5 Cargo vehicles, with GVW  $\leq 3.5$  t.
- 6 Cargo vehicles, having a GVW  $> 3.5$  t, but  $\leq 12$  t.
- 7 Cargo vehicles, with GVW  $> 12$  t.
- 8 GDP per capita - the country's wealth indicator, calculated by dividing the country's GDP by the number of its inhabitants
- 9 Digital Challengers, i.e. markets with high growth potential for the digital economy: Bulgaria, Croatia, Czech Republic, Lithuania, Latvia, Poland, Romania, Slovakia, Slovenia and Hungary.
- 10 France, Germany, Italy, Spain, United Kingdom.
- 11 Digital Leaders: Belgium, Denmark, Estonia, Finland, Ireland, Luxembourg, the Netherlands, Norway, Sweden.
- 12 PwC, "Transport of the future. Report on development prospects for road transport in 2020-2030."
- 13 TLP's statement regarding the European Commission proposal on the EP and Council Directive amending Directive 2003/59/EC on the initial qualification and periodic training of drivers of certain road vehicles for the carriage of goods or passengers, and Directive 2006/126/EC on driving licenses.
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